CITY OF Marysville WASHINGTON

# 2009 CITY OF MARYSVILLE Water Comprehensive Plan

HDR

# City of Marysville
# 2009 Water Comprehensive Plan

**Adopted by Resolution No. 2781**
**on July 27, 2009**

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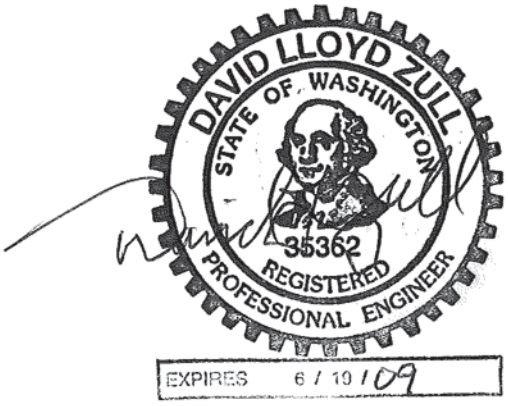
# City of Marysville

## 2009 Water Comprehensive Plan

# CERTIFICATION

This 2009 Water Comprehensive Plan for the City of Marysville has been prepared under the direction of the following Registered Professional Engineers.

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# Executive Summary

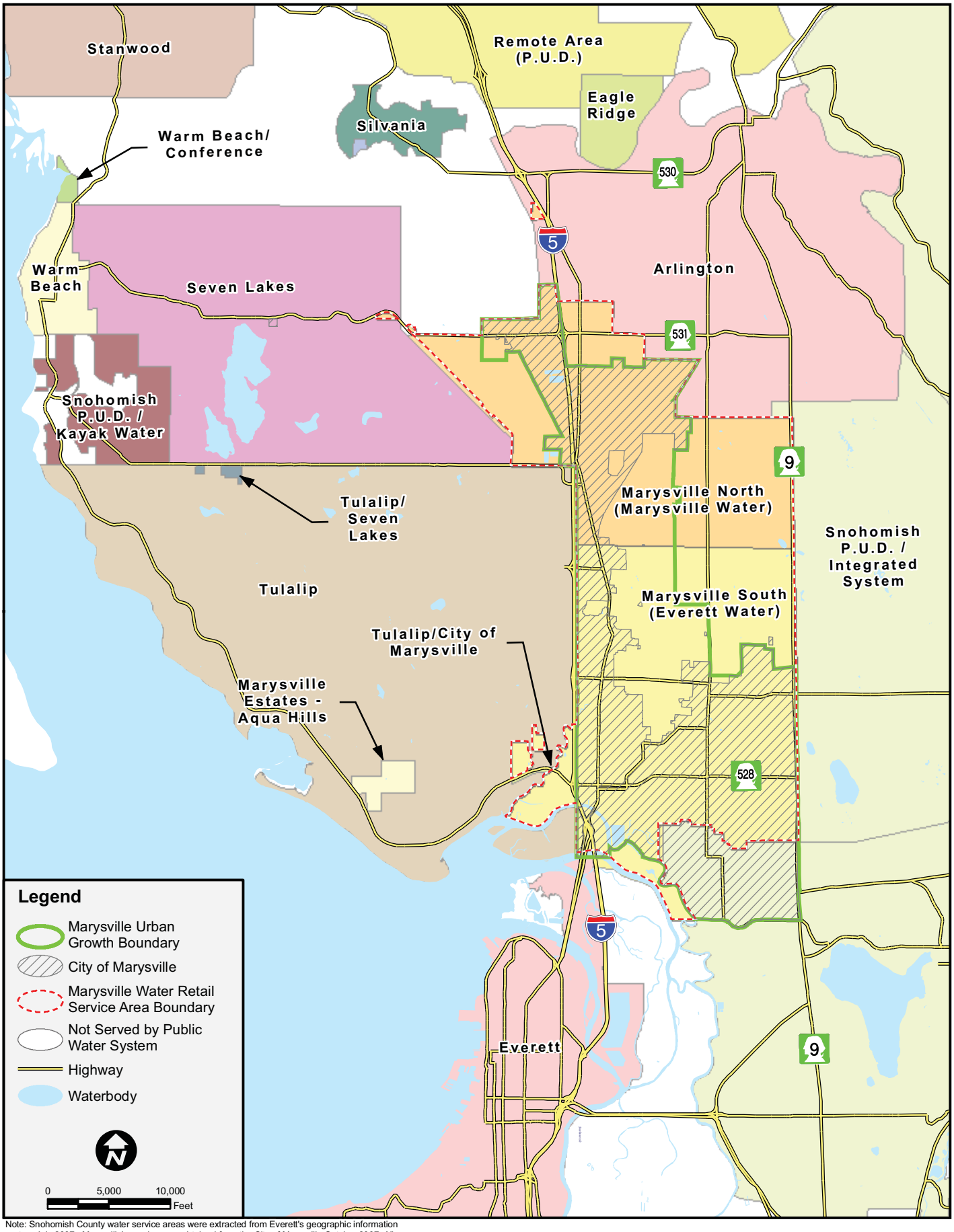
This Water Comprehensive Plan (WCP) for the City of Marysville (Marysville) has been developed pursuant to WAC 246-290-100, which requires that public water systems submit a water system plan to the Washington State Department of Health every six years. The 20-year planning horizon for this plan is 2009 to 2028. Appendix ES-1 contains related procedural documents including: standard plan checklist, municipal water law checklist, municipal water law consistency statements, SEPA documentation, and comments received on the plan.

## Chapter 1 - System Description

The Marysville water system was established in the 1930's with Edward Springs and has developed over time into a multifaceted system. The area served by Marysville is shown in Figure ES-1. The main components of Marysville's system are listed in Table ES-1, most of which are also shown on Figure ES-2.

**Table ES-1 Main System Components**

| | |
|---|---|
| Main Supply Sources (4): | North System: Stillaguamish River, Edward Springs, and Lake Goodwin well. |
| | South System: City of Everett intertie. |
| Emergency Supply Sources (2): | Highway 9 well and Sunnyside well. |
| Treatment Facilities (2): | Stillaguamish River Water Treatment Plant (WTP) and Edward Springs Treatment Facility. |
| Storage Facilities (8): | North System: Edward Springs reservoir, Stillaguamish WTP clearwell, Wade Road reservoir, and 327 Zone reservoir. |
| | South System: Getchell reservoir, Cedarcrest reservoir, Highway 9 reservoir, and Sunnyside reservoir. |
| Pump Stations (3): | Edward Springs, Cedarcrest, and High Service. |
| Pressure Zones (9): | North System: 327, 240 North, and 460. |
| | South System: 170, 203, 240 South, 260, 360, and 510. |
| Adjacent Utilities (5): | City of Everett, Tulalip Tribes, Snohomish County PUD, City of Arlington, and Seven Lakes Water District. |

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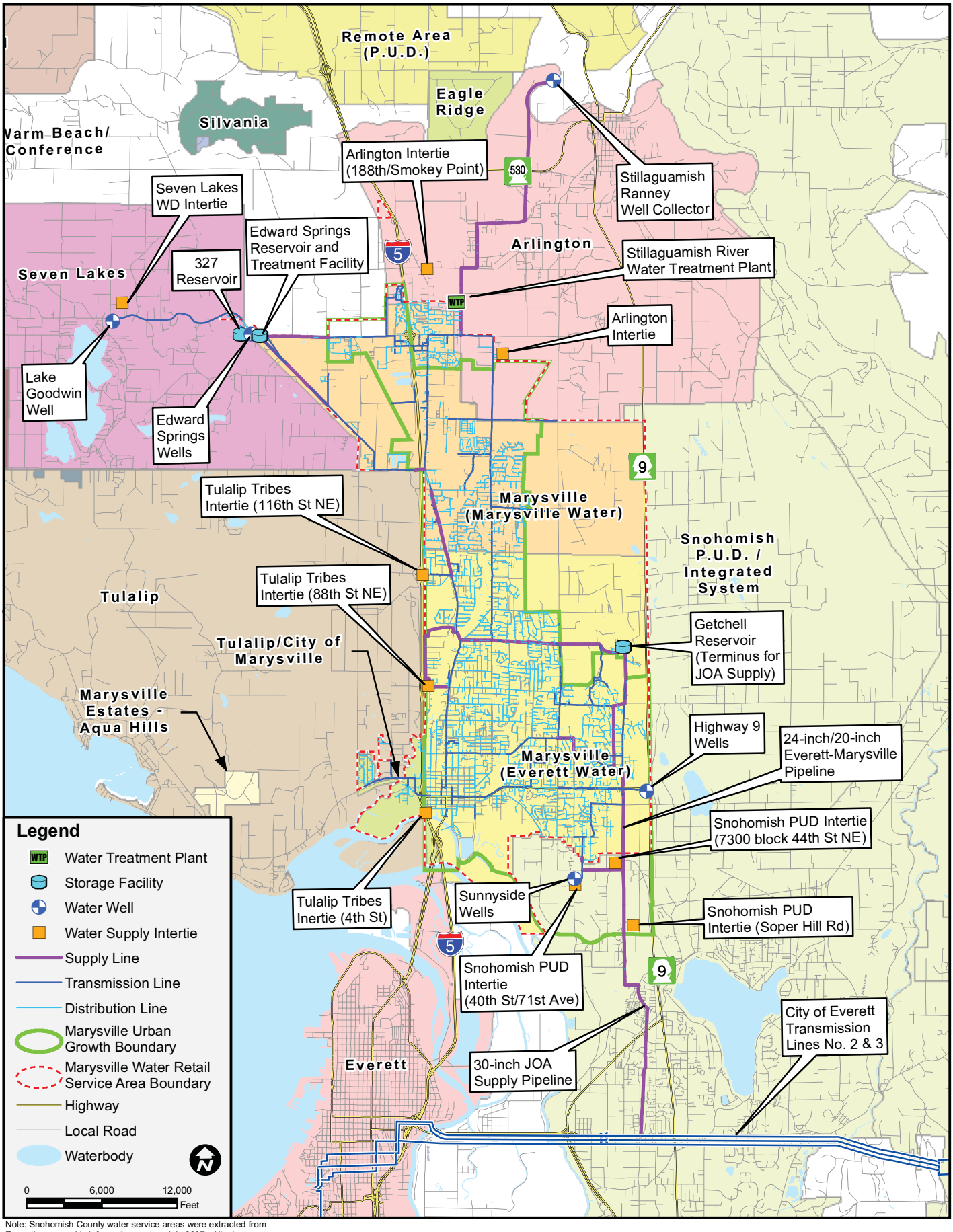
Note: Snohomish County water service areas were extracted from Everett's geographic information system July 2007. Marysville's service area obtained from the City of Marysville October 2007. All other map data was obtained from Snohomish County GIS 2007.

## *Service Area & Neighboring Utilities*

***FIGURE ES-1***




Note: Snohomish County water service areas were extracted from Everett's geographic information system July 2007. All other map data was obtained from the City of Marysville GIS 2007.

# Water Supply Facilities

**FIGURE ES-2**

# Chapter 2 - Related Plans, Policies and Agreements

Marysville's program to provide a comprehensive and reliable system for delivering water supply to its customers is part of a larger network of plans, policies and agreements that address land uses and water supply within Snohomish County. This chapter provides a brief description of selected plans, policies and agreements that relate to the Marysville water system. The documents discussed in the chapter, and their relevance to this WCP, are shown in Table ES-2.

**Table ES-2 Related Plans, Policies, and Agreements**

| Document | Relevance |
|---|---|
| City of Marysville Comprehensive Plan | Land use and growth management strategies within Marysville's water retail service area are defined by these plans. |
| Snohomish County Comprehensive Plan | |
| North Snohomish County Coordinated Water System Plan | Established a procedure for water utilities to coordinate planning and resolve problems related to inadequate water quality, unreliable service, or lack of coordination in planning. |
| City of Everett Comprehensive Water Plan | Marysville purchases water from Everett for the southern portion of its system. |
| City of Marysville Municipal Code (selected sections) | Establishes various utility policies including conditions of service, water service fees, annexation and water service extension. |
| Joint Operating Agreement (JOA) | Agreement between Marysville, Snohomish County PUD and the Tulalip Tribes to cooperatively plan, design, construct, operate and maintain facilities allowing for delivery of water from Everett. |
| Additional Agreements Related to JOA | Four additional agreements related to the JOA. |
| Other Agreements | Five miscellaneous agreements related to easements, emergency interties, mutual aid, annexation, and wholesale water. |

# Chapter 3 - Planning Data and Demand

The demographic data used for this WCP includes historical and projected demographic data for Marysville's retail service area. The water use characteristics include summaries of production, peaking factors, sales, connections, and water use factors. The demand forecast combining the demographics and the water use characteristics to develop Marysville's demand forecast for the next 20 years is shown in Table ES-3. This same information is shown graphically on Figures ES-3 and ES-4.

## Table ES-3 Demand Forecast

| Year | Demand Without Additional Conservation | | | | | Demand With Additional Conservation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average Day Demand (mgd) | | | | Maximum Day Demand (mgd) | Average Day Demand (mgd) | | | | Maximum Day Demand (mgd) |
| | Retail | Tulalips | PUD | Total | | Retail | Tulalips | PUD | Total | |
| **2007** (Current Yr[1]) | 5.1 | 0.6 | 0.5 | 6.2 | 9.7 | 5.1 | 0.6 | 0.5 | 6.2 | 9.7 |
| **2009** (Plan Yr 1) | 5.9 | 1.5 | 0.7 | 8.1 | 12.2 | 5.9 | 1.5 | 0.7 | 8.0 | 12.1 |
| **2010** (Plan Yr 2) | 6.0 | 2.3 | 0.8 | 9.2 | 13.4 | 6.0 | 2.3 | 0.8 | 9.1 | 13.3 |
| **2011** (Plan Yr 3) | 6.2 | 3.6 | 1.0 | 10.8 | 15.1 | 6.1 | 3.6 | 1.0 | 10.7 | 15.0 |
| **2012** (Plan Yr 4) | 6.3 | 4.1 | 1.2 | 11.6 | 16.0 | 6.2 | 4.1 | 1.2 | 11.5 | 15.8 |
| **2013** (Plan Yr 5) | 6.5 | 4.1 | 1.4 | 11.9 | 16.5 | 6.3 | 4.1 | 1.4 | 11.8 | 16.3 |
| **2014** (Plan Yr 6) | 6.6 | 4.1 | 1.6 | 12.3 | 17.0 | 6.5 | 4.1 | 1.6 | 12.2 | 16.7 |
| **2028** (Plan Yr 20) | 9.1 | 4.1 | 3.4 | 16.6 | 22.9 | 8.9 | 4.1 | 3.4 | 16.4 | 22.6 |

1. At the time the demand forecast was developed, the most recent year for which a complete year of data was available from the City was 2006. Therefore, the water use characteristics were analyzed through 2006. 2007 data was provided with the City's hydraulic model at a later date. Since the modeling work uses 2007 as the current year, it was decided that all chapters will use 2007 as the current year for consistency. Note that for the demand forecast, 2007 is a projected number.

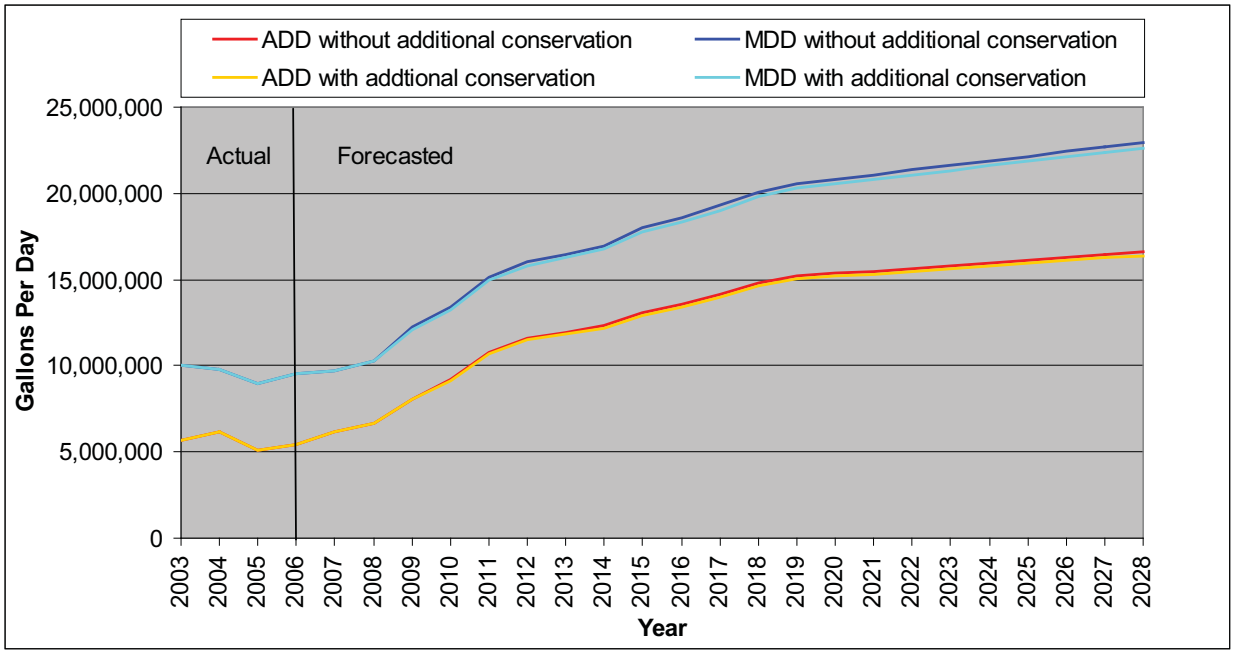



**Figure ES-3 Demand Forecast - Summary**

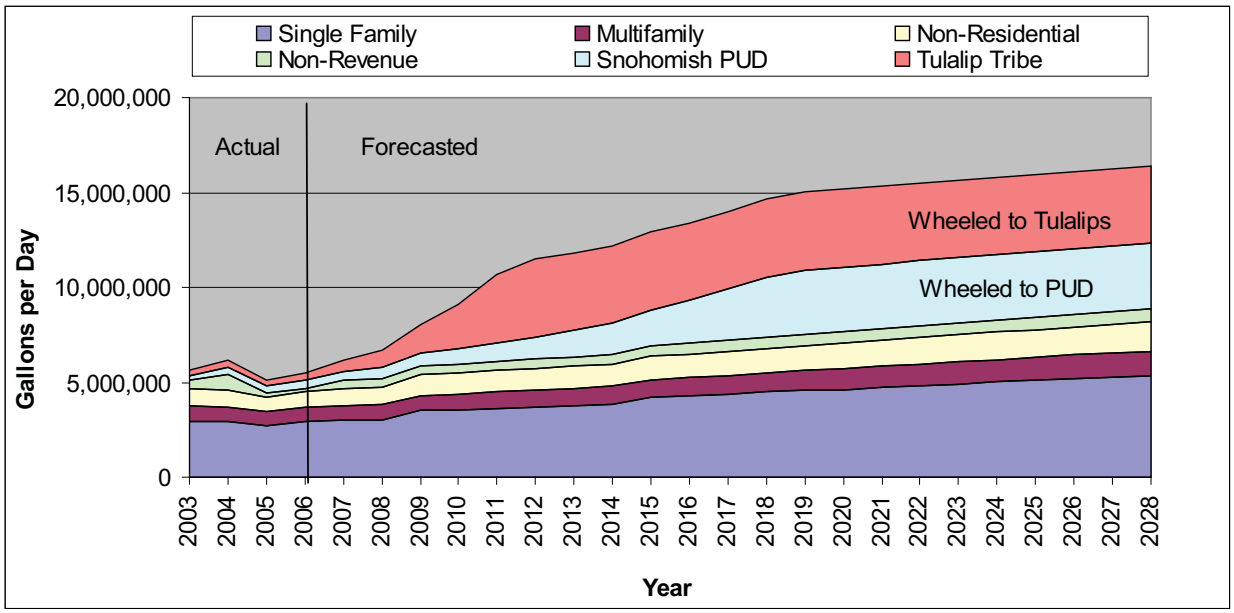



**Figure ES-4 Demand Forecast – Average Day Demand With Conservation**

# Chapter 4 - Conservation Program

Marysville's conservation program from 2009 to 2014 is comprised of a combination of regional and local measures. The regional measures are part of a regional conservation program Everett implements throughout its retail and wholesale service area. This regional program, called the Everett Water Utility Committee program, also requires implementation assistance by Marysville staff. The local measures are specific to Marysville and are implemented by Marysville staff in Maryville's service area.

Marysville's conservation program for 2009-2014 will consist of the 13 measures shown in Table ES-4. These measures have been selected due to a combination of factors including applicability to Marysville's service area, customer acceptance, cost effectiveness, and/or savings potential. It should be noted that Marysville will continue to use source meters, service meters, and system leak detection and repair, although those activities are not counted as official conservation "measures" under the new Water Use Efficiency Rule. This program will help Marysville achieve its official water conservation goal of saving 129,000 gallons per day on an annual basis (as opposed to peak season) at full implementation of the six year program by the end of 2014.

**Table ES-4 2009-2014 Conservation Program**

| Measure | Sectors[1] | | | Local or Regional | Relationship to Current Program |
|---|---|---|---|---|---|
| | SF | MF | ICI | | |
| 1. Conservation Pricing[2] | X | X | | Local | Continuation |
| 2. Bills Showing Consumption History | X | X | X | Local | Continuation |
| 3. Toilet Rebates – 1.6 gpf | X | | | Local | Continuation |
| 4. Customer AMR-Based Leak Detection | X | X | X | Local | New |
| 5. School-Based Education | n/a | | | Regional | Continuation |
| 6. Public Outreach | n/a | | | Regional | Continuation |
| 7. Indoor Retrofit Kits | X | X | | Regional | Modification |
| 8. Outdoor Irrigation Kits | X | X | | Regional | Modification |
| 9. Toilet Leak Detection | X | X | X | Regional | Modification |
| 10. Toilet Rebates - HETs | X | X | X | Regional | New |
| 11. Clotheswasher Rebates | X | X | X | Regional | New |
| 12. School Irrigation System Audits | | | X | Regional | Modification |
| 13. Commercial Indoor Audits | | | X | Regional | New |

1. SF = single family, MF = multifamily, ICI = industrial, commercial, institutional.
2. The City's rate structure has elements that promote conservation, as well as elements that do not.

# Chapter 5 - System Analysis

Marysville's water system was analyzed as to whether the source, storage, and distribution system are sufficient to support existing and projected demands. Improvement projects were identified to remedy system deficiencies, where appropriate, and have been included and scheduled in the CIP to ensure that the projected system demand will be met over the planning period.

The source and storage analyses are performed using desktop calculations. The source must be adequate to meet the projected maximum day demand (MDD) for each area being evaluated. For the storage analysis, the following components were evaluated: operational storage; equalizing storage; standby emergency storage; fire suppression storage; and dead storage. The results of the source and storage analyzes are presented in Table ES-5.

## Table ES-5 Source and Storage Analysis

| Source Analysis | |
|---|---|
| Area Analyzed | Capacity Adequate Through 2028 |
| North System – All | Yes. |
| North System - 460 and 327 Zones. | Yes. |
| North System - North 510 and North 360 Zones. | These are future zones that will require a new pump station to provide supply. The future pump station will be required to supply approximately 311,000 gpd (or 216 gpm) in 2028. |
| South System - All | Yes. |
| South System – South 510 Zone. | The current capacity of the existing pump station is sufficient to provide the needed supply beyond 2028. If the Soper Hill area currently owned by Snohomish PUD is annexed, Marysville plans to replace the existing pump station with a new pump station. The proposed new pump station is adequate to provide supply for this zone in 2014 and 2028. |
| Storage Analysis | |
| Area Analyzed | Capacity Adequate Through 2028 |
| North System – North 240 Zone | Yes. |
| North System – 327 Zone | Yes. |
| North System - North 510 and North 360 Zones | These future zones will require a new reservoir to provide storage. The future reservoir will be required to provide at least 400,000 gallons of effective storage in 2028. This does not take into account additional dead storage volume that may be incorporated in the reservoir design. |
| South System – Except 170 Zone and South 510 Zone | Yes. |
| South System - Except South 510 Zone | Yes. |
| South System - South 510 Zone | The current capacity is adequate to provide required storage volumes through 2014. However, the existing reservoir is anticipated to be deficient in its ability to support standby and fire flow storage by approximately 30,000 gallons. A capital improvement project involving a second Highway 9 Reservoir with a capacity of 1.8 MG is included in the CIP. |

Distribution system analysis was performed using Marysville's hydraulic model, which was upgraded and calibrated for this WCP. The system was analyzed for the following two conditions: peak hour demands, and maximum day demands plus fire flow. The key conclusions of the hydraulic analysis are:

- Peak hour demand conditions: Results for this analysis showed similar areas of low and high pressures in the system for the existing, 2014 and 2028 model runs. The low pressures are due to high ground elevations as compared to the hydraulic grade of the surrounding pressure zone. These low pressure areas are localized and near system facilities, where there is typically limited service to customers. In addition, the pressures observed are generally between 20 and 30 psi and therefore no improvements are recommended. For the high pressure areas, it is recommended that Marysville install

pressure reducing valves (PRVs) on service lines if new developments are built in the high pressure area.

- Maximum day demands plus fire flow conditions: Available fire flow was found to be inadequate in certain locations of the 170 Zone and North 240 Zone for the existing system and six year planning horizons. Projects were identified to address these deficiencies. No new fire flow deficiencies were identified for the twenty year planning horizon.

# Chapter 6 - Water Rights, System Reliability, and Source Water Protection

Marysville has a multifaceted approached to ensure the provision of water in sufficient quantity and quality at all times. This is achieved by careful management of water rights, planning for adverse events such as drought or emergency, and by managing and protecting Marysville's water sources.

Marysville has sufficient existing water rights to meet the demands projected through the 20-year planning period of this WCP. Marysville holds eleven water right certificates and one water right permit for use as municipal water supply. The total quantity of water available to Marysville including Marysville's primary water rights and water purchased from Everett is 20.71 millions of gallons per day (mgd) on an annual basis and 25.75 mgd on an instantaneous basis. The 20-year (2028) forecasted demand indicates an average day demand of 16.58 mgd and a maximum day demand of 22.92 mgd.

Marysville has a comprehensive *Contingency Plan for Water Supply Disruptions During Emergencies* (2002). Marysville has a *Drought Response Plan* (2001) which was developed to conserve available water supply, protect the integrity of Marysville's water system, and minimize the adverse impacts of water supply shortage conditions. Marysville developed a *Water System Emergency Response Plan* (2004) which documents responses to water system emergency scenarios, including specific emergencies such as microbial contamination, chemical contamination, and hazardous materials spills.

As an owner/operator of drinking water sources of supply, Marysville is responsible for meeting requirements for source water protection. Marysville protects the Stillaguamish source of supply through its Watershed Control Plan and protects the Edward Springs, Edward wells and other groundwater sources through a Wellhead Protection Plan.

# Chapter 7 - Water Quality Review and Regulatory Compliance

Marysville's water system is accountable to multiple state and federal drinking water quality regulations related to treatment, finished water, distribution system, and consumer confidence and public notification. A review of Marysville's monitoring and compliance procedures and water quality monitoring results indicates that Marysville is in full compliance with all state and

federal regulations. Table ES-6 summarizes Marysville's regulatory status and provides associated recommendations for continued compliance.

**Table ES-6 Water Quality Regulatory Compliance**

| Regulation | Requirements | Compliance | Recommendation |
|---|---|---|---|
| Phase I, II and V Regulations (IOC, VOC and SOCs) | • Monitoring | Yes | • Continue monitoring as required |
| Arsenic Rule | • Monitoring | Yes | • Continue monitoring as required |
| Radionuclides | • Monitoring | Yes | • Continue monitoring as required |
| Surface Water Treatment Rule & Interim ESWTR | • Watershed Control Plan (Edward Springs)<br>• Monitoring | Yes | • Continue programs as currently implemented for both filtered and unfiltered sources |
| LT2 ESWTR | • Monitor watershed for Cryptosporidium & Giardia<br>• Measure turbidity with particle counters | Yes | • Implement LT2 ESWTR Monitoring Plan submitted to EPA in January 2006 |
| Groundwater Rule | • Source monitoring<br>• Sanitary surveys | NA | • Keep up to date with DOH plans for Rule implementation in Washington. |
| Wellhead Protection Program | • Define WHPA<br>• Inventory<br>• Management strategies | Yes | • Implement WHP Plan recommendations |
| Lead and Copper | • Monitoring<br>• Public notification<br>• Treatment optimization | Yes | • Prepare formal monitoring plan<br>• Treatment optimization as needed<br>• Review existing monitoring activities for compliance with LCR updates |
| Total Coliform Rule | • Written Plan<br>• Monitoring | Yes | • Expand Coliform Monitoring Plan |
| Stage 1 D/DBP Rule | • Written Plan<br>• MCL Compliance | Yes | • Update monitoring locations as needed to reflect changing conditions in the North Service Area (modified Plan must be submitted and approved by DOH) |
| Stage 2 D/DBP Rule | • MCL compliance & increased parameter list | Yes | • Complete IDSE Monitoring<br>• Complete IDSE Report<br>• Begin routine DBP monitoring |
| CCR and Public Notification Rules | • Annual Reports<br>• Reporting as needed | Yes | • Continue as required |

# Chapter 8 - Operations and Maintenance

Marysville has a well developed operations and maintenance program that includes organizational structure and responsibilities, operator certification, systems operations, design and construction standards, water quality operations, supplies and equipment, maintenance, and information and records management.

Recommended improvements to this operations and maintenance program include:

- Continue implementation of the new maintenance management software.
- Continue installation of Automatic Meter Reading equipment.
- Install sampling stations throughout the new 327 Zone.
- Enhance flushing and valve exercising programs to meet goal of completing entire system every two years.
- Tie dead end mains, where possible, to close loops and increase fire flow.
- Pave around Edwards Springs to increase ease of maintenance.
- Evaluate de-chlorination alternatives for use during distribution system flushing.
- Complete job standards for every task/activity performed by the Utility Maintenance Division.
- Upgrade the distribution system instrumentation and control system to effectively operate the transmission system.
- Lake Goodwin Well Improvements to include new sodium hypochlorite disinfection system.
- Install new sodium hypochlorite disinfection system at Sunnyside reservoir for emergency events.
- Video, inspect and rehabilitate Sunnyside Well 2 if necessary.

# Chapter 9 - Capital Improvement Program

A capital improvement plan (CIP) was developed from a combination of the following elements: projects previously identified and included in the Marysville 2007/2008 Capital Improvement Program; projects identified through conversations with Marysville staff; and projects identified during the system analysis of Marysville source, storage, distribution, transmission and water quality, as documented in earlier chapters of this WCP. In addition, recurring or annual capital projects related to system maintenance (e.g., spring collector improvements and water main replacement programs) have also been included in the list of improvements. A summary of the total costs for the recommended CIP is shown in Table ES-7.

**Table ES-7 Summary of Capital Improvement Program**

| Project Type | 2009 - 2014 (Years 1-6) | 2015 - 2028 (Years 7-20) |
|---|---|---|
| Supply and Treatment | $1,410,000 | $0 |
| Storage | $6,820,000 | $5,180,000 |
| Booster Pump Stations | $1,510,000 | $1,360,000 |
| Transmission and Distribution System | $22,900,000 | $26,916,000 |
| Maintenance and Operations | $4,938,000 | $7,014,000 |
| Totals | $37,578,000 | $40,470,000 |

# Chapter 10 – Financial Plan

The purpose of the financial plan is to provide reasonable assurance that Marysville has and will have the financial ability to maintain and operate the utility on an ongoing basis, plus have the

capacity to obtain sufficient funds to construct the water system improvements as identified in Chapter 9.

A summary of the financial plan and resulting financial status of the water system is provided in Table ES-8. The results show that existing rates are not sufficient to cover anticipated expenses. When interpreting the results of Table ES-8 it is important to understand that the final row "Cumulative Balance/(Deficiency) as a % of Rates" is cumulative. That is, any rate adjustments made in previous years would reduce the required adjustment in the following years. It is also important to keep in mind that the model assumes expenses are completely expended within each year. Typically, utilities receive additional revenue and often actual expenditures do not total 100 percent of budget appropriations. Marysville has a number of options for deferring the rate adjustment until the latter part of the planning period. Those options would include adjusting capital improvement timing, use more reserves for capital improvements, reducing some other operating expenses, and closely monitoring additional revenue or increased growth beyond the assumed growth rate.

**Table ES-8 Projected Six-Year Financial Plan (000s)**

| | Budget | | Projected | | | | |
|---|---|---|---|---|---|---|---|
| | 2007 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Sources of Funds | | | | | | | |
| Water Sales | $6,700 | $6,500 | $6,565 | $6,696 | $6,830 | $7,103 | $7,388 |
| Other Sources | 769 | 679 | 927 | 1,036 | 1,036 | 1,016 | 949 |
| Total | $7,469 | $7,179 | $7,492 | $7,732 | $7,866 | $8,119 | $8,337 |
| Applications of Funds | | | | | | | |
| O&M and Taxes | $6,501 | $6,646 | $6,732 | $7,044 | $7,775 | $8,231 | $8,729 |
| CIP Funded From Rates | 0 | 1,035 | 1,402 | 1,832 | 2,240 | 2,600 | 3,000 |
| Debt Service (P+I) | 2,194 | 2,193 | 2,189 | 2,191 | 2,257 | 2,170 | 2,167 |
| Total | $8,695 | $9,874 | $10,323 | $11,067 | $12,272 | $13,001 | $13,896 |
| Initial Balance/(Deficiency) of Funds | ($1,226) | ($2,695) | ($2,831) | ($3,335) | ($4,406) | ($4,882) | ($5,559) |
| Additional Taxes | (62) | (136) | (142) | (168) | (222) | (246) | (280) |
| Total Balance/(Deficiency) of Funds | ($1,288) | ($2,831) | ($2,973) | ($3,503) | ($4,627) | ($5,128) | ($5,839) |
| Cumulative Balance/(Deficiency) as a % of Rates | 19.2% | 43.5% | 45.3% | 52.3% | 67.7% | 72.2% | 79.0% |

# 1. System Description

This chapter provides a general overview of the water system, including information on the City of Marysville's (Marysville) management, service area, and adjacent purveyors. A detailed description of Marysville existing water facilities is also included in this chapter.

## 1.1. Ownership and Management

The Marysville water system is owned and operated by the City of Marysville. The most current Water Facilities Inventory (WFI) report is attached in Appendix 1-1. The WFI contains basic administrative information regarding the water system and is filed annually with the Washington State Department of Health (DOH). Pertinent information from Marysville's most recent Water Facilities Inventory is summarized in Table 1-1.

**Table 1-1 Water System Information**

| | |
|---|---|
| **System Name:** | Marysville Utilities |
| **System ID Number:** | 51900C |
| **System Type:** | Group A Community Water System |
| **Owner Type:** | City/Town |
| **System Contact Person:** | Terry Hawley (Public Works Operations Manager) |
| **Owner Address:** | 80 Columbia Avenue<br>Marysville, WA 98270 |
| **Location:** | Snohomish County, WA |
| **Service Connections:** | 19,234 |
| **Population Served:** | 56,000 |

The water system is operated and maintained by the Department of Public Works which is managed by the Public Works Director. Several divisions exist within the organization overall and address various facilities and services. Four divisions are associated with the water system and its operation. These divisions are managed by the Public Works Superintendent, the City Engineer, the Fleet/Facility Manager, and the Business Office Supervisor. These positions report directly to the Public Works Director. Marysville's organizational structure is shown in Figure 1-1. Additional detail regarding management structure is provided in the Operations and Maintenance chapter of the Plan.

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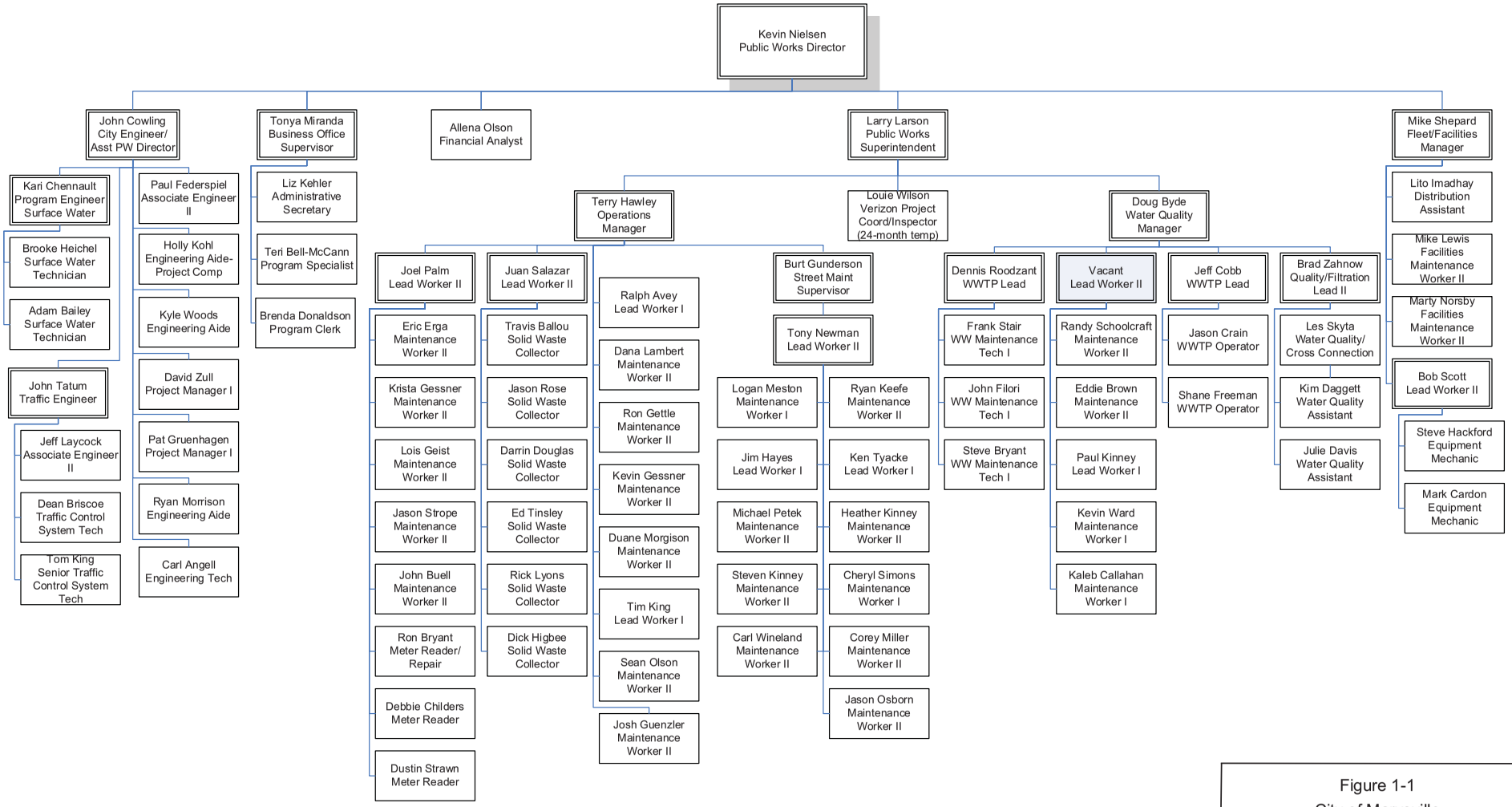



Figure 1-1
City of Marysville
Public Works Organization Chart
Water Comprehensive Plan

## 1.2. Service Area Description

Marysville's municipal boundary, urban growth area (UGA) and water retail service area are shown in Figure 1-2. Marysville's water retail service area is based on the 1991 North Snohomish County Coordinated Water System Plan (CWSP), plus subsequent modifications made by Marysville. It should be noted that Marysville does not currently provide service to all areas within its retail service area. Figure 1-3 displays how Marysville's retail service area is divided into the following four timeframes for providing service:

- **Currently Serving:** Marysville may not technically have distribution pipe throughout this entire area. However, for all intents and purposes, Marysville serves the majority of this area.
- **Service Anticipated Years 1-6:** Marysville anticipates serving this area within the six-year planning period of this water system plan. While Marysville will be expanding into this area within years 1-6, buildout based on current zoning is not expected until after year 20. There is a small area shown on Figure 1-3 that is currently part of Snohomish County PUD's retail service area, but is anticipated to be assumed by Marysville within the next six years and therefore demand for that area is included in Marysville's demand forecast. That area is in the Southeast corner of the map, north of Soper Hill Road.
- **Service Anticipated Years 7-20:** Marysville anticipates serving this area between year seven and year 20 of this water system planning period. While Marysville will be expanding into this area within years 7-20, buildout based on current zoning is not expected until after year 20.
- **Service Not Anticipated Until at Least Year 21:** Marysville does not anticipate serving this area within the 20 year planning period of this water system plan. In some cases, these areas will never be developed (e.g., area is a wetland). In other cases, the area will be developed, however that development will not occur until at least year 21.

Marysville's service area is approximately nine miles along a north-south line and varies from one to three miles in an east-west direction. The widest portion of the service area is at the southern extreme that includes the business district and the main industrial area. The service area is bounded by Interstate 5 and the Tulalip Indian Tribe Reservation on the west, and Highway 9 on the east. The northern boundary varies but is generally considered as 180$^{th}$ Street NE. The Steamboat Slough restricts the southern extent of the service area. Three small developed areas located along 172$^{nd}$ Street NE and Warm Beach Road are located outside the current service area boundaries but are served by Marysville.

The majority of the service area is located within the Quilceda Creek watershed. The smaller Allen Creek watershed accounts for the remainder of the service area. A complex of tidal sloughs lies immediately to the south of the service area and just beyond the north limit is a drainage divide defining the Stillaguamish River basin. The Stillaguamish River flows about two miles north of the service area boundary.

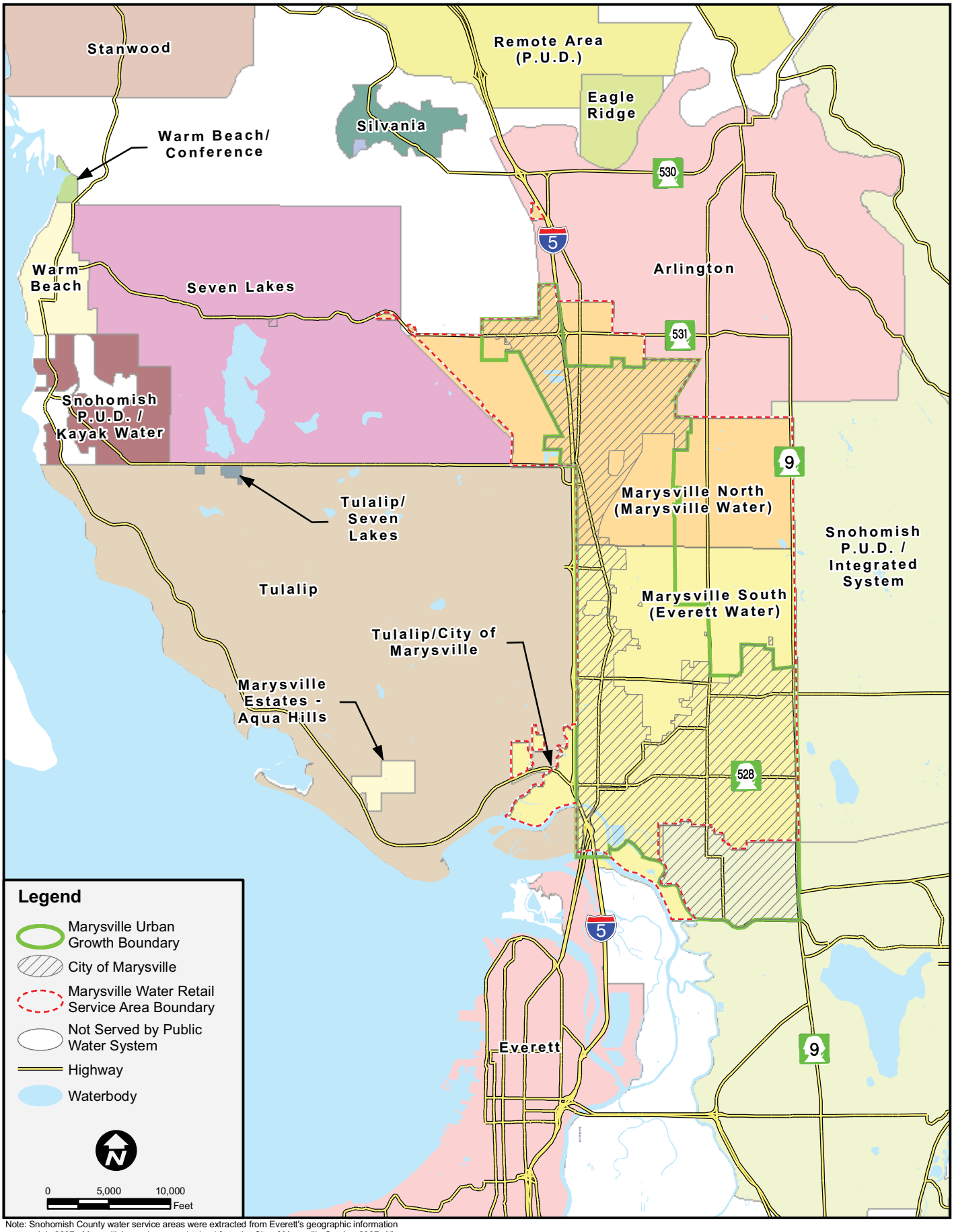
### 1.2.1. Topography

The topography of the service area is generally rising in elevation to the north with some hillsides on the west and east. Service area elevation begins at sea level in the south, with the highest elevation being 450 feet on the eastern side. Topography of the Marysville service area is shown in Figure 1-4.

### 1.2.2. Natural and Constructed Barriers

There are few significant obstacles to water system development within the service area. Interstate 5 defines most of the service area's west boundary. Service west of Interstate 5 is limited and not expected to increase significantly. The flatness of the land provides for few natural reservoir sites and as a result most of the system's storage capacity is located outside the service area.

The service area is physically divided into north and south service areas by valves. Water is not shared between the two distinct service areas under normal operating conditions. The south service area is served with water purchased from the City of Everett. The north service area is served from Marysville-owned sources.

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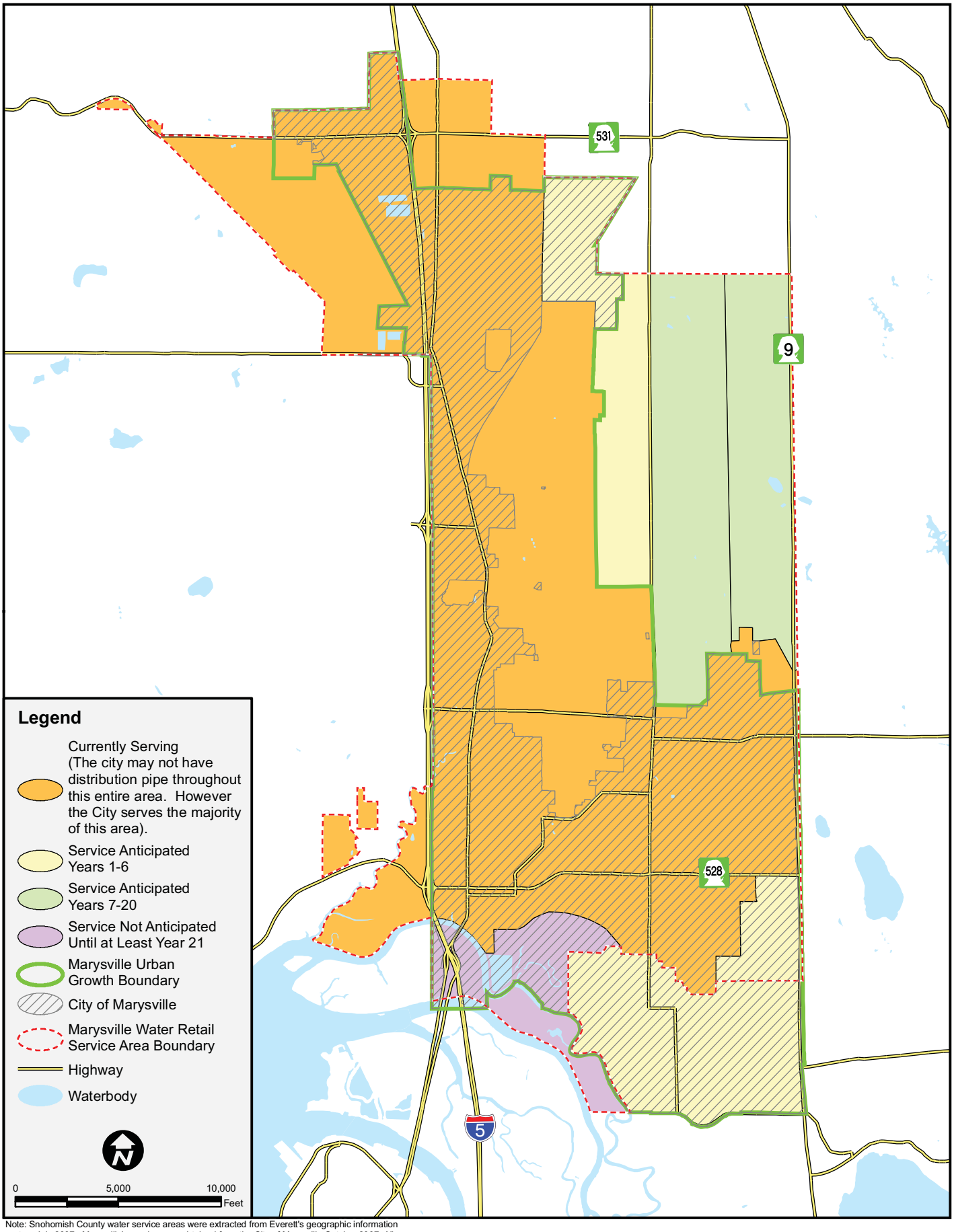
Note: Snohomish County water service areas were extracted from Everett's geographic information system July 2007. Marysville's service area obtained from the City of Marysville October 2007. All other map data was obtained from Snohomish County GIS 2007.

## *Service Area & Neighboring Utilities*

***FIGURE 1-2***

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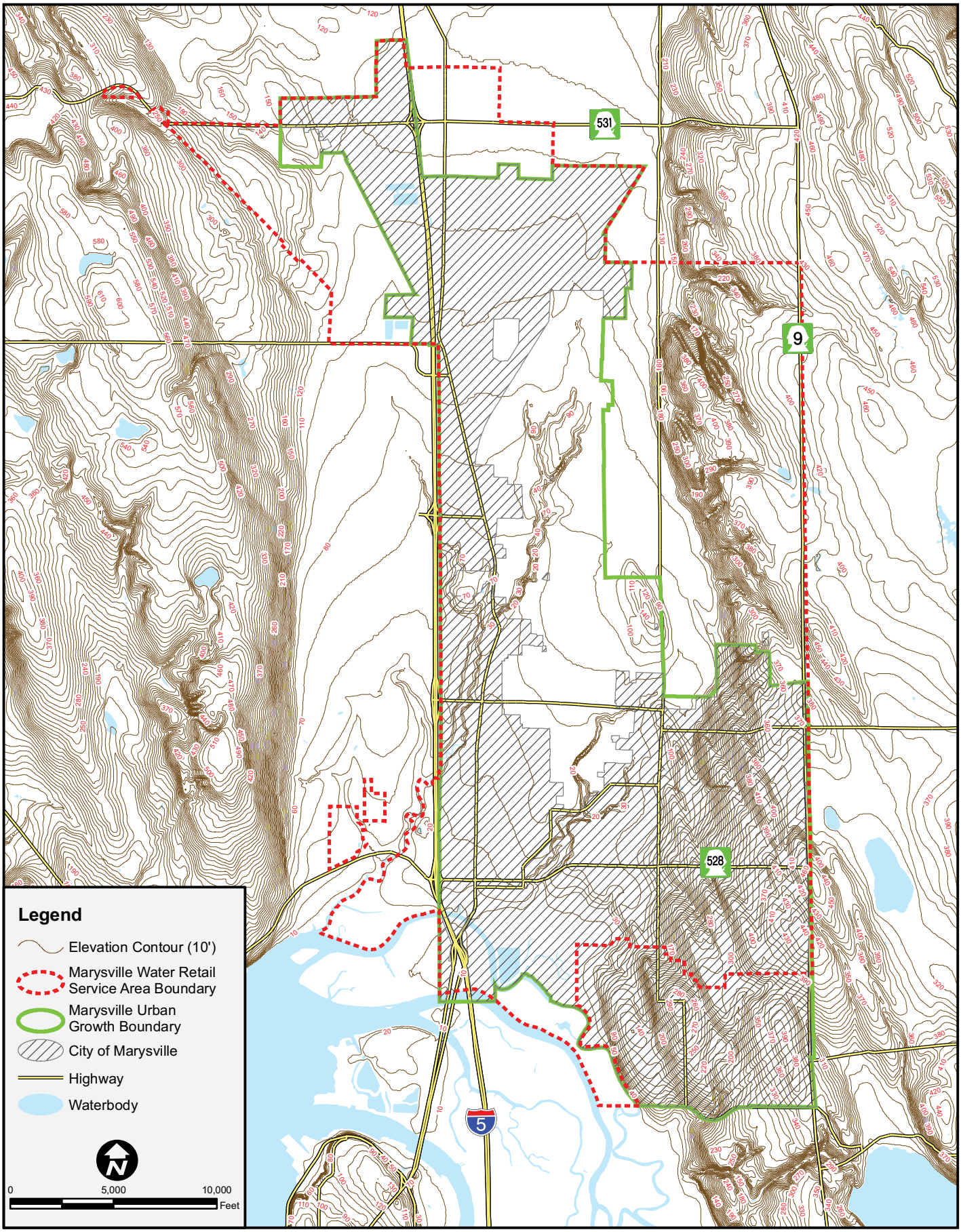
Note: Snohomish County water service areas were extracted from Everett's geographic information system July 2007. Marysville's service area obtained from the City of Marysville October 2007. All other map data was obtained from Snohomish County GIS 2007.

# *Service Area Timing*

***FIGURE 1-3***

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Note: Marysville's service area obtained from the City of Marysville October 2007. All other map data was obtained from Snohomish County GIS 2007.

# Topography
**FIGURE 1-4**

# 1.3. Adjacent Purveyors, System Interties and Water Wheeling

The Marysville service area shares a common boundary with five adjacent purveyors, which include the City of Everett, the Tulalip Tribes, the Snohomish County Public Utility District No. 1 (Snohomish County PUD), the City of Arlington, and the Seven Lakes Water Association. Growth, regionalization of water supply, and the Joint Operating Agreement No. 1 (JOA) requires coordination and cooperation among all of these purveyors. Figure 1-2 shows the regional water supply setting, including Marysville and other purveyor service areas.

In 1991 the Tulalip Tribes, Snohomish County PUD, and Marysville participated in JOA No. 1, a regional supply from the City of Everett transmission mains connecting to Marysville's distribution system at 44th Street NE and 83rd Avenue NE. In addition to JOA No. 1, Marysville maintains additional systems interties with the Tulalip Tribes, Snohomish County PUD, and the City of Arlington, which are described below. (Marysville previously had an intertie with the Seven Lake Water Association, although that agreement was terminated in 2008.) The JOA and other agreements with adjacent purveyors are also described in greater detail in Chapter 2 of the Plan.

## 1.3.1. City of Everett

The Everett service area is located south of Marysville and across the Steamboat Slough and Snohomish River. In addition to its own service area, the Everett water system also provides wholesale water to Monroe, Snohomish, Lake Stevens, Alderwood Water and Wastewater District, the Snohomish County PUD, and 52 other water districts and water associations.

## 1.3.2. Tulalip Tribes

The Tulalip Reservation system serves an area of approximately 24 square miles, located west of and contiguous with the Marysville service area, from Steamboat Slough north to Fire Trail Road. The original water sources serving the Tulalip Tribes include a surface water spring, a well system, and a single connection to the Marysville system. A portion of the Reservation east of Quilceda Creek and the subdivision of Marysville West is served by Marysville.

In 1991, the Tribes participated in the JOA which allows three connections to the Marysville system. The Tribes purchased capacity rights in the pipeline equal to 4.09 MGD, which is valid until the year 2020. The JOA agreement acknowledges that in order for the Tribes to use the capacity, the Tribes would wheel water through the Marysville distribution system connecting to their distribution system west of I-5 at 4th Street NE, 88th Street NE and 116th Street NE.

The 1995 Wheeling Agreement (Marysville and Tulalip Tribes) addresses the connection points at 4th Street and 88th Street. The 4th Street NE meter is located at the intersection of 31st Avenue and 66th Street near the Tulalip Casino. The 88th Street NE master meter is installed at the northwest corner of the intersections of 88th Street and 36th Avenue NE. The meter presently serves the new Quilceda Business Park and future commercial sites adjacent to the business park.

The 1995 Wheeling Agreement has conditions and service written into it that describes simultaneous delivery points. In 2008, the peak day demand at the 4th Street NE location was 2,000 gallons per day (GPD). At the 88th Street NE location the peak day demand was 2.0

MGD. The 1995 Wheeling Agreement is in the process of being amended to reflect revised flow allocations and rates.

By addendum to the 1995 Wheeling Agreement, the Tulalip Tribes were granted a 2-inch metered connection at 19th Avenue NE and 70th Street NE with a peak day demand of 160 GPM. The water utilized at this connection is counted against the 4th Street NE JOA allocation. Marysville/Tribes have a 4-inch emergency intertie at Marine View Drive and 20th Avenue NE., and a 6-inch emergency intertie at Marine View Drive and 27th Avenue NE. The 4-inch and the 6-inch connections are not metered.

The Tribes anticipate that the 116th Street NE connection will be completed sometime in the near future. They recently requested an interim connection to an existing 6-inch line which supplied water to the now unused Boeing site. Flow through the interim 116th Street NE. connection (if granted) would be a portion of the JOA allocation.

## 1.3.3. Snohomish County PUD No. 1

The Snohomish County PUD service area is contiguous with the east boundary of Marysville along Highway 9. Snohomish County PUD is also a participant in the JOA and is connected to the 30-inch water pipeline (JOA supply pipeline) at 28th Street NE (Soper Hill Road) at 83rd Avenue NE. This connection is metered and has a maximum flow of 2,500 GPM.

Originally, Snohomish County PUD purchased capacity equal to 3.42 MGD according to the JOA agreement, which was valid until 2020. In addition, Snohomish County PUD had equal rights (with Marysville) to 7.21 percent of the JOA supply pipeline capacity, which was designated for the Marysville/PUD overlap area. In 2003, Snohomish County PUD entered into an agreement with Marysville that transferred rights to capacity specified in the JOA as the Marysville/PUD Overlap area to Marysville. Therefore, Marysville now has purchased 63.65 percent of the capacity of the JOA supply pipeline, which is equivalent to 13.15 MGD and has agreed to serve customers in the Marysville/PUD overlap area.

In addition to the JOA connection at Soper Hill Road, the Snohomish County PUD has a 4-inch connection at 4020 – 71st Avenue NE. Flow is possible in both directions. Use of the intertie is mutual with an agreement stipulating that the Snohomish County PUD is to provide water at a hydraulic gradeline of 420 feet, and in return Marysville is to provide the Snohomish County PUD water at a hydraulic gradeline of 360 feet.

A second Snohomish County PUD intertie is located in the 7300 block of 44th Street NE. This is a one-way intertie into Marysville through an 8-inch connection. The intertie contains a meter and pressure-sustaining valve.

## 1.3.4. City of Arlington

Marysville's northern service area boundary is contiguous with the City of Arlington water service area boundary. The City of Arlington is supplied with water from four wells, a filtration plant adjacent to the Stillaguamish River, and interties with Marysville.

The Cities of Marysville and Arlington currently have two interties. A 1978 interlocal agreement for water purchased/utility intertie identified one point of connection in the Arlington airport vicinity. The maximum amount of flow at this connection point is not to exceed 100,000 GPD. A 10-inch connection (with meter) is installed at 172nd Street NE and 43rd Avenue NE

In 1998, Marysville and Arlington executed a service area settlement agreement which gave Arlington the option of purchasing the Marysville water system north of 180th Street NE. Per the 1998 agreement, an 8-inch master meter was installed at 180th Street NE and Smokey Point Boulevard with Marysville agreeing to deliver 70,000 GPD with a peak daily demand of 175,000 GPD. Since then, Arlington has purchased the portion of the Marysville system north of 180th Street on Smokey Point Boulevard and they now service this area with their own supply. The connection remains only as an emergency supply.

# 1.4. System Facilities

The Marysville water system consists of four primary sources, two emergency sources, two treatment facilities, nine storage reservoirs, three booster pump stations for the distribution system, over 290 miles of supply, transmission, and distribution pipelines, a Control Center, and many valves and other appurtenances.

## 1.4.1. Source of Supply

Currently, Marysville has two service areas within its system: the north service area is served by Marysville water from the Stillaguamish River, the Edward Springs facilities and the Lake Goodwin Well; customers in the south service area receive water from the City of Everett through the JOA agreement. Historical and current sources of supply for the Marysville system are described in greater detail below.

### History of Supply

The Marysville water system was first established in the 1930's with development of the Edward Springs collection system and supply main. Initially, the water right for the springs was limited to 0.5 MGD, but through application for additional rights a total of 3.2 MGD can now be legally withdrawn.

The Sunnyside Wells were the first to be brought on-line in the 50's and 60's, followed by the Lake Goodwin Well in 1970. In 1978, the surface waters of the Stillaguamish River were added using a Ranney Well Collector system. This was soon followed by construction and development of the Highway 9 Well in 1981.

The JOA supply line has an ultimate capacity of 20 million gallons per day of which Marysville is allocated 13.15 MGD. The purchased water from Everett serves the Marysville south service area while Edward Springs and the Stillaguamish Ranney Well Collector supply the north service area. In 2006, the Stillaguamish River Water Treatment Plant (Stillaguamish WTP) was constructed and put into service. The Stillaguamish WTP, a dual-train membrane treatment plant with a capacity of approximately 3.2 MGD, treats water from the Ranney Well Collector system which was designated a groundwater under the influence of surface water (GUI) source by DOH in 2000. In 2004, a treatment plant was constructed to treat the Edward Springs source, which was also designated a GUI source by DOH in 2000. Ultraviolet disinfection (UV) is planned to be installed in 2011.

The Lake Goodwin Well also contributes to the north service area. Lake Goodwin Well water may be isolated to a few homes or mixed with other north end supplies at the Edward Springs Reservoir, depending on valve settings. The Lake Goodwin Well is the source for the new 327 pressure zone in the north part of Marysville's service area. This pressure zone is proposed to help alleviate low pressure complaints in the area adjacent to the Edward Springs Reservoir.

## Capacity of Existing Sources

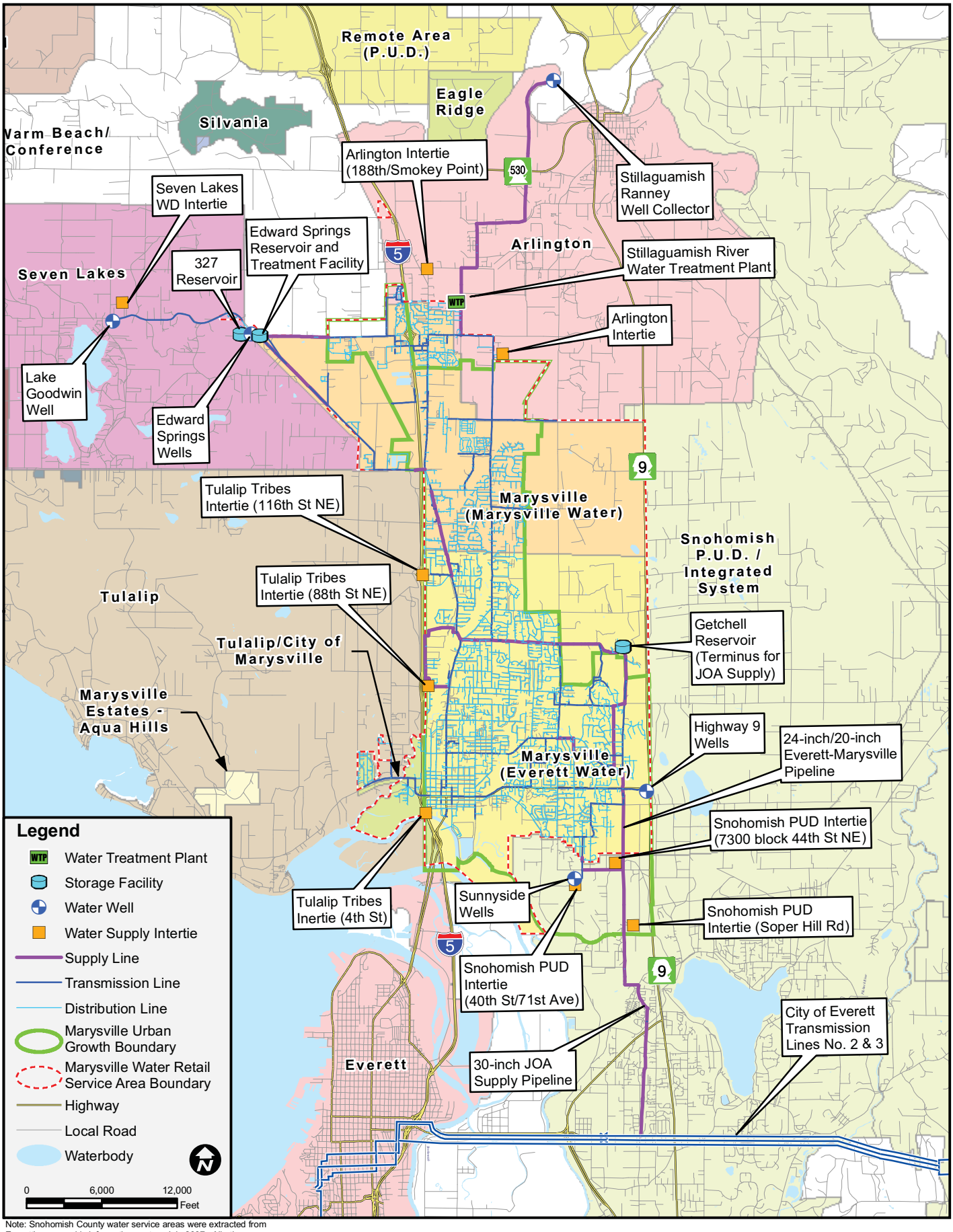
Primary sources are those that provide water during normal operating conditions. Secondary sources are intended for use in the event of emergencies, high demand, or when primary sources are off-line. Table 1-2 summarizes the classifications, capacity, and water right of each primary and secondary source. Water supply facilities are presented graphically in Figure 1-5. Distribution system facilities are discussed in detail in the following section.

### Table 1-2 Sources of Water Supply

| Primary Supply Sources | Reliable Capacity (MGD) | Water Rights | |
|---|---|---|---|
| | | Acre-Feet/Year | Conversion to MGD |
| Stillaguamish Ranney Well Collector | 3.2 | 3,600 | 3.2 |
| Edward Springs | 2.5 | 2,392 | 2.1 (1) |
| Lake Goodwin Well | 0.5 | 880 | 0.8 |
| JOA Supply Pipeline | 13.15 (2) | N/A (3) | 13.15 (3) |
| **Totals** | **19.35** | 6,872 | **19.25** |
| Secondary Supply Sources (4) | | | |
| Highway 9 Well | 1.4 | 1,600 | 1.4 |
| Sunnyside Well No. 2 | 1.1 | 1,176 | 1.1 |
| **Totals** | **2.5** | **2,776** | **2.5** |

Notes:

1) In addition to the primary water rights listed for Edwards Springs, Marysville also holds additional, supplemental water rights for this source.
2) Marysville's current entitlement based on the 1991 JOA and the 2003 Agreement with the Snohomish County PUD which transferred capacity for the Marysville/PUD Overlap area to Marysville. The full capacity of the JOA supply pipeline is 20 MGD. The remaining capacity is allocated to the Tulalip Tribes and Snohomish County PUD No. 1, and Marysville wheels water to each of them.
3) Water rights related to the JOA supply are held by the City of Everett. Value shown is Marysville's allocation under JOA.
4) Marysville holds water rights for two additional wells that are not currently in use: the Cedarcrest La Joy Well (only used for Cedarcrest Golf Course) and Sunnyside Well No. 1.




Note: Snohomish County water service areas were extracted from Everett's geographic information system July 2007. All other map data was obtained from the City of Marysville GIS 2007.

# Water Supply Facilities

**FIGURE 1-5**

### *Stillaguamish Ranney Well Collector*

The Stillaguamish Ranney Well Collector was constructed and brought on-line in 1978. The collector well has the capacity to supply the full 3.2 MGD water right. Two 100 HP 1,125 GPM capacity submersible pumps are installed in a 16-foot-diameter, 38-foot-deep caisson buried in the riverbed. During the construction of the new Stillaguamish Water Treatment Plant, the Ranney pumps were de-staged and variable frequency drives were added to the pump controls. Seven screened 10-inch collector lines, each approximately 100 feet long, extend out radially from the caisson bottom. Subsurface water is screened through the collectors and flows by gravity to the caisson pumps where it is pumped to the Stillaguamish River Water Treatment Plant for treatment and is then pumped out into the distribution system. Because of the historic high turbidity level and the inability to control activity in the watershed the Stillaguamish source is classified as a "filtration required source." The new membrane facility was put in service in December 2006.

### *Edward Springs and Associated Wells*

The Edward Springs source was developed as a Work Projects Administration project in the 1930's with an initial capacity of 1.4 MGD. Improvements to the collection system have increased the capacity to 2.5 MGD. Water is collected from springs by approximately 23 shallow collectors. Water flows by gravity from the collectors to a screen house.

In addition to the spring, there are three drilled wells in the Edward Springs watershed. Wells No. 1 and No. 2 were installed prior to 1960. Well No. 3 is located near the Edward Springs Reservoir and was installed in 1987. Well No. 1 was recently replaced and put in service in 2008. Wells No. 2 and 3 were rehabilitated in 2004. All wells are pumped to the Edward Springs Treatment Facility located adjacent to the Edward Springs Reservoir. Water is no longer chlorinated at the screen house and the treatment equipment has been removed.

Washington State DOH classified the spring collection system as a GUI source in March 2000. This classification has made the source subject to all rules and requirements of the Surface Water Treatment Rule (SWTR). In contrast to the Stillaguamish Ranney Well Collector source, Edward Springs has a controlled access watershed and water with consistently low turbidity. Marysville operates the Edward Springs source under the filtration avoidance clause of the SWTR through development of a Watershed Management Plan and other improvements which include fencing and signage at the watershed perimeter and disinfection and CT compliance improvements. In addition, Marysville thoroughly documents water quality history for the Edward Springs source as another requirement to continue avoiding filtration for this source. In preparation for upcoming regulations, Marysville designed and built a chlorine disinfection system for the Edward Springs source in 2004. A UV disinfection system will be installed in 2011.

### *Lake Goodwin Well*

The Lake Goodwin Well was originally constructed in 1970. The well is located approximately two miles west of Edward Springs and has the capability to pump directly into the Edward Springs Reservoir through a twelve-inch supply main. The well was intended to provide an additional 550 GPM backup to Edward Springs. However, pumping at that flow created clogging of the well screen by small silt particles. Therefore, the maximum operating capacity of the Lake Goodwin Well is limited to 350 GPM.

Water from this source is currently isolated from the Edward Springs Reservoir by a closed valve. The Lake Goodwin Well is the source for the 327 pressure zone, which was put into service in 2008. The well also serves 25 homes along the supply line.

*JOA Supply Pipeline*

In June of 1992 Marysville began receiving wholesale water from the City of Everett under the JOA. The 30-inch JOA supply pipeline connects to Everett's transmission lines near Hewitt Road and extends north connecting to the Marysville water system at the intersection of 83rd Ave NE and 44th St NE. The source of that water is the Sultan River. The water is treated by filtration and chlorinated by Everett before transmission to Marysville. Total capacity of the 30-inch JOA supply pipeline is 20 MGD; under the JOA and subsequent agreement with Snohomish County PUD, Marysville receives up to 13.15 MGD. The remaining 7.51 MGD is wheeled to the Tulalip Tribes and Snohomish County Public Utility District in accordance with the JOA. The JOA and related agreements which assign capacity rights to the JOA participants are described in greater detail in Chapter 2.

*Highway 9 Well*

Located west of State Route 9 at 64th Street NE, (SR 528) the Highway 9 Well was constructed in 1981 to serve the 510 pressure zone. The Highway 9 Well has had serious iron and manganese problems since it was first brought on-line. Customer complaints of reddish water and stained laundry prompted Marysville to treat the well output with a sequestering agent to prevent the iron and manganese from precipitating. The sequestering process was effective only for a short period and as the water was stored in the reservoir iron precipitate formed and settled.

Compounding the iron and manganese problem was the influence of the Highway 9 Well on private wells in the area. It became evident that the aquifer had limited capacity when the water level and level of area wells dropped after a period of operation. Operating the Highway 9 Well caused water levels to drop enough that the private wells were nearly dry. Marysville was forced to respond by providing water service free of charge. In 1984 the Highway 9 Well was taken off-line due to these issues. The well is only used to augment supply during emergency periods and is exercised on a quarterly basis to remain operable. The well was chlorinated when operated as a primary source; however all disinfection equipment was removed when the well was reclassified for secondary use only.

*Sunnyside Wells*

Sunnyside Well No. 1 was constructed in 1956. Sunnyside Well No. 2 was constructed in 1965 to operate in conjunction with Well No. 1. In 1977, and again in 1980, Well No. 1 was pumped dry during a summer drought. As a result, Well No. 1 was taken off-line soon after and has since been abandoned and filled with grout. A study is currently being conducted to relocate Well No. 1. Sunnyside Well No. 2 experienced similar problems and is now maintained only as an emergency source in the event the JOA supply pipeline is off-line. The source is exercised on a quarterly basis and tested annually enabling Marysville to use it as necessary. The well was chlorinated when operated as a primary source; however all disinfection equipment was removed when the well was reclassified for secondary use only.

## 1.4.2. Treatment Facilities

### Stillaguamish River Water Treatment Plant

The Stillaguamish River Water Treatment Plant was built and put in service in 2006 in response to the designation of the Ranney Well Collector source as a GUI source by DOH in March 2000. The new membrane plant was designed to treat the Ranney Well Collector source water in compliance with the Surface Water Treatment Rule and the Long Term 2 Enhanced Surface

Water Treatment Rule (LT2ESWTR). The plant operates 24 hours a day, seven days a week, year round. The plant is designed to produce a maximum quantity of approximately 3.2 MGD.

Raw water is pumped from the Ranney Well Collector through an 18-inch diameter supply line and passes first through a basket strainer prior to entry to the main plant. The flow then enters the membrane filtration tanks where it is treated. The primary treatment process for the WTP is a filtration process utilizing low-pressure, submerged membrane technology manufactured and supplied by Zenon Environmental, Inc. No pre-treatment is currently used in the treatment process; however, provisions have been designed to incorporate chlorine into the process upstream of the membrane tanks if needed in the future. Filtered water is pumped by vacuum from the membrane tanks and is disinfected with sodium hypochlorite, followed by storage and disinfection contact in an above-grade, 0.2 MG, steel clearwell before being pumped into Marysville's distribution system.

**Edward Springs Treatment Facility**

In 2004, Marysville built an on-site generation sodium hypochlorite chlorine disinfection facility with the ability to install UV disinfection at a later date for the Edward Springs system. The treatment facility is located at the Edward Springs Reservoir site. UV disinfection was selected to meet the requirements of the LT2ESWTR, which requires unfiltered surface water (and unfiltered GUI) supplies to achieve a minimum of 2-log inactivation for *Cryptosporidium* by 2012. The UV disinfection is planned to be in service by 2011.

## 1.4.3. Pressure Zones

The service area is physically divided into north and south service areas by valves. The south service area is served with water purchased from the City of Everett. The north service area is served from Marysville-owned sources.

**North Service Area**

The north portion of the Marysville service area is comprised of a 460 pressure zone, the north 240 pressure zone and a smaller 327 pressure zone. The pressure zones and facilities that comprise the north service area are shown in Figure 1-6.

### *460 Zone*

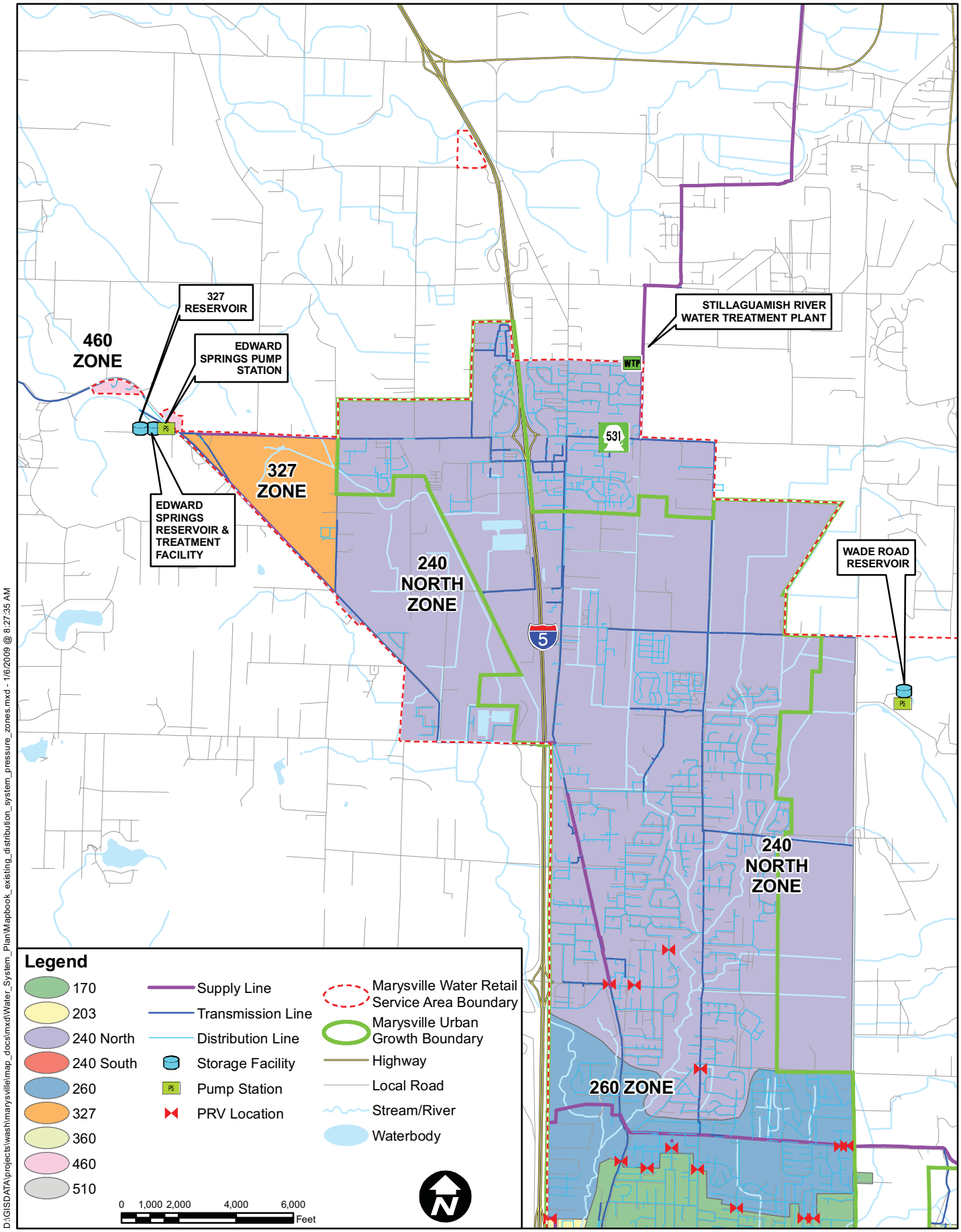
The Lake Goodwin Well serves as the source for customers in this small pressure zone, which is comprised of approximately 25 homes. Marysville plans to tie in and upgrade the Edward Springs Booster Pump Station in the next few years to provide additional fire flow capacity to this pressure zone.

### *North 240 Zone*

The north 240 zone is served by the Edward Springs Reservoir and the Stillaguamish River Water Treatment Plant. The Wade Road Reservoir also provides storage for this pressure zone.

### *327 Zone*

The Lake Goodwin Well provides water to customers in the 327 pressure zone through a pressure sustaining valve. The 0.68 MG 327 Zone Reservoir provides storage for this zone in Marysville's north service area. The Edward Springs Booster Pump Station can also be used to serve the 327 zone during periods of high demand.




# Existing Distribution System & Pressure Zones North System

**FIGURE 1-6**

## South Service Area

The south portion of the Marysville service area is currently divided into six pressure zones. The zones are labeled according to the elevation, relative to mean sea level, of the static pressure head in each zone. The zone boundaries are located to provide a service pressure range of 30 to 90 psi under maximum and average day demand conditions. Zone boundaries and water facilities located within the south service area of the Marysville water system are shown in Figure 1-7.

### *170 Zone*

The 170 zone is fed by PRVs at various locations from the south 240 zone, the 260 zone and the 360 zone. The Cedarcrest Reservoir provides storage for the 170 pressure zone.

### *203 Zone*

This small zone is fed by a single PRV from the 260 pressure zone. This zone was created to increase pressure for a hotel complex located within its boundaries. There is no storage in this pressure zone.

### *South 240 Zone*

The south 240 pressure zone is fed by PRVs from the 360 pressure zone. There is no storage in this pressure zone.

### *260 Zone*

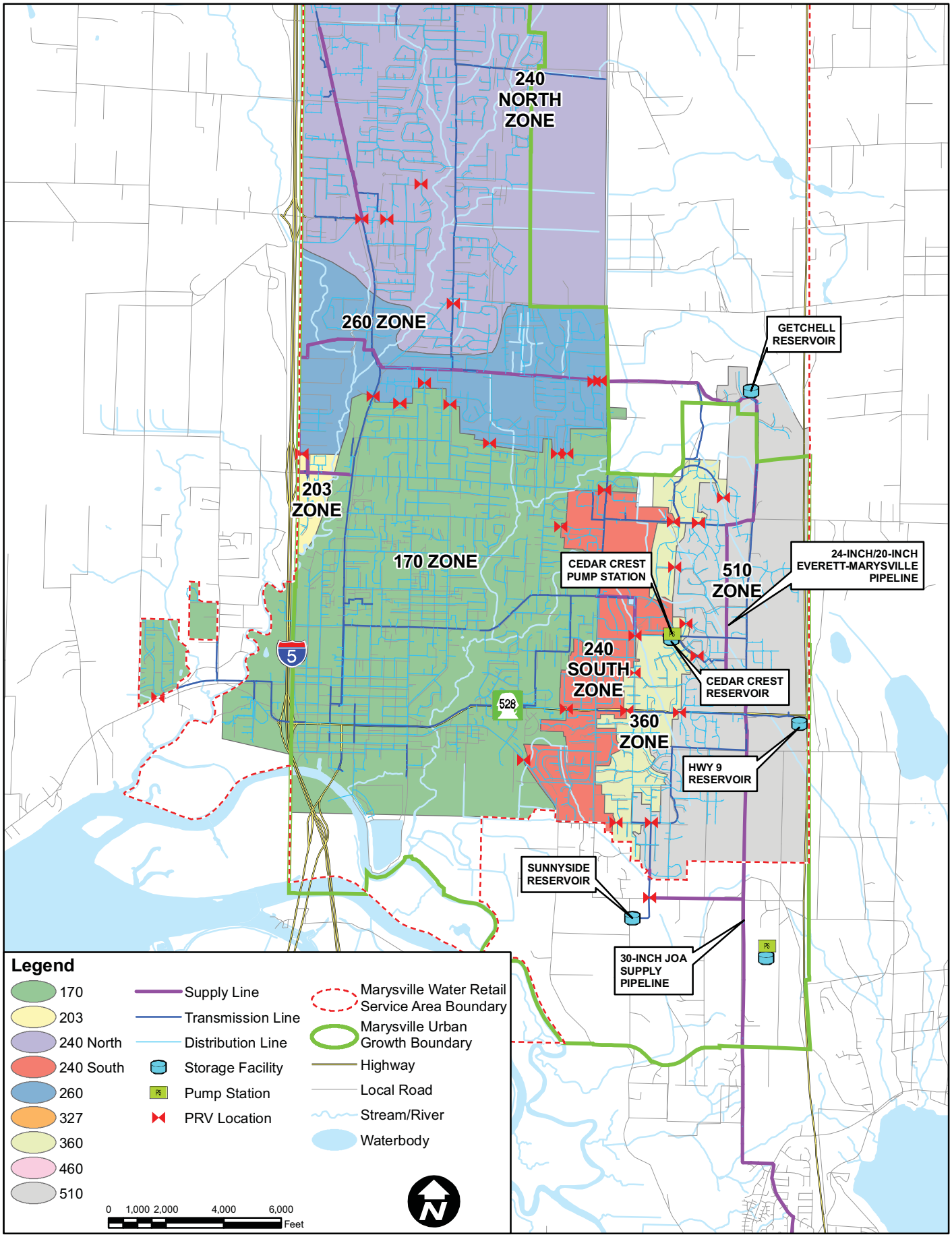
The hydraulic gradeline of the 260 zone was formerly 240 feet. This pressure zone is fed by PRVs from the 360 pressure zone. This pressure zone can back feed to the north 240 zone through valves for emergency purposes. There is no storage in this zone.

### *360 Zone*

The 360 zone is fed by the Getchell Reservoir, which serves as the terminus for the JOA and Everett-Marysville supply pipelines. This 6.0 MG reservoir provides water for all of the pressure zones in the south service area. The Sunnyside Reservoir also serves the 360 zone and Sunnyside Well No. 2 serves as an emergency source for this pressure zone. PRVs feed the 260, 240 and 170 pressure zones.

### *510 Zone*

The 3.5 MG Cedarcrest Reservoir is the source of supply for the Cedarcrest Booster Pump Station which pumps water to feed the 510 pressure zone. The Highway 9 Reservoir provides storage for the 510 pressure zone. The Highway 9 Well serves as an emergency source of supply for this zone.




# Existing Distribution System & Pressure Zones South System

**FIGURE 1-7**

The nominal gradelines (HGLs) and the range of service elevations and pressures for each of Marysville's pressure zones are summarized in Table 1-3. Individual PRVs are installed on services that encounter pressures greater than 90 psi. The hydraulic relationship among pressure zones, reservoirs, pump stations, PRVs, source of supply and interties for the north and south service areas are shown in Figures 1-8 and 1-9, respectively.

**Table 1-3 Pressure Zones**

| Pressure Zone | Minimum Service Elevation (ft) | Maximum Service Elevation (ft) | Minimum Static Service Pressure (psi) | Maximum Static Service Pressure (psi) |
|---|---|---|---|---|
| **North 240** | 60 | 200 | 17 | 78 |
| **327** | 173 | 250 | 34 | 67 |
| **170** | 5 | 97 | 32 | 72 |
| **203** | 40 | 59 | 70 | 62 |
| **South 240** | 40 | 170 | 30 | 87 |
| **260** | 43 | 132 | 56 | 94 |
| **360** | 75 | 285 | 33 | 124 |
| **510** | 145 | 430 | 35 | 158 |

*Intentionally left blank.*

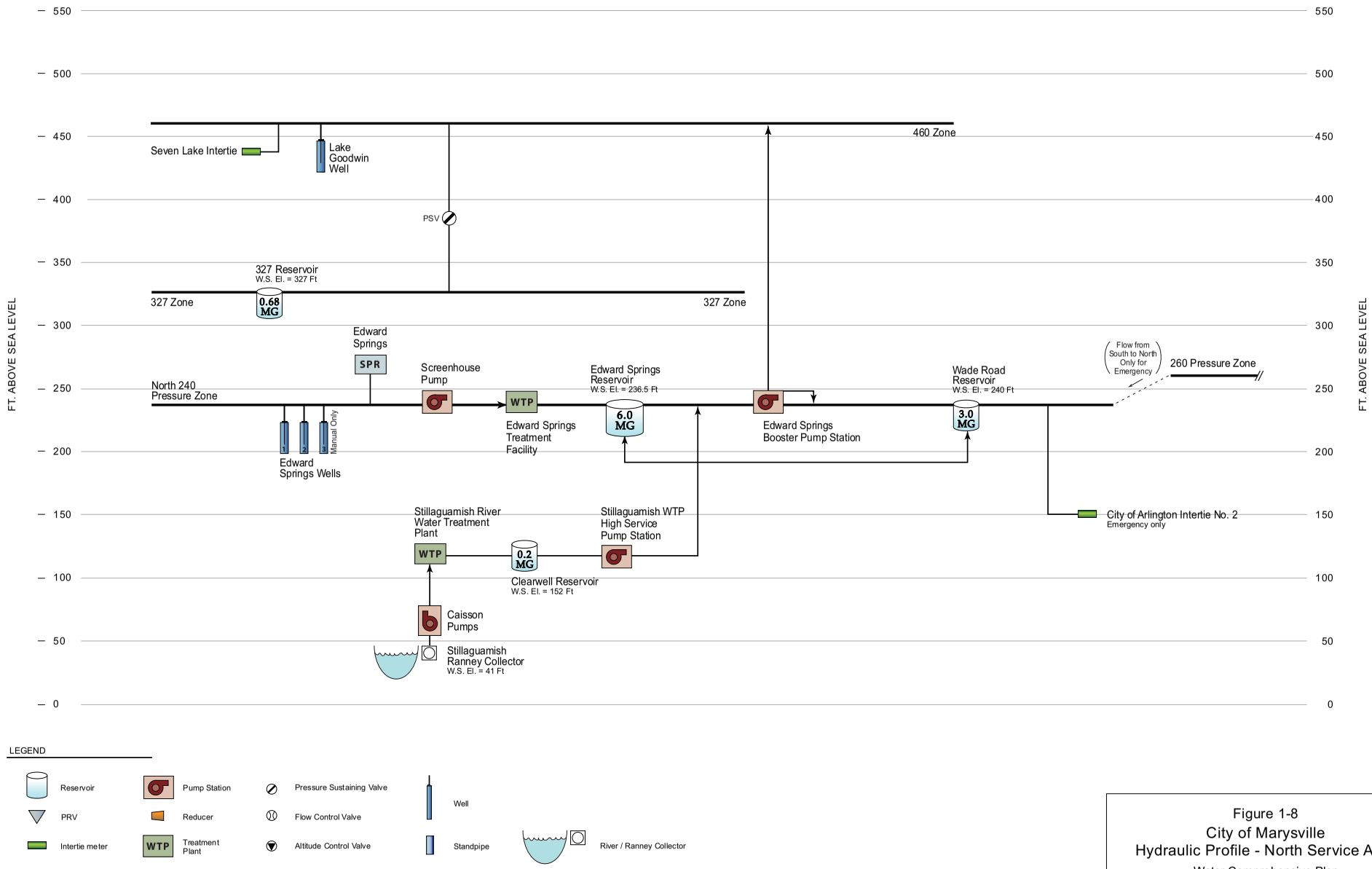



Figure 1-8
City of Marysville
Hydraulic Profile - North Service Area
Water Comprehensive Plan

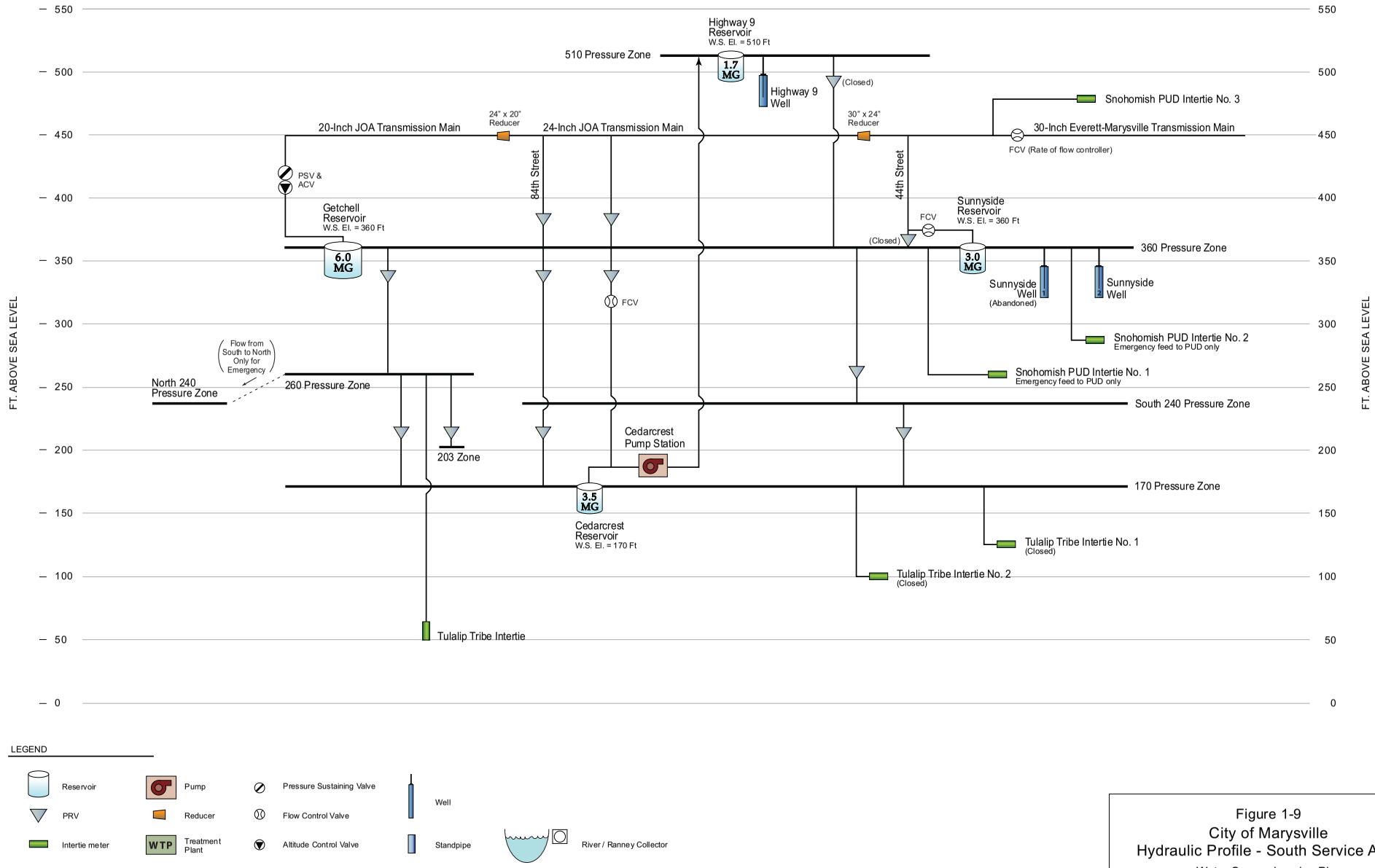



Figure 1-9
City of Marysville
Hydraulic Profile - South Service Area
Water Comprehensive Plan

## 1.4.4. Storage

The Marysville water system currently has 24.34 million gallons (MG) of available water storage. Table 1-4 describes specific features of each storage facility and a summary of each facility follows.

**Table 1-4 Existing Water Storage Facilities**

| Facility | Year Constructed (year updated) | Water Surface Elevation | Diameter (ft) | Height (ft) | Capacity (MG) | Construction Material |
|---|---|---|---|---|---|---|
| **North Service Area** | | | | | | |
| Edward Springs Reservoir | 1975 (1999) | 239.4 | Irregular shape | 15 | 6.0 | PVC Lined [1] |
| Stillaguamish WTP Clearwell | 2006 | 152.0 | 59.0 | 22.5 | 0.46 | Steel |
| Wade Road Reservoir | 2007 | 239.4 | 120.6 | 35 | 3.0 | Steel |
| 327 Zone Reservoir | 2008 | 327.0 | 66.0 | 27 | 0.68 | Steel |
| **South Service Area** | | | | | | |
| Getchell Reservoir | 1995 | 360.0 | 182 | 32 | 6.0 | Pre-stressed concrete |
| Cedarcrest Reservoir | 1987 | 170.0 | 150 | 30 | 3.5 | Pre-stressed concrete |
| Highway 9 Reservoir | 1998 | 510.0 | 77 | 54.75 | 1.7 | Steel |
| Sunnyside Reservoir | 2007 | 360.0 | 92 | 64 | 3.0 | Steel |
| **Total Storage Capacity** | | | | | **24.34** | |

Notes:
1) Embankment covered with PVC Liner.

### Edward Springs Reservoir

The Edward Springs Reservoir has a storage capacity of 6 MG. It operates at the nominal water surface elevation of 240 feet mean sea level (MSL). The reservoir is supplied by the Edward Springs collection system and deep wells, the Stillaguamish Ranney Well Collector, and has the potential to be supplied from the Lake Goodwin Well. A new Hypalon® cover and PVC liner with an improved anchoring system were installed in 1999.

### Stillaguamish River Water Treatment Plant Clearwell

This 0.2 MG steel clearwell reservoir is located at the site of the Stillaguamish WTP. Finished water is pumped from the membrane tanks into the clearwell and the High Service Pump Station pumps from the clearwell into the Edward Springs Reservoir, the north 240 zone or the Wade Road Reservoir.

### Wade Road Reservoir

The Wade Road Reservoir is a 3 MG steel tank that was constructed in 2007. The reservoir was built to provide storage on the east side of the north 240 pressure zone.

### 327 Zone Reservoir

The 0.68 MG 327 Zone Reservoir was constructed in 2008. This steel reservoir provides storage for the 327 pressure zone.

### Getchell Reservoir

The Getchell Reservoir was brought on-line in 1996. It is a pre-stressed concrete reservoir designed to meet current seismic standards. This reservoir provides 6 MG of storage and is the terminus point of the JOA and Everett-Marysville supply pipelines.

### Cedarcrest Reservoir

The 3.5 MG Cedarcrest Reservoir was constructed in 1987. The pre-stressed concrete reservoir primarily serves the 170 pressure zone.

### Highway 9 Reservoir

The Highway 9 Reservoir is a 1.7 MG steel tank that was constructed in 1998 on the Highway 9 Well site. The overflow elevation of the reservoir was increased by 20 feet (490 to 510) to eliminate low pressure in several areas throughout the 510 pressure zone. The Highway 9 Reservoir is filled by the Cedarcrest Booster Pump Station and in an emergency by the Highway 9 Well. It provides the only storage for the 510 pressure zone and can supply the lower zones through pressure reducing valves. There are two reservoirs on the site. One reservoir is in use. The second reservoir is not in use and will be demolished soon and will be replaced with a similar 1.7 MG steel reservoir in 2009.

### Sunnyside Reservoir

The 0.2 MG Sunnyside Standpipe was replaced in 2007 with a 3 MG steel reservoir, which operates at the same water surface elevation of 360 feet. The JOA supply pipeline supplies water to the reservoir.

## 1.4.5. Pump Stations

The existing water system was designed to provide as much water as possible to customers via gravity flow, resulting in better reliability and lower operating costs. Marysville uses two booster pump stations to operate the system, the Edward Springs Booster Pump Station and Cedarcrest Booster Pump Station. The High Service Pump Station at the Stillaguamish WTP is also required to provide water for the north service area. Table 1-5 lists the characteristics for these pump stations.

### Edward Springs Booster Pump Station

The Edward Springs Booster Station was originally constructed to boost pressure during peak demands and provide adequate fire flow in the north service area prior to the installation of the High Service Pumps at the Stillaguamish WTP. The booster station is located adjacent to the Edward Springs Reservoir. With the new high service pumps in operation, the Edward Springs Booster Pump Station is no longer needed for this purpose, and it is now used to supply fire flow to the 460 zone and backup supply to the 327 zone.

### Cedarcrest Booster Pump Station

The Cedarcrest Booster Pump Station was constructed in 1987 and is adjacent to the Cedarcrest Reservoir. The three 150 hp electric motors drive the pumps that deliver 1,200 GPM to the Highway 9 Reservoir in the 510 pressure zone. Each pump is independent of one another and only one pump operates at any given time.

### High Service Pump Station

Three high service pumps at the Stillaguamish WTP pump finished water from the clearwell into the Edward Springs Reservoir, the Wade Road Reservoir and/or the north 240 pressure zone.

## Table 1-5 Pump Stations

| Facility | Year Station Built/(Pump Updated) | Supply HGL | Pressure Zone Served | Pump No. | Pump Manufacturer | Pump Model | Capacity (gpm) | Rated Head (ft) | Speed (rpm) | Motor Power (hp) | Backup Power |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Stillaguamish WTP Ranney Well Collector Pumps | 1998/(2000) | NA | Raw Water to Stillaguamish WTP | 1 | Byron Jackson | 11MQH | 1,125 | 187 | 900-1,770 | 100 | No |
| | | | | 2 | Byron Jackson | 11MQH | 1,125 | 187 | 900-1,770 | 100 | No |
| Stillaguamish WTP High Service Pump Station | 2006 | 240 | North 240 | 1 | Paco | 11-40129-0A6N11-2902EE | 1,100 | 118 | 180 – 1,800 | 50 | No |
| | | | | 2 | Paco | 11-40129-0A6N11-2902EE | 1,100 | 118 | 180 – 1,800 | 50 | No |
| | | | | 3 | Paco | 11-40129-0A6N11-2902EE | 1,100 | 118 | 180 – 1,800 | 50 | No |
| Edward Springs Booster Pump Station | 2001 | 240 | North 240 | 1 | Simflo | SK16C | 3,500 | 68 | 1,800 | 75 | Yes |
| | | | | 2 | Simflo | SK16C | 3,500 | 68 | 1,800 | 75 | Yes |
| Cedarcrest Booster Pump Station | 1987 | 170 | 510 | 1 | Byron Jackson | 12MQ | 1.000 | 400 | 1,750 | 150 | No |
| | | | | 2 | Byron Jackson | 12MQ | 1,000 | 400 | 1,750 | 150 | No |
| | | | | 3 | Byron Jackson | 12MQ | 1,000 | 400 | 1,750 | 150 | No |

## 1.4.6. Supply, Transmission, and Distribution Pipelines

The Marysville supply, transmission and distribution consist of 292 miles of pipes. Table 1-6 summarizes the system's piping according to main size, materials and total length. Figures 1-5, 1-6 and 1-7 all show the location of Marysville's supply, transmission, and distribution mains.

### Supply Mains

Supply mains convey the water from the sources to the distribution system and storage. Marysville categorizes supply mains generally as any main 18-inches or greater in diameter. Marysville has 22.7 miles of supply mains including two principal supply mains, one serving the south portion and one serving the north portion of the Marysville water system.

*JOA Supply Pipeline*. The largest supply main is the 30-inch steel JOA supply pipeline constructed in 1992. The supply main begins at Everett's No. 2 and No. 3 transmission lines near the intersection of the Bonneville Power Administration right-of-way and Hewitt Avenue East in Everett. Connection to the Marysville system is located at the intersection of 83rd Avenue NE and 44th Street NE, just northeast of the Sunnyside Wells and Reservoir.

*Everett-Marysville Pipeline*. In 1993, the JOA supply pipeline was extended from 44$^{th}$ Street NE to SR 528 (64$^{th}$). This portion of the pipeline, referred to as the Everett-Marysville pipeline was reduced from 30-inch to 24-inch.

In 1994-1995 the 24-inch Everett-Marysville pipeline was extended north from SR 528 (64$^{th}$ Street) to 84$^{th}$ Street along 83$^{rd}$ Street/Olympic Pipeline right-of-way. At 84$^{th}$ Street the main is reduced to 20-inches, and extends north along 83$^{rd}$ Street right of way to 100$^{th}$ Street terminating at the Getchell Reservoir. A 24-inch transmission main is located along 100$^{th}$ Street NE leading to the former site of the Kellogg-Marsh Reservoir just west of 67$^{th}$ Ave NE on 100$^{th}$ Street NE. In 1996 an 18-inch water main was extended along 100$^{th}$ Street NE west to State Avenue. Water is conveyed to the distribution system through 18-inch/24-inch transmission main within 100$^{th}$ Street NE.

*Stillaguamish Collector Supply Main.* The Stillaguamish Collector supply main is an 18-inch ductile iron pipe carrying raw water from the Ranney Well Collector, in the Stillaguamish River, south to the Stillaguamish River Water Treatment Plant and then continues carrying treated water from the clearwell into the distribution system. Some modifications were made to break the existing line into two lines, one carrying raw water from the river to the WTP and the other carrying water from the clearwell into the north 240 pressure zone.

### Transmission Mains

Transmission mains are generally 12- to 16- inch mains that connect with the distribution mains. Many of the system transmission mains are restricted by control valves at the pressure zone boundaries. The Marysville system has approximately 49 miles of transmission mains.

### Distribution Mains

Marysville has approximately 219 miles of distribution mains. Distribution mains are typically 10-inch and smaller and supply water to service connections and fire hydrants. The current Marysville standard minimum distribution main size is 8-inches.

**REVISED FOR NEW PLAN USING GIS DATA PROVIDED IN SUMMER 2007**

## Table 1-6 Water System Pipelines

| Diameter (in) | Total Length (ft) | AC | CI | COP | DI | GALV | PVC | Unknown Material |
|---|---|---|---|---|---|---|---|---|
| **Unknown** | 21,619 | 4 | 2,926 | | 5,413 | 11 | 0 | 13,264 |
| **<3** | 2,437 | | 828 | 146 | 785 | 469 | 108 | 100 |
| **3** | 156 | | | | 147 | | | 9 |
| **4** | 68,064 | | 19,375 | | 48,236 | | 180 | 274 |
| **6** | 448,979 | 2,426 | 297,003 | | 145,340 | 130 | 1,233 | 2,846 |
| **8** | 554,772 | 2,799 | 74,998 | | 475,320 | | 36 | 1,619 |
| **10** | 62,298 | 1,238 | 20,838 | | 40,129 | | | 94 |
| **12** | 224,183 | 52,682 | 69,769 | | 97,681 | | 567 | 3,484 |
| **14** | 15,231 | | 4,387 | | 10,844 | | | |
| **16** | 19,238 | | | | 19,032 | | 206 | |
| **18** | 67,837 | | 316 | | 47,602 | | | 19,919 |
| **20** | 5,595 | | | | 4,434 | | 1,161 | |
| **24** | 23,904 | | | | 21,741 | | 2,163 | |
| **30** | 22,541 | | | | 21 | | | 22,521 |
| **Total** | **1,536,855** | **59,149** | **490,440** | **146** | **916,725** | **611** | **5,655** | **64,130** |

Notes: Pipe information summarized from GIS data provided by City of Marysville, September 2007.
AC = asbestos cement
CI = cast iron
COP = copper
DI = ductile iron
GALV = galvanized steel
PVC = polyvinyl chloride

### 1.4.7. Valves

Marysville uses pressure reducing valves (PRVs) and other valving such as altitude valves, gate valves, and butterfly valves to maintain adequate system pressures, direct flow in the system, isolate the north and south service areas, and at interties. The system contains 29 PRVs. Table 1-7 summarizes the location, to and from pressure zones, size, elevation, settings and downstream hydraulic grade lines for all PRVs in the Marysville system.

## Table 1-7 PRV Information

| Station/Location | Pressure Zones | | Size (in) | Setting (psi) | Elevation (ft) | HGL (ft) | Comment |
|---|---|---|---|---|---|---|---|
| | From | To | | | | | |
| 7701 Grove St NE | Everett | 360 | 10<br>3 | 34<br>39 | 270.9 | 349.3<br>360.9 | Active |
| 7528 64th St NE | Everett | 360 | 8<br>3 | 43<br>47 | 249.8 | 349.0<br>358.4 | Active |
| 7301 44th St NE | Everett | 360 | 10<br>4 | 40<br>45 | 256.8 | 349.1<br>360.6 | Closed |
| 7609 84th St NE | Everett | 360 | 8<br>3 | 25<br>30 | 274.7 | 332.4<br>343.9 | Active |
| 7421 78th St NE | 510 | 360 | 6<br>1 ½ | 35<br>40 | 241.9 | 322.6<br>334.2 | Active |
| 7311 76th Dr NE | 510 | 360 | 6<br>1 ½ | 35<br>40 | 255.0 | 335.7<br>347.3 | Active |
| 7301 52nd St NE | 510 | 360 | 8<br>2 | 15<br>20 | 284.5 | 319.1<br>330.7 | Active |
| 6605 100th St NE | 360 | S 240 | 12<br>6 | 65<br>70 | 109.7 | 259.7<br>271.2 | Active |
| 6904 71st Ave NE | 360 | S 240 | 8 | 32 | 167.1 | 240.8 | Active |
| 7000 64th St NE | 360 | S 240 | 8<br>2 | 29<br>34 | 161.5 | 228.4<br>239.9 | Active |
| 6831 52nd St NE | 360 | S 240 | 8<br>1 ½ | 23<br>28 | 177.3 | 230.4<br>241.9 | Active |
| 7309 84th St NE | 360 | S 240 | 8<br>3 | 32<br>37 | 153.9 | 227.3<br>239.3 | Active |
| 9700 State Ave NE | S 240 | 170 | 12<br>4 | 46<br>51 | 51.2 | 157.5<br>168.9 | Active |
| 9509 45th Dr NE | S 240 | 170 | 8<br>3 | 43<br>48 | 52.8 | 152.0<br>163.5 | Active |
| 6429 100 St NE | S 240 | 170 | 8 | 24 | 113.8 | 169.2 | By-pass open |
| 9804 48th Dr NE | S 240 | 170 | 8 | 44 | 59.7 | 158.2 | Active |
| 9600 51st Ave NE | S 240 | 170 | 6 | 32 | 74.8 | 148.6 | Active |
| 9201 55th Ave NE | S 240 | 170 | 8 | 42 | 66.7 | 163.6 | Active |

| Station/Location | Pressure Zones | | Size (in) | Setting (psi) | Elevation (ft) | HGL (ft) | Comment |
|---|---|---|---|---|---|---|---|
| | From | To | | | | | |
| 9135 61st Dr NE | S 240 | 170 | 4 | 41 | 64.8 | 159.4 | Active |
| 9135 62nd Dr NE | S 240 | 170 | 4 | 42 | 65.2 | 162.1 | Active |
| 6629 88th St NE | S 240 | 170 | 10<br>4 | 30<br>34 | 85.2 | 154.4<br>163.6 | Active |
| 7216 71st Ave NE | S 240 | 170 | 8<br>2 | -<br>22 | 148.4 | -<br>199.1 | Not Active (Bailey Valve) |
| 6502 64th St NE | S 240 | 170 | 8<br>2 | 37<br>42 | 66.3 | 151.6<br>163.1 | Active |
| 5801 Sunnyside Blvd | S 240 | 170 | 8<br>3 | 53<br>58 | 36.6 | 158.9<br>170.4 | Active |
| 3508 90th St NE | S 240 | 170 | 12<br>4 | 48<br>53 | 46.5 | 157.3<br>168.8 | Active |
| 6621 79th Pl NE | S 240 | 170 | 6<br>2 | 36<br>41 | 65.5 | 148.5<br>160.1 | Active |
| 6213 83rd Pl NE | S 240 | 170 | 6<br>2 | 34<br>39 | 59.9 | 138.1<br>149.8 | Active |
| 10700 51st Ave NE | S 260 | N 240 | 8<br>2 | 65<br>70 | 0<br>0 | -<br>- | Emergency North to South Conn. |
| 8210 100th St NE | Everett Supply | Getchell Reservoir | - | 32 psi on Inlet and 5 psi on Outlet | - | - | Pressure sustaining valve for Getchell Reservoir feed |

## 1.4.8. Control/Telemetry

The water system has a Headquarters telemetry control panel at the Public Works Building on Columbia Avenue. Marysville also has a remote control facility located at the Stillaguamish River Water Treatment Plant. System facilities including source, storage, and pumping can be controlled with the telemetry system. Detailed facility-specific telemetry capabilities are included in the Operations and Maintenance chapter of this Water System Plan.

Marysville is currently in the process of upgrading their telemetry system for both the water and wastewater systems. The project should be complete in 2008. General instrumentation and control capabilities are shown below. Please refer to Chapter 8 for a table that shows telemetry capabilities for every major facility within the Marysville water system.

- Altitude valve open/close
- Chlorine alarm
- Communication failure
- Control room intrusion alarm
- Flow totalizer
- High/low flow
- High/low level alarm
- High/low pressure alarm
- High temperature
- Line/power failure alarm
- Low suction pressure
- Low well level alarm
- Pump failure
- Pump control
- Reservoir outlet flow recorder
- Reservoir inlet flow
- Reservoir level recorder
- Smoke alarm
- Surge control valve failure alarm
- Valve failure
- Water in control room alarm/flood alarm
- Well water turbidity
- Well level recorder – Ranney Well only
- Well pump overload alarm
- Turbidimeter

# 2. Related Plans, Policies and Agreements

The City of Marysville's (Marysville) program to provide a comprehensive and reliable system for delivering water supply to its customers is part of a larger network of plans, policies and agreements that address land uses and water supply within Snohomish County. This chapter provides a brief description of selected plans, policies and agreements that relate to the Marysville water system. Relevant excerpts from the documents described in this chapter may be found in Appendix 2-1.

## 2.1. Comprehensive Land Use Plans

Land use and growth management strategies within Marysville's water retail service area are defined by land use plans prepared by Marysville and Snohomish County. As development within Marysville's water retail service area occurs under the provisions of these land use plans, Marysville provides for extension of the water system to meet water supply needs.

### 2.1.1. City of Marysville Comprehensive Plan

Marysville's Comprehensive Plan was originally adopted in 1996, and the most recent update was completed in 2005. Based on community values and vision, the Comprehensive Plan provides a framework for decisions on growth, land use, transportation, public facilities and services, parks and recreation, resource lands, and critical areas through the year 2025. The Comprehensive Plan was developed pursuant to the State Growth Management Act (GMA). The Comprehensive Plan includes nine "elements," or chapters, of which the Land Use, Housing and Public Facilities and Services elements are considered most relevant to this Plan. A summary of these sections and their relevancy to and consistency with this Plan are provided below.

**Land Use**

The Land Use element establishes the basis for balancing all other elements of the comprehensive plan, and drives future utility, capital facility and service decisions and needs. This plan element provides an inventory of existing population and employment capacity, and an analysis comparing the capacity to 2025 forecasts.

The Land Use element also evaluates the capacity of Marysville's Urban Growth Area (UGA) to accommodate future population growth. Snohomish County is responsible for approving the UGA for each city and urban area. The County is required to collaborate with cities in making these decisions. Cities are then expected to ultimately annex areas within their respective UGAs and to plan for service delivery for these areas. Marysville's original UGA was established in 1995 by the Snohomish County Council. Marysville's current UGA and its relationship to Marysville's water retail service area is shown in Figure 1-2 (see Chapter 1). As discussed in Chapter 1, Marysville does not currently provide service to all areas within its water retail service area, but it is anticipated that Marysville will serve this area within the 20 year planning period of this Plan.

Table 2-1 presents population and employment projections for the Marysville UGA and compares the land capacity of the UGA under the 2005 comprehensive plan update. These forecasts are similar to those provided in Chapter 3 of this Plan. The population forecast developed as part of this Plan projects a population of 73,875 within Marysville's water retail service area in the year 2025 (see Appendix 3-1). This forecast is within eight percent of the medium-growth population scenario in Marysville's Comprehensive Plan. The employment forecast developed as part of this Plan projects the number of employees in the water retail service area to be 16,553 in 2025. (see Appendix 3-1). This forecast is within four percent of the medium-growth employment forecast in Marysville's Comprehensive Plan.

**Table 2-1 Marysville Comprehensive Plan Population and Employment Forecasts**

| Population Scenario | 2025 Population Target | Additional Population[1] | 2025 Employment Target | Additional Employment[2] |
|---|---|---|---|---|
| Low | 73,110 | 20,068 | 17,230 | 6,872 |
| Medium | 79,800 | 26,758 | 17,230 | 6,872 |
| High | 86,490 | 33,448 | 25,000 | 14,642 |
| 2005 Land Use Plan Capacity | 80,431 | - | 26,766 | - |

Source: City of Marysville Comprehensive Plan, 2005, Table 4-2

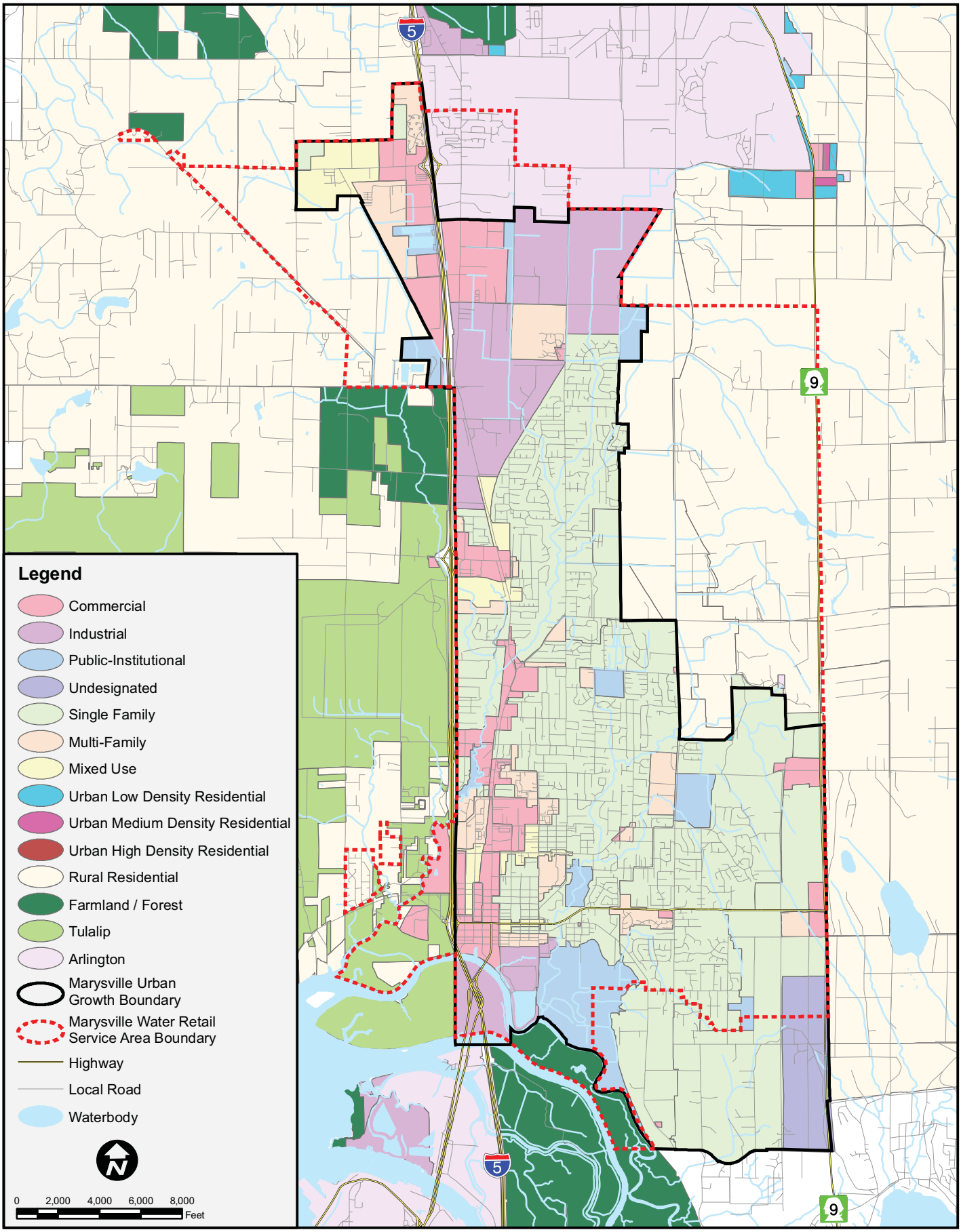
1) Additional population refers to the numeric change in population from 2005.
2) Additional employment refers to the numeric change in employment from 2005.

The Comprehensive Plan identifies three main categories of zoning: residential, commercial, and industrial. Each of these is divided into further designations. Figure 2-1 shows the land use designations identified in the Comprehensive Plan.

With regard to residential development, most of the UGA's land area is designated for single-family residences. However, because of the increased cost of single-family housing, it is anticipated that one third of the new Marysville population will live in multiple-family housing (which is inherently more compact). The Comprehensive Plan points out that population increases will depend on economic development, market forces and State growth management policies, and will follow a non-linear pattern characteristic of an economic cycle.

The Comprehensive Plan designates commercial lands primarily running north to south near the I-5 corridor (see Figure 2-1). Additional small community and neighborhood commercial areas are also provided for within residential areas.

Industrial lands designated in the Comprehensive Plan are located primarily in North Marysville along the east side of I-5; and at the south end of Marysville in the Ebey Slough area (see Figure 2-1). The Comprehensive Plan notes that demand for industrial land is difficult to estimate. Factors such as decreasing availability and increasing cost of industrial land in the region, traffic congestion in other parts of the central Puget Sound region, and proximity to surface transportation associated with rail and the I-5 corridor are cited as influential in determining the attractiveness of Marysville lands for industrial development. Increasing development costs for industrial lands in the south end and decreasing availability in the region may increase the desirability of industrial lands at the north end of Marysville.




Note: Map data was obtained from the City of Marysville GIS 2007 and PSRC 2007.

# *Marysville & Snohomish County Land Use Designations*

***FIGURE 2-1***

The Comprehensive Plan also discusses rural residential lands outside the UGA. One category of rural residential lands is anticipated to be included within the UGA at a later date to accommodate higher densities. The other category would be anticipated to remain rural in the long-term.

**Housing**

The Housing element provides an analysis of existing household characteristics, housing stock, and housing needs within Marysville and its UGA. It identifies projected housing needs and identifies goals and policies to guide future housing development to meet these needs within the community. It is noted in the Comprehensive Plan that Marysville will consider a mix of densities and unit types in its land use plan to accommodate housing needs.

The land capacity analysis described above identifies a population capacity of 80,431 within the UGA, which represents additional capacity for 10,739 new households on 8,313 buildable acres. This forecast is similar to that provided in Chapter 3 of this Plan. The forecast of households developed as part of this Plan projects an increase of 12,196 single family households and an increase of 3,821 multi-family households, for a total increase of 16,017 new households within Marysville's water retail service area by 2025 (see Appendix 3-1). This forecast is within 33 percent household forecast for the UGA in Marysville's Comprehensive Plan. The disparities in these figures can be attributed to the difference in geographical area used to develop each estimate.

**Public Facilities and Services**

The Comprehensive Plan addresses water service under the Public Facilities and Services element. It discusses the North Snohomish County Coordinated Water System Plan and the Joint Operating Agreement (see discussion below) and the construction of the 30-inch JOA pipeline from Everett to Marysville, which was completed in 1992. The Comprehensive Plan also provides descriptive information on the Marysville water system and customer base, similar to that provided in other chapters of this Plan. The Comprehensive Plan states that Marysville will provide water service within Marysville's Urban Growth Area. Requests for water service outside the UGA can be met only if a property meets criteria outlined in Marysville's Municipal Code.

## 2.1.2. Snohomish County Comprehensive Plan

The 2005 Snohomish County Comprehensive Plan guides growth and development in the unincorporated areas of Snohomish County through 2025. The County's Comprehensive Plan includes four chapters that are relevant to this Plan, including: Population and Employment, Land Use, Utilities, and Inter-jurisdictional Coordination. A summary of these sections and their relevancy to and consistency with this Plan are provided below.

**Population and Employment**

The Population and Employment chapter of the Snohomish County Comprehensive Plan provides projections for population and employment numbers for the year 2025 (see Table 2-2).

These projections are not the same as those used for the demand forecast in Chapter 3 of this Plan. The difference is attributed to different sources (the demand forecast uses demographic data from the Puget Sound Regional Council) and different geographical areas (Marysville's water retail service area vs the Marysville UGA).

The population forecast developed for Marysville's water retail service area as part of this Plan is within 7 percent of the population forecast for Marysville's UGA in the County's Comprehensive Plan.

The employment forecast for the water retail service area developed as part of this Plan varies by 30 percent from the employment forecast for Marysville's UGA in the County's Comprehensive Plan. Note that additional analysis was performed to explore the implications of using the higher employment numbers from the County for the demand forecast. The results of that analysis showed that no additional Capital Improvement Projects would be needed.

A similar comparison of the number of households was not possible because the Snohomish County Comprehensive Plan does not provide a household forecast.

**Table 2-2 Snohomish County Population and Employment Forecasts for Marysville**

| Area | 2002 Estimated Population | 2025 Population Target | Forecast Increase |
|---|---|---|---|
| Marysville UGA | 50,828 | 79,800 | 28,972 |
| Marysville City | 27,580 | 36,737 | 9,157 |
| Unincorporated | 23,248 | 43,063 | 19,815 |
| **Area** | **2002 Estimated Employment** | **2025 Employment Target** | **Forecast Increase** |
| Marysville UGA | 11,292 | 24,008 | 12,716 |
| Marysville City | 9,369 | 16,851 | 7,482 |
| Unincorporated | 1,923 | 7,157 | 5,234 |

Source: Snohomish County Comprehensive Plan, December 2006, Appendix D, Tables D-1 and D-2

### Land Use

The Snohomish County Comprehensive Plan designates UGAs and characterizes land use classifications for all unincorporated land in the county. Figure 2-1 shows County land use designations in Marysville's UGA and unincorporated Snohomish County.

### Utilities

Snohomish County does not supply water; however, it has a vested interest in water supply issues, as the County is ultimately responsible for water service if a water utility fails to provide service or becomes financially insolvent. The Snohomish County Comprehensive Plan identifies the following goals for utility planning:

- **Goal UT 1**: Enhance the efficiency and quality of service from utility providers through the review and evaluation of utility, land use, transportation, and natural environment planning documents.

- **Goal UT 2**: Work with provider agencies of Snohomish County and assist them to ensure the availability of a reliable, high quality water supply for all households within the county in a manner that is consistent with the comprehensive plan and protection of the natural environment.

**Inter-jurisdictional Coordination**

The Snohomish County Comprehensive Plan discusses the need for coordination across jurisdictions to address certain planning issues that cross jurisdictional boundaries, such as water supply. Additionally, as land is incorporated, governance of that land shifts from county to municipal control. The Inter-jurisdictional Coordination chapter of the County's Plan identifies the following goal:

- **Goal IC**: Promote the coordination of planning, financing, and implementing programs between the county and local jurisdictions including tribal governments.

## 2.2. Comprehensive Water System Plans

This section provides a summary of other jurisdictions' comprehensive water plans that are relevant to Marysville's water system, including the North Snohomish County Coordinated Water System Plan and the City of Everett Comprehensive Water Plan.

### 2.2.1. North Snohomish County Coordinated Water System Plan

The North Snohomish County Coordinated Water System Plan (CWSP) was developed to establish a procedure for water utilities to coordinate their planning and construction programs with each other and with local land use authorities, and to resolve problems related to inadequate water quality, unreliable service, or lack of coordination in planning. It provides a means that local water utilities can use to define their role in meeting adopted city and County land use plans and growth management strategies for lands within the planning area. The CWSP process was guided by the State's Public Water System Coordination Act of 1977 (Chapter 70.116 RCW).

The CWSP covers a planning area north of Everett and east of the Snohomish River into the Cascade foothills, including Marysville, Lake Stevens, Arlington and the Tulalip Reservation, among other communities. This area was designated as a Critical Water Supply Service Area by the Snohomish County Council in 1988, thereby triggering the CWSP process. The CWSP was developed through a collaborative process involving Snohomish County government; local water purveyors including Marysville, Snohomish PUD, the City of Arlington and Tulalip Tribes (among many others); the City of Everett as a regional water purveyor; DOH, and Ecology. The CWSP was completed in 1991. Since that time, the water service areas designated in the CWSP have been updated from time to time. The service area attributed to the City of Marysville will need to be updated again in the CWSP to include the area east of 67$^{th}$ Avenue NE and north of 89$^{th}$ Place NE.

With regard to Marysville's water system, key elements of the CWSP include:

- Identification of 24 "expanding" systems, including Marysville.
- Designation of service areas for public water utilities. These show the full area each utility is ultimately authorized to serve as it expands to serve new development. For

Marysville, this element of the CWSP defines the Coordinated Service Area (CSA) that was originally adopted by the City Council, which has since been updated by Marysville to become Marysville's water retail service area (see Figure 1-2).

- Defines a county-wide procedure that determines which utility will serve a proposed new development. Within a service area, the procedure indicates that Marysville will either provide service to the new development; approve installation of a "satellite" water system to be owned and operated by Marysville; approve installation of a satellite water system to be owned and operated by another entity, with Marysville having responsibility to monitor operations and ensure water quality; or deny provision of service (thereby triggering a relinquishment of part of the defined service area). Marysville would also be responsible to serve as a court-appointed "receiver" for any failing water system located within its service area.
- Establishes minimum design standards. For cities such as Marysville, the design standards apply to extension of the water system into unincorporated lands outside city limits.
- Describes a recommended framework for water conservation programs, with implementation to be led by each individual utility in accordance with local needs and conditions.
- Describes a water supply plan for meeting the forecasted growth in the North Snohomish County planning area. The water supply plan indicates that existing local sources such as ground water supplies should continue to be used and maintained, and that the City of Everett's Sultan River supply system should be utilized to meet additional regional needs within the North Snohomish County area. The installation of a 30-inch pipeline, referred to in this Plan as the JOA pipeline, to deliver water from Everett to Marysville and other communities is specifically identified as a plan element, and this element was subsequently constructed.
- Describes the "joint use" concept for regional facilities such as the JOA pipeline. The CWSP specifically identifies the JOA among Marysville, Snohomish PUD and the Tulalip Tribes as an element in applying the joint use concept. The CWSP also envisions possible expansion of the joint use concept to meet the needs of other communities through regional facilities.

## 2.2.2. City of Everett Comprehensive Water Plan

The City of Everett prepared its most recent Comprehensive Water Plan update in 2007. This plan is relevant to the Marysville water system because of Everett's role as a wholesale supplier of water to Marysville.

### Demand Forecast and Water Supply to Marysville

Everett's Comprehensive Water Plan identifies Marysville as a direct wholesale customer that is being partially served by Everett. Demand forecasts in the Everett Plan were derived from the demographic projections from the Puget Sound Regional Council (PSRC), although from an earlier version of the PSRC data than was used for this plan. Table 2-3 shows the portion of Marysville's demand that is expected to be supplied by Everett. The table compares these numbers as provided in Everett's plan and for similar years as developed for this plan.

**Table 2-3 Marysville Demand Supplied by Everett**

| Year | Average Day Demand (mgd) | | | Maximum Day Demand (mgd) | | |
|---|---|---|---|---|---|---|
| | From Marysville's 2009 Plan[1] | From Everett's 2007 Plan[2] | Marysville Plan as % of Everett Plan | From Marysville's 2009 Plan[1] | From Everett's 2007 Plan[2] | Marysville Plan as % of Everett Plan |
| 2007 | n/a | 4.5 | n/a | n/a | 8.3 | n/a |
| 2012 | 4.3 | 5.0 | 86% | 7.3 | 9.3 | 79% |
| 2026 | 5.8 | 6.1 | 95% | 9.9 | 11.5 | 86% |

NOTES:
1. Developed from the analysis presented in Appendix 3-1. This includes demands from the six "Everett" pressure zones (170, 203, 240 South, 260, 360, and 510), plus the portion of demand from areas not currently in a pressure zone that are expected to be served by Everett water.
2. From City of Everett Water Comprehensive Plan, 2007, Tables 3-11 and 3-12

The demand from this plan is less than the demand in Everett's plan. Part of this difference is likely because a revised PSRC data set was used for the Marysville plan. Additionally, the Everett numbers do not include conservation since the Everett Comprehensive Water Plan addresses conservation savings at the regional level, and does not specify savings attributed to each wholesale customer. The difference between the Marysville and Everett plans errs on the side of caution in that Everett is planning to be able to provide more water to Marysville than Marysville anticipates needing.

The Tulalip Tribes currently receive water from Everett through a wheeling agreement with Marysville (see discussion below). It is anticipated that within Everett's 20 year planning period the Tulalip Tribes will also receive water directly from Everett. For planning purposes, it is assumed that this new connection will begin operating in 2012. The projected demand to be supplied to the Tulalip Tribes by Marysville is expected to reach 0.7 mgd by 2026. For purposes of this Water Comprehensive Plan, demands for the supply delivered via Marysville from 2012 through 2026 are assumed to remain constant, with additional Tulalip demands being supplied through a new, direct connection with Everett.

### Existing Everett System and Proposed Improvements

The main facilities in Everett's system that are critical to Marysville's water supply are the source, treatment and transmission facilities. The Everett Comprehensive Water Plan provides an evaluation of these components, and presents a six-year and 20-year Capital Improvements Plan. The results are summarized as follows:

- Source of Supply: It was found that Everett's existing water rights are adequate to meet the existing and projected regional demands through 2026. The City will continue to monitor demands over the next planning horizon to assess the necessity for additional water rights.
- Treatment: The treatment for Everett's system is the Water Filtration Plant (WFP) with a current capacity of 132 mgd. There is currently adequate capacity at the WFP to meet the projected demand through approximately 2013. Following that date demand begins to exceed the existing capacity and will be deficient by approximately 131 mgd under 2050 demands. The City of Everett is aware of the projected deficit

and has begun the expansion of the WFP so as to ensure sufficient supply through 2050 to its wholesale customers, including the City of Marysville.

- Transmission: Water for Marysville is provided from one of three lines that convey treated water for the Everett System (a fourth line conveys untreated, industrial water). Everett's Capital Improvement Plan includes $63 Million for improvements and maintenance of transmission lines through 2012. Additional large-scale transmission projects are planned for the long-term planning horizon.

# 2.3. City Policies

This section provides a summary of selected provisions from Title 14 of the Marysville Municipal Code that affect the Marysville water system, including: utility service policies, water service fees, and city policies regarding annexation and associated water service extension.

## 2.3.1. Utility Service Policies

Marysville's utility service policies are contained in Marysville Municipal Code, Chapter 14.01. Selected provisions include the following (for specific language, see Marysville Municipal Code):

- The water and sanitary sewer systems are owned, operated, administered and financed as a single utility under the exclusive jurisdiction of Marysville.
- Marysville owns all utility lines it has constructed, or which are conveyed to Marysville. Privately constructed mains to be conveyed to Marysville must meet city specifications. Marysville has no responsibility with respect to lines it does not own.
- Property owners desiring water or sewer service must apply for connection using specified forms. Provisions are made for appropriate fees and charges.
- Properties outside city limits cannot connect to Marysville sewer system, unless also connected to the water system. Properties inside city limits seeking connection to the sewer system must connect to the water system or another public agency whose system meets minimum city standards.
- Marysville will not provide water service to a property that is connected to a public sewer service supplied by another jurisdiction or utility.
- Property owners within city limits, whose property is not connected to city water, city sewer, or both, must extend any utility line within 200 feet of the structure to be served, under defined conditions such as new construction, major additions or alterations, change in occupancy classification, or failure of an on-site septic system. Similar provisions apply to owners of property outside city limits, which are connected to city water service but not to sewer service. In this case, the extension of the utility line applies to the sanitary sewer line.
- Marysville may enter and inspect appliances, utility lines and appurtenances connected to Marysville's utility system.

## 2.3.2. Water Service Fee Policies

Chapter 14.07 of the Marysville Municipal Code provides a fee structure for water service connections and rates for service after connection. Fees for connection to the water system vary based on the size of the connection and the volume of water to be provided. Water rates are based on the volume of water provided, and are classified in three categories: city rates,

which are charged to properties within the city limits; "CWSP Rates," charged to properties outside of the city limits but within the UGA boundary; and "OCWSP Rates," charged to properties outside of the UGA boundary. Additional detail about Marysville's water rate structure is provided in Chapter 10 of this Plan.

### 2.3.3. Water System Extension and City Annexation Policies

Chapter 14.03 of the Marysville Municipal Code contains rules for construction, installation, and connection to Marysville's water and sewer utility system. Selected provisions include (for specific language, see Marysville Municipal Code):

- Specifications for construction of utility lines and connection to Marysville utility system.
- Location of utility lines within public streets, alleys, or easements.
- Setbacks of structures from utility lines.
- Water meters are required at each individual connection and shall be owned by Marysville. Master meters may be used for duplexes, multi-family dwellings, condominiums, and mobile-home parks.
- Requirements for fire hydrants.
- Length of service connections.
- Developer installed service connections.
- Restrictions on cross-connections.
- Frontage requirements on water distribution mains and sewer collection lines.
- Supervision of water main construction by a Professional Engineer licensed in the State of Washington.
- Requirement for as-built drawings of utility lines.
- Conveyance of privately-constructed lines to Marysville.
- Insurance, bonding, and indemnification for parties installing, repairing, extending, or modifying utility lines.

Marysville's annexation policy is outlined in Resolution 1939. Marysville's utility codes and utility planning are intended to support and promote annexation, as well as logical extension of urban services within the Urban Growth Area. Properties applying for utility service from Marysville are required to petition for annexation if they are contiguous or within two parcels of Marysville limits. Marysville also requires property owners within Marysville's UGA to sign an annexation covenant agreeing to future annexation of their properties as a condition of utility service, if they are not currently contiguous or within two parcels of the city limits.

Further requirements relating to provision of water or sewer service to properties outside city limits are contained in Marysville Municipal Code, Chapter 14.32. The Code details factors to be considered in determining whether to provide service and includes implementation rules and administrative procedures.

## 2.4. Interlocal Agreements

Marysville has entered into several agreements with other jurisdictions that support Marysville's ability to provide adequate and reliable water service to its customers. These agreements are described below.

### 2.4.1. Joint Operating Agreement (JOA)

As part of the CWSP process, a Joint Operating Agreement (JOA) was developed in 1991, with Marysville, the Snohomish PUD and Tulalip Tribes as the initial signatories. Pursuant to the CWSP, the JOA indicates that "projects that provide for the joint use and operation of transmission, storage, and pumping facilities" are in the best interest of Snohomish County citizens. The general intent of the participants was "to cooperatively plan, design, construct, operate and maintain" the JOA pipeline and related facilities, to allow for delivery of water from Everett's Sultan River source of supply. The JOA served to initiate construction of the pipeline, allocate capacity among the three participants, and provide for future cooperation. The JOA also describes conditions regarding wholesaling of water delivered through the pipeline.

The JOA recognizes that additional participants may join in the agreement in the future. Other agencies desiring capacity in the pipeline could potentially purchase capacity rights, but only upon the unanimous consent of the initial three participants. Other agencies may also have the opportunity to become a participant in the JOA for additional projects that may be developed in the future.

The JOA assigned capacity rights for the JOA pipeline to each of the initial three participants. In addition to their primary allocations, Snohomish County PUD and Marysville originally shared equal rights for the final 7.21 percent of the pipeline capacity, which was designated as supply for an area of overlap between the two entities' service areas; this area was referred to as the "Marysville/PUD Overlap area." In 2003, Snohomish County PUD entered into an agreement with Marysville that transferred the PUD's portion of the "Marysville/PUD Overlap area" capacity rights to Marysville (see description of this agreement below). As a result of this agreement, Marysville's total capacity rights increased to 63.65 percent of the total capacity of the pipeline, which is equivalent to 13.15 mgd.

The current assigned capacity rights for the JOA pipeline are shown in Table 2-4.

**Table 2-4 Current Capacity Rights for the JOA Pipeline**

| Entity | Pipeline Capacity for Forecasted 2010 Peak Day Demand (%) | Equivalency in MGD[1] |
|---|---|---|
| Marysville | 63.65[2] | 13.15 |
| Snohomish PUD | 16.55 | 3.42 |
| Tulalip Tribes | 19.80 | 4.09 |
| Total | 100.00 | 20.66 |

NOTES:
1) Capacity for each participant in the JOA is based on a percentage of the 2010 Peak Day Demand as estimated in 1991 in the North Snohomish Coordinated Water System Plan.
2) Per a 2003 Agreement between Marysville and the Snohomish PUD, the capacity formerly outlined in the JOA as the 'Marysville/PUD Overlap Area' has been transferred to Marysville.

As part of the JOA, Marysville agreed to wheel water through its distribution system to the Tulalip Tribes, subject to capacity constraints in the Marysville system and the ability to meet the needs of Marysville's own customers. It was recognized that distribution system upgrades could be needed in the future to accommodate wheeling, and that costs would be shared on the basis of benefits received. As described above, the Tulalip Tribes also now plan to

construct a pipeline that will connect directly to Everett's system to meet future demand beyond their capacity right for the JOA pipeline.

The participants recognized that the JOA pipeline would meet only a portion of their future needs, and that additional facilities would be required, such as a second pipeline intertie with Everett and a regional reservoir. Planning for additional facilities is to be triggered when one of the JOA participants reaches 60 percent of its capacity rights. Construction is to begin when one of the participants reaches 85 percent of its capacity rights. Based on recent demand forecasts completed by the other JOA participants and Marysville's projected demand described in Chapter 3 of this Plan, it is likely that the need for additional facility planning will be triggered during the 20-year planning period. Marysville and the other JOA participants are aware of this situation and will plan accordingly.

## 2.4.2. Additional Agreements Related to JOA

Several additional agreements were negotiated among Marysville and its partners in the JOA, as well as with the City of Everett. Collectively, these agreements define the terms and conditions related to construction and operation of the JOA pipeline and related facilities. These agreements are summarized below.

**Water Supply Contract between Everett and JOA Participants**

This agreement, initially signed in 1989 and revised in 1991, among Marysville, Everett, the Snohomish County PUD, and Tulalip Tribes addresses water supply from Everett's water system, delivered through the JOA pipeline. The term of the contract extends to July 1, 2020. Everett agrees to deliver water to serve as a primary source of supply by the three JOA participants, in return for payment. The agreement indicates that the participants will reach peak demands of 18 million gallons per day through the pipeline during the term of the contract, and that additional facilities will be required to meet long-range demands. The agreement does not require the JOA participants to purchase any minimum quantity of water. The agreement restricts resale of water through any meter larger than 12 inches in diameter or to any customer requiring more than one mgd, unless authorized by Everett. Water must be distributed in accordance with the Everett Water System Plan, the CWSP, and the participants' individual water system plans, as approved by DOH. The service area for water deliveries is restricted to a defined area of the county based on Everett's regional service area (Marysville's water retail service area lies within the area described). The agreement also contains provisions related to the quality of the water delivered, rates and charges, payments, construction, operations and maintenance.

**Debt Service Agreement between Marysville and the Tulalip Tribes**

This agreement defines the terms of payment from the Tulalip Tribes to Marysville for principal and interest related to the Tribes' capacity in the pipeline constructed under the terms of the JOA. The agreement includes a promissory note and a payment schedule as attachments.

**Wheeling Agreement between Marysville and the Tulalip Tribes**

This 1995 agreement defines the terms and conditions related to delivery of water from the JOA pipeline to the Tulalip Tribes via the Marysville water system (i.e. "wheeling" through the

Marysville system). Wheeling is necessary because the point of delivery from Everett is at the southeast corner of the Marysville water system, while the points of delivery from Marysville to the Tulalip Tribes are along the west side of the Marysville water system. The agreement includes several sections, defining various aspects of the wheeling arrangement. It addresses the potential need for Marysville to acquire certain distribution facilities from the Tribes, in the event Marysville's Coordinated Service Area is extended into the Tribes' service area. It establishes conditions for potential construction of a transmission line to be owned by the Tribes, and to be located within city boundaries. It identifies two connection points between Marysville's water system and the Tribes' water system, located at 88th Street Northeast and Marine Drive. The quantity of water to be delivered is also defined. The agreement establishes a Storage Deficiency Demand Charge, to address any deficiency in storage on the part of the Tribes related to differentials between the instantaneous flow and the 24-hour average flow rate needed. It defines terms and conditions related to a master meter for measuring flows to the Tribes. It provides that Marysville will make "every reasonable effort" to deliver water equal in quality to the water delivered by Everett to Marysville. It provides that the Tribes will compensate Marysville through payment of a "JOA Water Rate" and a "wheeling charge." A formula for calculation of each charge is given in the agreement. This agreement is in the process of being amended to reflect revised flow allocations and rates.

**Water Supply Agreement between Marysville and Snohomish PUD**

This 2003 agreement resolved issues regarding the PUD's service area and capacity rights to the JOA pipeline. Originally, Snohomish County PUD and Marysville shared equal rights for 7.21 percent of the pipeline capacity, which was designated as supply for an area of overlap between the two entities' service areas; this area was referred to as the "Marysville/PUD Overlap area." It is assumed that Marysville will gradually take control of water service in the Overlap area as portions of this area are annexed by Marysville. This agreement transfers the PUD's portion of the Overlap area capacity rights to Marysville, and describes conditions for transferring ownership of PUD distribution facilities within the Overlap area to Marysville in areas that are annexed. Marysville agrees to provide wholesale water to the PUD as needed to serve the Overlap area. The PUD agrees to pay operation and maintenance costs for the JOA pipeline to Marysville as long as it receives wholesale water from Marysville. This agreement will extend for the useful life of the JOA pipeline and will be reviewed by the participants every ten years.

## 2.4.3. Other Agreements

In addition to the agreements described above, Marysville has executed agreements with other water systems in Snohomish County. These agreements are summarized below.

**Interlocal Agreement with City of Arlington for Easement, Water Purchase and Intertie**

This 1978 agreement provides for an easement for Marysville's transmission line from the Stillaguamish River, crossing City of Arlington property near the Arlington Airport. The agreement also provides for sale of water to Arlington to serve the Arlington Airport, west of Runway #15-33, and discusses rates and additional terms and conditions of this sale. It also provides for an intertie for emergency relief purposes between the two systems.

### Water Supply Contract with Warm Beach Water Association

This 1993 agreement provides for delivery of water to Warm Beach from the Lake Goodwin well, consistent with the terms of the CWSP. Marysville agrees to make best efforts to deliver 200,000 gpd, but delivery is subject to meeting the needs of Marysville's own retail customers. The term of the contract extends through December 31, 2013. However, Warm Beach retains the right to develop its own, independent source of supply.

### Mutual Aid Agreement

Marysville is party to a 1995 "Sewer and Water Mutual Aid Agreement" that addresses sharing of personnel and equipment during emergency conditions. Such mutual aid is authorized in State law, at Chapter 39.34 RCW. Other parties to the agreement include the Cities of Edmonds, Everett, Lynnwood, and Monroe; and the following special districts: Alderwood Water District, Cross Valley Water District, Mukilteo Water District, Olympic View Water and Sewer District, and Silver Lake Water District. Further information is provided in Marysville's Contingency Plan for Water Supply Disruptions During Emergencies (see Chapter 6 and Appendix 2-1).

### Annexation and Service Area Settlement Agreement

An Annexation and Service Area Settlement Agreement was executed in 1996 by Marysville, the City of Arlington and Snohomish County Fire District 12, as a negotiated agreement to resolve litigation related to Marysville's service area. The agreement identifies separate urban growth boundaries for the two cities, subject to approval by Snohomish County. It discusses certain land use issues, particularly with reference to the Arlington Airport area. It identifies water and sewer utility service areas. Certain areas are designated for further study. It also states that Marysville will continue to provide water and sewer service to the Smokey Point area, under certain conditions. The agreement contains a number of other provisions as well, on topics not directly related to water service.

### Agreement with Arlington for the Assumption of a Portion of the Marysville Utility System and to Provide Wholesale Water

This 1998 agreement addresses wholesale water service from Marysville to Arlington for the area north of 180th Street Northeast and east of I-5. Provisions related to water service include transfer of certain water facilities to the City of Arlington, and agreement that Marysville will provide water as needed for service and fire flows to Arlington in the Smokey Point area. The peak day demand to be met is 175,000 gpd. The agreement also establishes a water rate for this service. Arlington has recently purchased this portion of Marysville's water system, and now serves this area with their own supply. The intertie with Marysville's system is maintained for emergency use.

# 3. Planning Data and Demand

This chapter discusses planning data and the City of Marysville's (Marysville) demand forecast and is presented in three main sections. The first section summarizes historical and projected demographic data for Marysville's retail service area. The second section summarizes Marysville's water use characteristics including production, consumption and related factors. The third section combines the demographics and the water supply characteristics to develop Marysville's demand forecast for the next 20 years.

## 3.1. Demographics – Historical and Projected

The demographic data used in this plan is comprised of four key categories: population, single family households, multifamily households, and employees. Table 3-1 shows historical and projected demographics for key milestone years.

**Table 3-1 Demographics**

| Year | Population | Single Family Households | Multifamily Households | Employment |
|---|---|---|---|---|
| **2007** (Current Yr)[1] | 44,436 | 15,861 | 4,670 | 10,623 |
| **2009** (Plan Yr 1) | 52,213 | 18,880 | 4,978 | 12,385 |
| **2010** (Plan Yr 2) | 53,142 | 18,937 | 5,466 | 12,555 |
| **2011** (Plan Yr 3) | 54,265 | 19,427 | 5,583 | 12,814 |
| **2012** (Plan Yr 4) | 55,389 | 19,917 | 5,700 | 13,074 |
| **2013** (Plan Yr 5) | 56,513 | 20,407 | 5,816 | 13,334 |
| **2014** (Plan Yr 6) | 57,637 | 20,897 | 5,933 | 13,594 |
| **2028** (Plan Yr 20) | 77,244 | 29,212 | 8,140 | 17,364 |

1. At the time the demand forecast was developed, the most recent year for which a complete year of data was available from Marysville was 2006. Therefore, the water use characteristics were analyzed through 2006. 2007 data was provided with Marysville's hydraulic model at a later date. Since the modeling work uses 2007 as the current year, it was decided that all chapters will use 2007 as the current year for consistency.

Below is a brief explanation of how these demographics were developed. See the Planning Data and Demand Forecast Technical Memorandum in Appendix 3-1 for more detailed information on how these demographics were developed, demographic breakdowns by pressure zone, and demographic numbers for intervening years.

The demographics are based on Puget Sound Regional Council (PSRC) data. The PSRC provides projections for certain milestone years and the intervening years were interpolated for this project. The PSRC data is allocated to small geographic areas called Traffic Analysis Zones (TAZs). The TAZ boundaries are independent of Marysville's retail service area. Therefore, GIS analysis was used to determine which TAZs, or portions thereof, are in Marysville's retail service area. As explained in Chapter 1, Marysville is not currently serving every area within its retail service area; however Marysville plans to expand into its retail service area during the 20 year planning period. Therefore, the demographics are incorporated into the demand forecast in keeping with when Marysville anticipates serving particular areas.

# 3.2. Water Use Characteristics

## 3.2.1. Production and Peaking Factor

Marysville produces water from three of its own sources and purchases water from the City of Everett. Marysville's sources serve its north service area, while the Everett water serves Marysville's south service area. Table 3-2 shows the average production over the last three years, by source and by month. The total average production has been 2,033 million gallons (mg). The majority of Marysville's supply is purchased from Everett (74%). As is typical with most water utilities, production increases in the summer months. Figures 3-1 and 3-2 show this same information graphically. The annual production for each year from 1998 to 2006 is shown in Figure 3-3.

**Table 3-2 Production/Purchases Summary 2004-2006 Average (mg)**

| Month | North Service Area | | | | South Service Area | Total | |
|---|---|---|---|---|---|---|---|
| | Edward Springs | Stillaguamish Well | Lake Goodwin Well | North Subtotal | Everett Intertie | Qty | Percent |
| Jan | 38 | 2 | 0.4 | 40 | 103 | 143 | 7% |
| Feb | 33 | 2 | 0.4 | 35 | 91 | 126 | 6% |
| Mar | 38 | 1 | 0.4 | 39 | 100 | 139 | 7% |
| Apr | 37 | 3 | 0.4 | 41 | 100 | 141 | 7% |
| May | 39 | 5 | 0.4 | 45 | 120 | 165 | 8% |
| Jun | 36 | 12 | 0.4 | 49 | 128 | 177 | 9% |
| Jul | 35 | 32 | 0.5 | 68 | 190 | 257 | 13% |
| Aug | 33 | 33 | 0.6 | 67 | 172 | 239 | 12% |
| Sep | 31 | 13 | 0.6 | 45 | 133 | 177 | 9% |
| Oct | 35 | 4 | 0.5 | 39 | 128 | 167 | 8% |
| Nov | 32 | 2 | 0.5 | 35 | 115 | 150 | 7% |
| Dec | 33 | 2 | 0.5 | 36 | 117 | 153 | 8% |
| **Total** | **420** | **112** | **6** | **538** | **1,495** | **2,033** | **100%** |
| **Percent** | **21%** | **6%** | **0.3%** | **26%** | **74%** | **100%** | |

Data Source: "Marysville Water Production" spreadsheet provided by Marysville staff.
Nine years of production data was analyzed, however the average uses the most recent three years in order to focus on current trends.

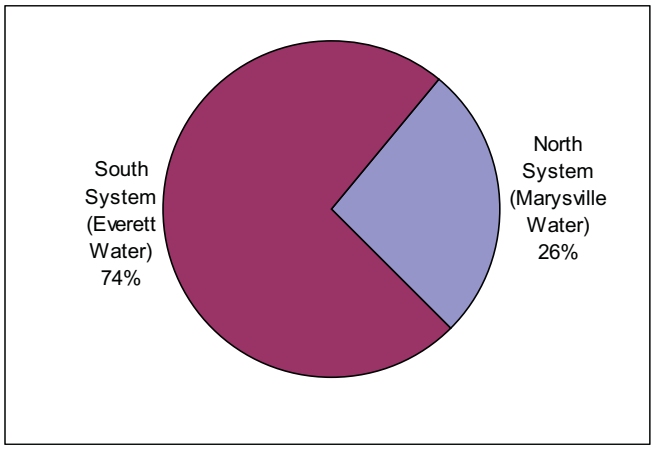



**Figure 3-1 Production/Purchases by Source (2004-2006 Average)**

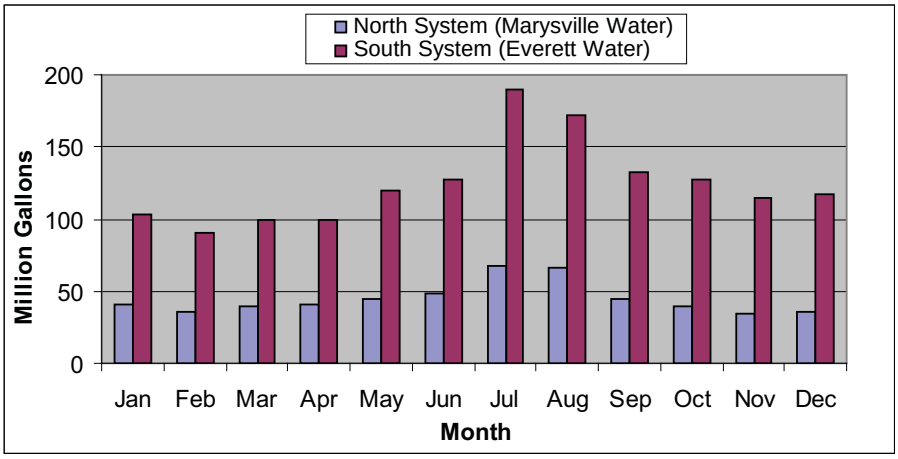



**Figure 3-2 Production/Purchases Monthly Distribution by Source (2004-2006 Average)**

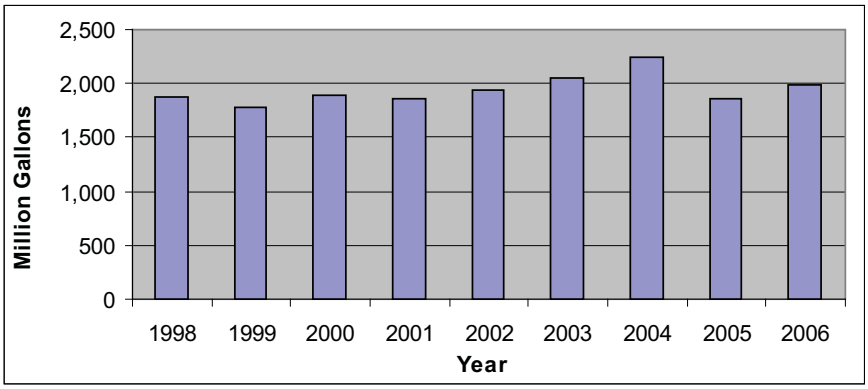



**Figure 3-3 Annual Production/Purchases (1998-2006)**

The maximum day versus average day peaking factors from 2003 to 2006 are shown in Table 3-3. The maximum day peaking factor has ranged from 1.6 to 1.8, and has averaged 1.7 for the most recent three years.

**Table 3-3 Maximum Day Peaking Factor**

| Year | Average Day (mgd) | Maximum Day | | Peaking Factor |
|---|---|---|---|---|
| | | (mgd) | Date | |
| 2003 | 5.6 | 10.0 | 7/19/03 | 1.8 |
| 2004 | 6.2 | 9.8 | 8/14/04 | 1.6 |
| 2005 | 5.1 | 9.0 | 7/27/05 | 1.8 |
| 2006 | 5.5 | 9.6 | 7/26/06 | 1.8 |
| **2004-2006 Avg** | **5.57** | **9.44** | **n/a** | **1.7** |

Data Source: "Peak Water Day Production (2003-2007)" spreadsheet provided by Marysville staff.

Data is presented for four years for which peak production history exists; however the average uses the most recent three years in order to focus on current trends.

## 3.2.2. Customer Categories, Connections, and Consumption

Marysville has six retail customer categories as shown below. Each category is further split between connections inside or outside the city limits, which are called either "city" or "rural" connections. Marysville also wheels water from the Everett supply source to the Tulalip Tribes and Snohomish Public Utility District (PUD).

- **Single Family:** Detached residential buildings serving a single family.
- **Multifamily:** Residential buildings, such as apartment buildings or condos, that serve multiple households.
- **Commercial:** All non-residential customers, except for schools.
- **Schools:** Schools.
- **Irrigation:** Service through a dedicated irrigation line. Note that irrigation water may also be provided through the other customer categories, particularly single family.
- **Fireline:** Connections for fire service.

The number of connections for each customer category from 2003 to 2006 is provided in Table 3-4. The majority of the connections are accounted for by single family (89%) and most of the remaining connections are equally split between multifamily (5%) and commercial (5%) customer categories. The split between city and rural connections is fairly even (54% city and 46% rural).

**Table 3-4 Connections by Customer Category**

| Customer Category | | Number of Connections | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2003 | 2004 | 2005 | 2006 | 2004-2006 Avg | |
| | | | | | | Number | Percent |
| 1. Single Family | City[1] | 7,536 | 7,401 | 7,697 | 7,899 | 7,666 | 45% |
| | Rural[2] | 8,041 | 7,510 | 7,575 | 7,640 | 7,575 | 44% |
| | **Total** | **15,577** | **14,911** | **15,272** | **15,539** | **15,241** | **89%** |
| 2. Multifamily | City[1] | 669 | 658 | 657 | 658 | 658 | 4% |
| | Rural[2] | 217 | 187 | 187 | 188 | 187 | 1% |
| | **Total** | **886** | **845** | **844** | **846** | **845** | **5%** |
| 3. Commercial | City[1] | 670 | 675 | 673 | 694 | 681 | 4% |
| | Rural[2] | 146 | 148 | 150 | 154 | 151 | 1% |
| | **Total** | **816** | **823** | **823** | **848** | **831** | **5%** |
| 4. Schools | City[1] | 46 | 43 | 45 | 46 | 45 | 0.3% |
| | Rural[2] | 0 | 0 | 0 | 0 | 0 | 0% |
| | **Total** | **46** | **43** | **45** | **46** | **45** | **0.3%** |
| 5. Irrigation | City[1] | 75 | 74 | 68 | 72 | 71 | 0.4% |
| | Rural[2] | 35 | 38 | 31 | 36 | 35 | 0.2% |
| | **Total** | **110** | **112** | **99** | **108** | **106** | **0.6%** |
| 6. Fireline | City[1] | 77 | 76 | 74 | 68 | 68 | 0.4% |
| | Rural[2] | 0 | 0 | 0 | 0 | 0 | 0% |
| | **Total** | **77** | **76** | **74** | **68** | **68** | **0.4%** |
| **Total** | City[1] | 9,073 | 8,927 | 9,214 | 9,437 | 9,188 | 54% |
| | Rural[2] | 8,439 | 7,883 | 7,943 | 8,018 | 7,948 | 46% |
| | **Total** | **17,512** | **16,810** | **17,157** | **17,455** | **17,136** | **100%** |

Data Source: "Consumption and Usage by Classification and Rate Code" spreadsheet provided by Marysville staff.
Data is presented for four years to show a longer history; however the average uses the most recent three years to focus on current trends.
1. Sales to customers within the city limits.
2. Sales to customers outside the city limits.

Average consumption, by customer category and by month, over the last three years is provided in Table 3-5. The largest share of water consumption is accounted for by the single family customer category (55%), followed by multifamily (14%) and commercial (14%). The majority of Maryville's water is sold to their retail customers (86%) and the remaining amount (14%) is wheeled to the Tulalips and the PUD. Figures 3-4 and 3-5 show the retail portion of this information graphically. Note that this information is based on meter read dates, some of which are read bi-monthly, therefore the monthly distribution of actual water consumption may differ somewhat from the table.

### Table 3-5 Sold and Wheeled Water 2004-2006 Annual Average (mg)

| Customer Category | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Single Family | City[1] | 19 | 58 | 19 | 42 | 18 | 60 | 26 | 90 | 37 | 63 | 22 | 44 | 499 | 26% |
| | Rural[2] | 42 | 40 | 41 | 29 | 43 | 38 | 59 | 54 | 77 | 47 | 46 | 30 | 547 | 29% |
| | Total | 61 | 98 | 60 | 71 | 61 | 98 | 86 | 144 | 113 | 111 | 68 | 75 | 1,045 | 55% |
| 2. Multifamily | City[1] | 13 | 23 | 13 | 17 | 12 | 22 | 15 | 25 | 17 | 22 | 13 | 18 | 211 | 11% |
| | Rural[2] | 2 | 6 | 2 | 4 | 2 | 6 | 3 | 9 | 4 | 8 | 3 | 5 | 54 | 3% |
| | Total | 15 | 29 | 15 | 21 | 15 | 28 | 18 | 34 | 21 | 30 | 16 | 23 | 264 | 14% |
| 3. Commercial | City[1] | 11 | 20 | 11 | 17 | 11 | 21 | 14 | 20 | 18 | 21 | 15 | 14 | 194 | 10% |
| | Rural[2] | 5 | 8 | 4 | 6 | 4 | 8 | 5 | 7 | 7 | 8 | 4 | 7 | 73 | 4% |
| | Total | 16 | 29 | 15 | 23 | 15 | 29 | 19 | 28 | 25 | 29 | 19 | 21 | 267 | 14% |
| 4. Schools | City[1] | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 27 | 1% |
| | Rural[2] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% |
| | Total | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 27 | 1% |
| 5. Irrigation | City[1] | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 11 | 10 | 6 | 2 | 1 | 35 | 2% |
| | Rural[2] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 4 | 0 | 0 | 9 | 0% |
| | Total | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 14 | 10 | 10 | 3 | 1 | 45 | 2% |
| 6. Snohomish PUD - Wheeled Water | | 11 | 10 | 10 | 11 | 13 | 13 | 17 | 16 | 13 | 12 | 11 | 10 | 147 | 8% |
| | Total | 11 | 10 | 10 | 11 | 13 | 13 | 17 | 16 | 13 | 12 | 11 | 10 | 147 | 8% |
| 7. Tulalip Tribe - Wheeled Water | | 5 | 5 | 6 | 7 | 10 | 11 | 21 | 22 | 13 | 6 | 7 | 5 | 119 | 6% |
| | Total | 5 | 5 | 6 | 7 | 10 | 11 | 21 | 22 | 13 | 6 | 7 | 5 | 119 | 6% |
| **Total** | City[1] | 44 | 105 | 45 | 78 | 43 | 108 | 61 | 149 | 85 | 116 | 54 | 79 | 966 | 50% |
| | Rural[2] | 50 | 54 | 47 | 39 | 49 | 52 | 68 | 73 | 88 | 67 | 53 | 42 | 683 | 36% |
| | Wheeled[3] | 16 | 15 | 16 | 18 | 23 | 24 | 38 | 38 | 26 | 18 | 18 | 15 | 266 | 14% |
| | Total | 110 | 175 | 108 | 135 | 115 | 183 | 167 | 260 | 199 | 201 | 125 | 137 | 1,915 | 100% |
| Percent | | 6% | 9% | 6% | 7% | 6% | 10% | 9% | 14% | 10% | 10% | 7% | 7% | 100% | |

Data Source: "Billed Revenue" by Year and "Consumption and Usage by Classification and Rate code" spreadsheets provided by Marysville staff.

Five years of sales data was analyzed, however the average uses the most recent three years in order to focus on current trends.

The monthly distribution of actual water use may differ somewhat from this representation since billing numbers are based on meter read dates.

1. Sales to customers within the city limits.
2. Sales to customers outside the city limits.
3. Wheeled water to Snohomish PUD and Tulalip Tribes.

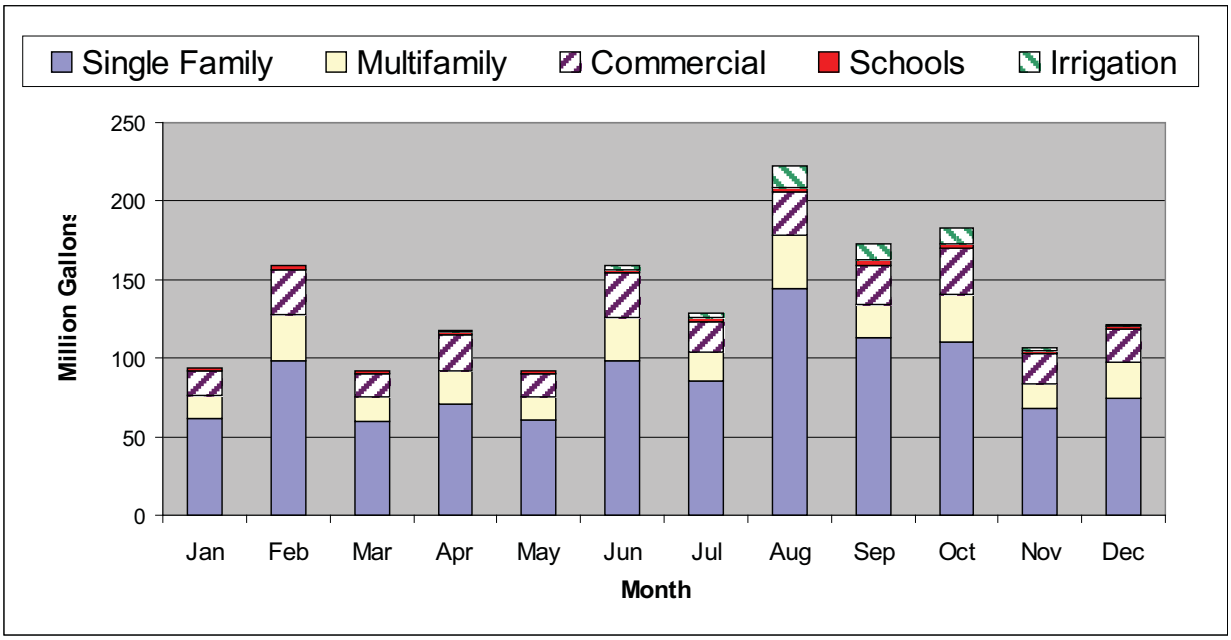



**Figure 3-4 Monthly Water Sale Volumes – Retail Only (2004-2006 Average)**

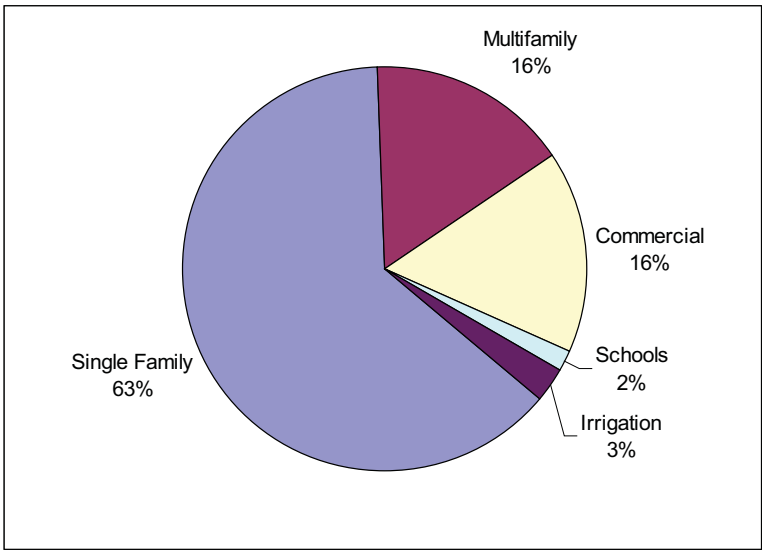



**Figure 3-5 Annual Water Sales by Customer Category – Retail Only (2004-2006 Average)**

Since water consumption does not always follow the same proportions as number of connections, Figure 3-6 compares the percent of connections to the percent of consumption. Three customer categories stand out in this comparison. Single family has a much larger percent of connections (89%) compared to the percent of consumption (63%). Multifamily has a much smaller percent of connections (5%) compared to the percent of consumption (16%). This is driven by the fact that one multifamily connection serves many multifamily households. Similarly, the commercial category has a much smaller percent of connections (5%) compared to the percent of consumption (16%).

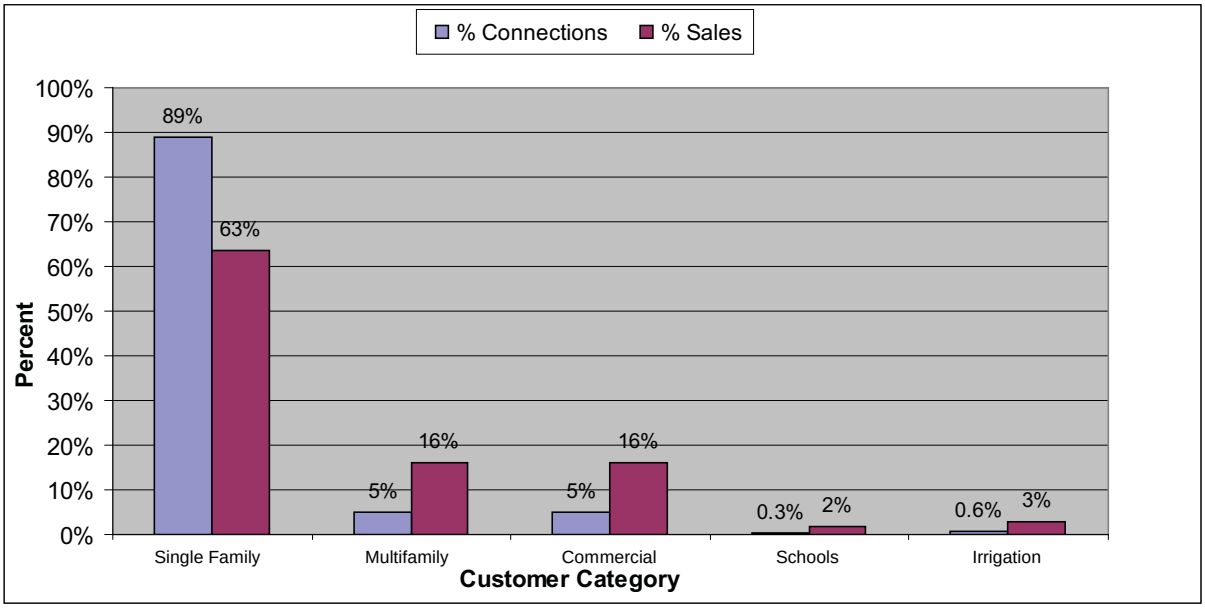



**Figure 3-6 Connections and Consumption Comparison – Retail Only (2004-2006 Average)**

Customers with large water demand are of interest since their demand could have significant impact on the overall demand for Marysville. This is particularly the case when the largest customers are commercial and industrial customers. The largest 10 sites in terms of water usage were examined for 2003 to 2006. Table 3-6 summarizes this information. For the multifamily and Marysville accounts, any changes in their future demand would likely also be reflected in the demographic projections. For the remaining commercial customers, those sites represent less than two percent of the total production. Therefore, no special treatment of the large customers was required for the demand forecast.

**Table 3-6 Large Water Consuming Sites**

| # | Name | Customer Type | 2004-2006 Average Sales (mg) |
|---|---|---|---|
| 1 | Pacific Coast Feather Co | Commercial | 16.8 |
| 2 | City of Marysville | Commercial | 9.5 |
| 3 | Commanding Officer | Commercial | 8.3 |
| 4 | National Food Corp #1 | Commercial | 7.2 |
| 6 | City of Marysville | Commercial | 6.6 |
| 7 | Smokey Point Mobile Park | Multi-Family | 5.6 |
| 8 | National Food Corp #2 | Commercial | 5.1 |
| 9 | Glenwood Mobile Estates | Multi-Family | 4.7 |
| 10 | Midway Garden Mobile Park | Multi-Family | 4.3 |
| 11 | Klein, John & Jim | Multi-Family | 4.1 |
| 12 | L155-1 Eagle Point LLC | Multi-Family | 3.9 |
| 13 | Windsor Square Apartments | Multi-Family | 3.8 |
| 14 | Greenman III, Robert F | Multi-Family | 3.3 |
| Total | | | 83.3 |

This list was compiled from the 10 largest sites for 2004, 2005, and 2006. This summary has more than 10 sites since the same sites did not make the top 10 list each year.
Data source: "Top Consumption by Site 2004", "Top Consumption by Site 2005" and "Top Consumption by Site 2006" spreadsheets provided by Marysville staff.

## 3.2.3. Water Balance, Non-Revenue, and Leakage

A water balance is an accounting for all water that is produced and purchased. Table 3-7 shows Marysville's 2006 water balance. The table is a slightly modified version of the format recommended for use by the American Water Works Association's Water Loss Committee.

**Table 3-7 Water Balance 2006**

| | Level 1 | Level 2 | Level 3 | Volume (mg) | % of Produced and Purchased Water |
|---|---|---|---|---|---|
| Water Produced and/or Purchased | Revenue Water | Billed Authorized Consumption | 1. Billed Water Exported | 0 [1] | 0% |
| | | | 2. Billed Metered Consumption | 1,651 [3] | 83% |
| | | | 3. Billed Unmetered Consumption | 0 | 0% |
| | Non-Revenue Water | Unbilled Authorized Consumption | 4. Unbilled Metered Consumption | 291 [2] | 14.6% |
| | | | 5. Unbilled Unmetered Consumption | 9 [4] | 0.5% |
| | | Apparent Losses | 6. Unauthorized Consumption | 0 | 0% |
| | | | 7. Customer Metering Inaccuracies | 0 | 0% |
| | | Real Losses | 8. Known Leakage | 0 | 0% |
| | | | 9. Assumed Leakage | 39 [5] | 1.9% |
| **TOTAL** | | | | **1,990** [6] | **100%** |

1. Marysville historically had an agreement to export water to the City of Arlington, however the Arlington Intertie was deactivated in 2005.
2. This is the water wheeled to the Tulalip Tribes and Snohomish PUD. Since this water is only wheeled through Marysville's pipes, but is not billed by Marysville, it is considered "unbilled metered consumption".
3. Data Source: "Consumption and Usage by Classification and Rate Code" spreadsheets provided by Marysville staff.
4. Estimated use as follows: 9.3 mg high volume flushing.
5. Water Production minus all other categories.
6. From "Marysville Water Production" spreadsheet provided by Marysville staff.

The water balance allocates the Water Produced and Purchased to different categories at three different levels.

Level 1 simply allocates the water to either Revenue Water or Non-Revenue Water. As implied by the names, Revenue Water generates income while Non-Revenue Water does not. This is helpful in understanding what percent of water production and purchases generates income for the water utility. Additionally, non-revenue water needs to be factored into the demand forecast. Marysville's 2006 water production is divided into 83 percent Revenue Water and 17 percent Non-Revenue Water. (Note that nearly 15 percent of the Non-Revenue water is the water wheeled to the Tulalips and the PUD.)

Level 2 splits Non-Revenue Water into the following three sub-categories which are useful in identifying potential additional revenue sources and identifying the magnitude of leaks that could be fixed:

- **Unbilled Authorized Consumption:** Includes uses such as water system flushing, firefighting, and unbilled contractor use. Typically, it is standard practice not to charge for uses falling into this sub-category. However, reviewing these uses to ensure a legitimate revenue opportunity is not missed is always a prudent idea. Marysville's 2006 unbilled authorized consumption is estimated at 15 percent. (Note that nearly all of this is the water wheeled to the Tulalips and the PUD.)

- **Apparent Losses:** Includes unauthorized uses and customer meter inaccuracies, both of which are lost revenue opportunities. Marysville's 2006 apparent losses is estimated to be zero.

- **Real Losses:** Includes various types of system leaks. A certain level of leakage is unavoidable, however, leakage beyond that level should be repaired in order to not unduly burden both the natural resource and the physical infrastructure. Under the American Water Works Association's protocol, as well as the formula for calculating distribution system leakage under Washington State's new Water Use Efficiency Rule, any amount that can not be assigned to another category is considered a real loss. Marysville's real losses are estimated at two percent.

Level 3 simply further splits water into additional sub-categories.

A longer history of some of the water balance elements, namely "retail" non-revenue water and distribution system leakage, is shown in Table 3-8. The table shows numbers from 2003 to 2006. The average from the most recent three years (2004-2006) shows that "retail" non-revenue water, which is used for the demand forecast, has been nine percent of billed consumption. The 2004-2006 average distribution system leakage has been six percent of water production and purchases. Under Washington State's new Water Use Efficiency Rule, distribution system leakage must be 10 percent or less, based on a three year rolling average. Marysville began reporting their annual distribution system leakage in 2008 and compliance will be determined in 2010, when the 2007 to 2009 leakage numbers are known. At the current distribution system leakage rate of 6 percent, Marysville is well positioned to meet the State requirement.

**Table 3-8 Distribution System Leakage and "Retail" Non-Revenue Water (mg)**

| Year | Water Produced / Purchased[1] | Authorized Consumption | | | | Distribution System Leakage[4] | | "Retail" Non-Revenue Water[5] | |
|---|---|---|---|---|---|---|---|---|---|
| | | Billed Consumption[2] | Unbilled Consumption | | | Qty | Percent of Production and Purchases | Qty | Percent of Billed Consumption |
| | | | PUD and Tulalip Wheeled Water | Other[3] | Total | | | | |
| 2003 | 2,059 | 1,697 | 198 | 10 | 208 | 153 | 7% | 163 | 9.6% |
| 2004 | 2,245 | 1,680 | 261 | 10 | 272 | 293 | 13% | 303 | 18.0% |
| 2005 | 1,863 | 1,546 | 246 | 9 | 255 | 63 | 3% | 71 | 4.6% |
| 2006 | 1,990 | 1,651 | 291 | 9 | 300 | 39 | 2% | 48 | 2.9% |
| **2004-2006 Avg[6]** | **2,033** | **1,626** | **266** | **9** | **276** | **131** | **6%** | **141** | **9%** |

1. Data Source: "Marysville Water Production" spreadsheet provided by Marysville staff.
2. Data Source: "Consumption and Usage by Classification and Rate Code" spreadsheets provided by Marysville staff.
3. This category represents any unbilled authorized consumption aside from the wheeled water such as flushing, firefighting, etc. For 2006, Marysville staff documented flushing usage ("2006 High Volume Flushing") at 9.3 mg. Flushing water was estimated for the other year using the 2006 ratio of flushing water to water production/purchases.
4. Distribution system leakage is defined in the new Water Use Efficiency Rule as water production and purchases minus authorized consumption.
5. This represents the non-revenue water that is used in the retail service area. The calculation is the water production and purchases minus the billed consumption and the PUD and Tulalip wheeled water. These numbers are used to develop the retail non-revenue portion of the demand forecast.
6. Data is presented for four years to show a lengthy history; however the average uses the most recent three years to focus on current trends.

## 3.2.4. Water Use Factors and ERUs

Water use factors were calculated for three customer categories: single family, multifamily, and non-residential. Table 3-9 shows the details for the water use factor calculations.

**Table 3-9 Water Use Factors and ERUs (2004-2006 Average)**

| Customer Category | Sales (gpd)[2] | Households or Employees | | Sales Per Household or Employee (gpd) | | Number of ERUs |
|---|---|---|---|---|---|---|
| Single Family | 2,864,212 | 15,241 | 3 | 188 | | 15,241 |
| Multifamily | 724,208 | 4,526 | 4 | 160 | 6 | 3,852 |
| Non-Residential[1] | 929,038 | 10,378 | 5 | 90 | | 4,942 |

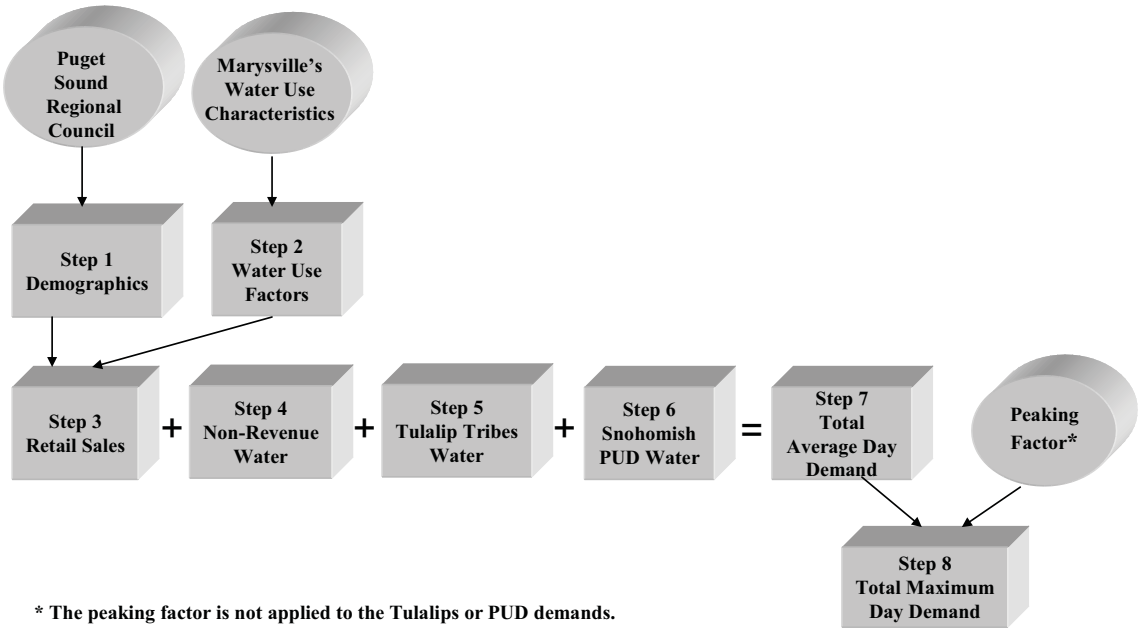
1. This includes the following customer categories: commercial, schools, and irrigation.
2. Data Source: "Billed Revenue" by Year and "Consumption and Usage by Classification and Rate code" spreadsheets provided by Marysville staff.
3. Assumed to be the same as the number as single family connections.
4. This number is the result of the actual multifamily sales divided by the estimated multifamily water use factor. See footnote #6 for more information.
5. Based on data in the demographics analysis. For 2006 10,482 employees were estimated. Back-calculated the number of employees for 2004 and 2005 (using 1.0 percent annual growth rates). Then calculated a 2004-2006 average.
6. Estimated to be 85 percent of the single family water use factor. An analysis dividing the actual multifamily sales by an initial estimate of the number of multifamily households (MF HH) resulted in an unrealistically high multifamily water use factor (248 gpd). Since it is believed the sales numbers are correct, it is assumed the initial MF HH estimate was incorrect. New MF HH estimates were developed based on the estimated multifamily water use factor.

Table 3-9 also shows the number of Equivalent Residential Units or ERUs in each customer category. ERUs are a method of representing water use by non-residential customers as an equivalent number of residential customers. An ERU is the amount of water used by a single family household. As such, Marysville's ERU number is 188 gpd, which is the same as the single family water use factor. The number of ERUs for each customer category is obtained by dividing the consumption for a customer category by 188. Therefore, the single family customer category equates to 15,241 ERUs, the multifamily category equates to 3,852 ERUs, and the non-residential category equates to 4,942 ERUs.

# 3.3. Demand Forecast

## 3.3.1. Demand Forecast Methodology

The methodology used to develop the demand forecast is shown in Figure 3-7. The basic process is to combine demographic data with water use factors to develop the demand for retail sales. Demand components for non-revenue water, as well as for the Tulalip Tribes and Snohomish PUD, are then added in to create the total average day demand. To generate the total maximum day demand, a peaking factor is applied to all demands except the Tulalip and PUD demands. See the Planning Data and Demand Forecast Technical Memorandum in Appendix 3-1 for more information on the methodology.



## 3.3.2. Demand Forecast Results

The projected demand is provided in Table 3-10, both without and with additional conservation. The forecast with additional conservation reflects the conservation program included in Chapter 4. The conservation adjustment was accomplished by reducing the water use factors in 2009-2014 to reflect the estimated conservation savings. Marysville plans to continue conservation efforts beyond 2014. However, since the conservation goals beyond 2014 are not defined at this time, the water use factors are then held constant for all years beyond 2014.

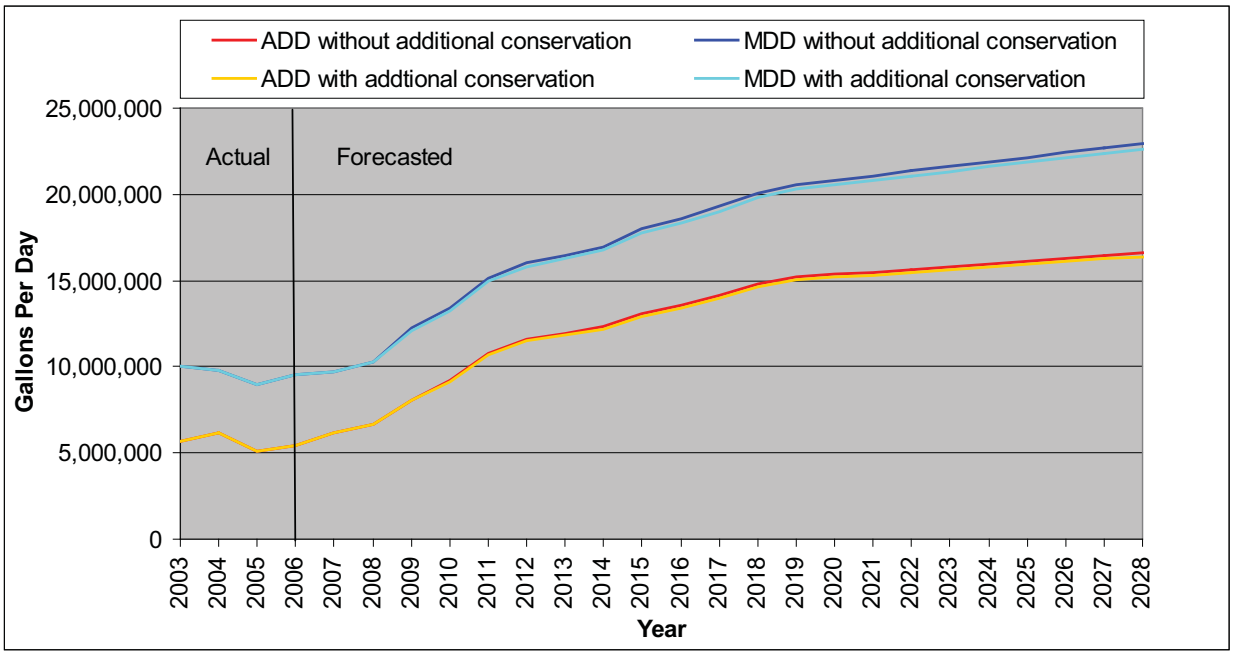
**Table 3-10 Demand Forecast - Summary**

| Year | Demand Without Additional Conservation | | | | | Demand With Additional Conservation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average Day Demand (mgd) | | | | Maximum Day Demand (mgd) | Average Day Demand (mgd) | | | | Maximum Day Demand (mgd) |
| | Retail | Tulalips | PUD | Total | | Retail | Tulalips | PUD | Total | |
| **2007** (Current Yr[1]) | 5.1 | 0.6 | 0.5 | 6.2 | 9.7 | 5.1 | 0.6 | 0.5 | 6.2 | 9.7 |
| **2009** (Plan Yr 1) | 5.9 | 1.5 | 0.7 | 8.1 | 12.2 | 5.9 | 1.5 | 0.7 | 8.0 | 12.1 |
| **2010** (Plan Yr 2) | 6.0 | 2.3 | 0.8 | 9.2 | 13.4 | 6.0 | 2.3 | 0.8 | 9.1 | 13.3 |
| **2011** (Plan Yr 3) | 6.2 | 3.6 | 1.0 | 10.8 | 15.1 | 6.1 | 3.6 | 1.0 | 10.7 | 15.0 |
| **2012** (Plan Yr 4) | 6.3 | 4.1 | 1.2 | 11.6 | 16.0 | 6.2 | 4.1 | 1.2 | 11.5 | 15.8 |
| **2013** (Plan Yr 5) | 6.5 | 4.1 | 1.4 | 11.9 | 16.5 | 6.3 | 4.1 | 1.4 | 11.8 | 16.3 |
| **2014** (Plan Yr 6) | 6.6 | 4.1 | 1.6 | 12.3 | 17.0 | 6.5 | 4.1 | 1.6 | 12.2 | 16.7 |
| **2028** (Plan Yr 20) | 9.1 | 4.1 | 3.4 | 16.6 | 22.9 | 8.9 | 4.1 | 3.4 | 16.4 | 22.6 |

1. At the time the demand forecast was developed, the most recent year for which a complete year of data was available from Marysville was 2006. Therefore, the water use characteristics were analyzed through 2006. 2007 data was provided with Marysville's hydraulic model at a later date. Since the modeling work uses 2007 as the current year, it was decided that all chapters will use 2007 as the current year for consistency. Note that for the demand forecast, 2007 is a projected number.

Figure 3-8 shows the average day and maximum day demands, both with and without additional conservation. Figure 3-9 shows the six components of the average day demand in order to understand the relative impact of the components. Figure 3-9 uses demand with additional conservation, since that is the demand Marysville expects to experience.

As indicated in these figures, the increased needs expected by the PUD and Tulalip Tribes represent most of the growth in demand for water managed by Marysville. Demands for Marysville's retail service area are also projected to grow, although not as quickly.




ADD = Average Day Demand MDD= Maximum Day Demand

**Figure 3-8 Demand Forecast - Summary**

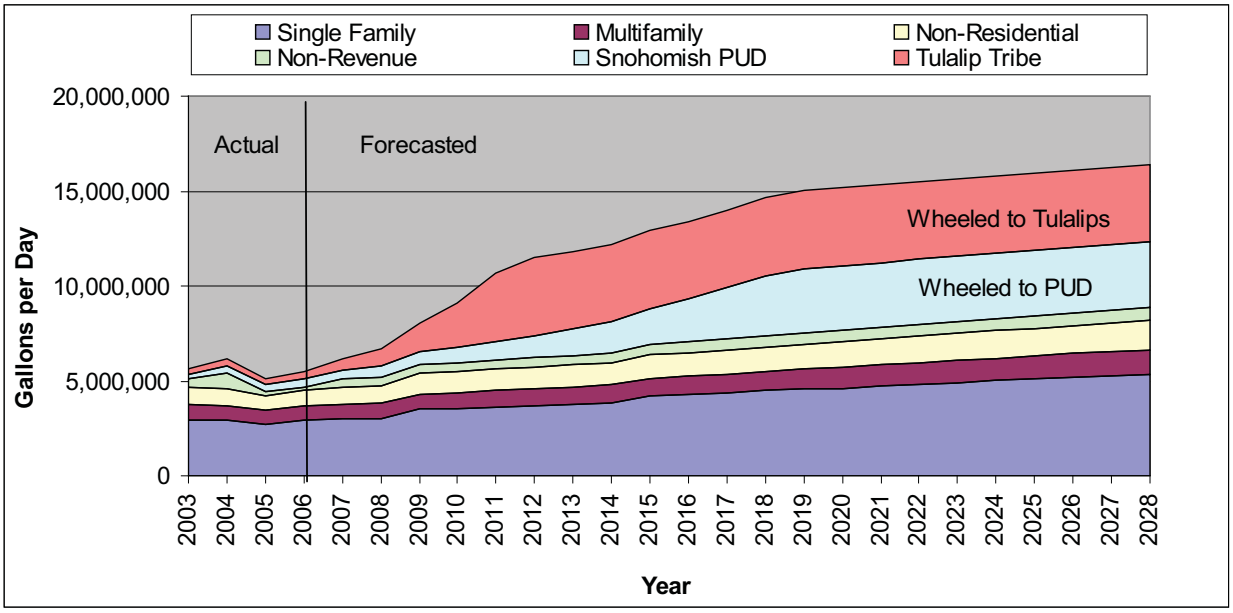



**Figure 3-9 Demand Forecast – Average Day Demand With Conservation**

# 4. Conservation Program

This chapter has three purposes: 1) review the City of Marysville's (Marysville) compliance with conservation planning requirements, 2) describe Marysville's existing conservation program, and 3) describe the six-year conservation program that Marysville will implement from 2009 through 2014.

Marysville's conservation program is comprised of a combination of regional and local measures. The regional measures are part of a regional conservation program Everett implements throughout its retail and wholesale service area. This regional program, called the Everett Water Utility Committee or EWUC program, also requires implementation assistance by Marysville staff. The local measures are specific to Marysville and are implemented by Marysville staff in Marysville's service area.

A progressive conservation program has been developed for the next six years that includes both the regional EWUC program as well as Marysville's local measures. The collective conservation program builds on the success of previous conservation efforts.

Marysville funds the conservation program through rates. For the elements of Marysville's program that are part of the regional EWUC program, the cost of the EWUC program is included in the wholesale water rates Marysville pays to Everett.

## 4.1. Conservation Requirements and Compliance Summary

The conservation planning requirements that must be addressed in water system plans are contained in the following Washington State Department of Health (DOH) documents and State law:

- Water Use Efficiency Rule (January 2007)
- Water System Planning Handbook (April 1997)

The State of Washington recently revised water conservation planning requirements as a result of the 2003 Municipal Water Law. An outgrowth of that law is the Water Use Efficiency Rule (Rule), which was finalized in January 2007. The Rule has several requirements and corresponding compliance dates. Some of the requirements are associated with water system plans, while other requirements are independent of the six year water system planning cycle.

Table 4-1 lists the requirements of the Rule and shows that Marysville is in compliance with current requirements, and will likely be in compliance with upcoming requirements. There are seven main categories of requirements: 1) meters, 2) data collection, 3) distribution system leakage, 4) goals, 5) efficiency program, 6) demand forecast, and 7) performance reports.

## Table 4-1 Compliance with Water Use Efficiency Rule Requirements

| Category | WAC[1] Section | Compliance Date | Requirement | Marysville in Compliance? |
|---|---|---|---|---|
| 1. Meters | 246-290-496 | Fully metered by January 22, 2017. Submit metering plan by July 1, 2008. | 1. Meter all **sources.** | **Yes**, all of Marysville's wells are metered, as is the connection to Everett's transmission line. |
| | | | 2. Meter all **service connections**. | **Yes**, all service connections are metered. |
| | | | 3. For systems **not fully metered**: Create meter installation plan, perform activities to minimize leakage until fully metered, and report annually on installation and leak minimization actions. | **N/A**, since Marysville is fully metered. |
| 2. Data Collection | 246-290-100 | WSPs submitted after January 22, 2008. | 1. Provide monthly and annual **production/purchase** numbers for each source. | **Yes**, provided in Section 3.2.1 |
| | | | 2. Provide annual **consumption** by customer class. | **Yes**, provided in Section 3.2.2. |
| | | | 3. Provide "**seasonal variations**" consumption by customer class. | **Yes**, provided in Section 3.2.2. |
| | | | 4. Provide annual quantity **supplied to other public water systems**. | **Yes**, provided in Section 3.2.2. |
| | | | 5. Evaluate **reclaimed water** opportunities. | **Yes**, provided in Section 6. |
| | | | 6. Consider water use efficiency **rate structure**. | **Yes,** as discussed in Section 4.2.1, Marysville's rate structure does incorporate seasonal rates. |
| 3. Distribution System Leakage | 246-290-820 | First report completed by July 1, 2008. First compliance determination made by July 1, 2010. | 1. **Calculate** annual volume and percent using formula defined in the Rule. | **Likely**. Marysville's 2004-2006 average distribution system leakage was 6 percent and the 2006 number was 2 percent. Assuming this stays relatively constant, Marysville will meet the 10 percent or less threshold. The leakage information is reported in Marysville's annual Consumer Confidence Report. |
| | | | 2. **Report** annually: annual leakage volume, annual leakage percent, and, for systems not fully metered, meter installation progress and leak minimization activities. | |
| | | | 3. Develop water loss control **action plan** (if leakage is over 10% for 3 year average). | |
| 4. Goals | 246-290-830 | Goals established by January 22, 2008. | 1. **Establish** measurable (in terms of water production or usage) conservation goals and re-establish every 6 yrs. Provide schedule for achieving goals. | **Yes,** measurable goals were established via a public process. See Section 4.3.1. |
| | | | 2. Use a **public process** to establish the goals. | |
| | | | 3. **Report** annually on progress. | **Yes,** the goals information is reported in Marysville's annual Consumer Confidence Report. |

1. WAC = Washington Administrative Code.

| Category | WAC[1] Section | Compliance Date | Requirement | Marysville in Compliance? |
|---|---|---|---|---|
| 5. Efficiency Program | 246-290-810 | WSPs submitted after January 22, 2008. | 1. **Describe existing** conservation program. | **Yes**, provided in Section 4.2.1. |
| | | | 2. **Estimate water saved** over last 6 years due to conservation program. | **Yes,** provided in Section 4.2.2 |
| | | | 3. Describe conservation **goals**. | **Yes,** provided in Section 4.3.1 |
| | | | 4. Implement or evaluate **1-12 measures**, depending on size. (9 measures for Marysville) | **Yes,** Marysville is required to implement or evaluate 9 measures, based on 16,665 connections as reported on Marysville's Water Facilities Inventory last updated on 6-21-06. Marysville has chosen to implement 13 measures. See Section 4.3. |
| | | | 5. Describe conservation **programs for next 6 years** including schedule, budget, and funding mechanism. | **Yes,** provided in Sections 4.3.2 and 4.3.3. |
| | | | 6. Describe how customers will be **educated** on efficiency practices. | |
| | | | 7. Estimate **projected water savings** from selected measures. | |
| | | | 8. Describe how efficiency program will be **evaluated** for effectiveness. | |
| | | | 9. Estimated **leakage from transmission lines** (if not included in distribution system leakage). | **N/A,** all leakage is included in the distribution system leakage number. |
| 6. Demand Forecast | 246-290-100 | WSPs submitted after January 22, 2008. | 1. Provide demand forecast reflecting **no additional conservation**. | **Yes,** see Section 4.3.4. |
| | | | 2. Provide demand forecast reflecting **savings from efficiency program**. | |
| | | | 3. Provide demand forecast reflecting **all "cost effective" evaluated measures**. | **N/A**. Since Marysville is implementing the required minimum number of measures (9), this forecast is not required. |
| 7.Performance Reports | 246-290-840 | First report completed by July 1, 2008. | 1. **Develop** annual report including: goals and progress towards meeting them, total annual production, annual leakage volume and percent, and, for systems not fully metered, status of meter installation and actions taken to minimize leakage. | **Yes**. The performance report is included in Marysville's annual Consumer Confidence Report and contains the required information. |
| | | | 2. **Submit annually** by July 1 to DOH and customers and make available to the public. | |

# 4.2. Existing Conservation Program

## 4.2.1. Measures

Marysville's existing conservation program consists of 12 conservation measures. A summary of the conservation measures which Marysville has implemented in the last six years is shown in Table 4-2. The details of each measure are discussed below.

**Table 4-2 Existing Conservation Program**

| Measure | Sectors[1] | | | Local or Regional | Years Implemented | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SF | MF | ICI | | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| 1. Source Meters | n/a | | | Local | X | X | X | X | X | X |
| 2. Service Meters | X | X | X | Local | X | X | X | X | X | X |
| 3. System Leak Detection and Repair | n/a | | | Local | X | X | X | X | X | X |
| 4. Conservation Pricing[2] | X | X | | Local | X | X | X | X | X | X |
| 5. Bills Showing Consumption History | X | X | X | Local | X | X | X | X | X | X |
| 6. Toilet Rebates – 1.6 gpf | X | | | Local | X | X | X | X | X | X |
| 7. School-Based Education | n/a | | | Regional | X | X | X | X | X | X |
| 8. Public Outreach | n/a | | | Regional | X | X | X | X | X | X |
| 9. Indoor Retrofit Kits | X | X | | Regional | X | X | X | X | X | X |
| 10. Outdoor Irrigation Kits | X | X | | Regional | X | X | X | X | X | X |
| 11. School Irrigation System Audits | | | X | Regional | | X | X | X | X | X |
| 12. Pre-Rinse Sprayheads | | | X | Regional | | | | | X | |

1. SF = single family, MF = multifamily, ICI = industrial, commercial, institutional.
2. Marysville's rate structure has elements that promote conservation, as well as elements that do not.

### 1. Source Meters

Source meters are a critical conservation tool since accurate water production and consumption data provides information used in developing conservation priorities, goals, and programs. Marysville has source meters on all of its wells, its treatment plant, its connection to the Everett transmission system, and its connection points for water wheeled to the Tulalip Tribes and Snohomish County PUD. The meter on the Everett connection is maintained by Everett. The meters for the wheeled water are calibrated by Marysville every two to three years. Marysville's other meters do not have a regular calibration schedule, although the meters at Edwards Springs and the treatment plant are relatively new and, as such, should currently be calibrated reasonably well.

### 2. Service Meters

Similarly, service meters are a key component of providing accurate water production and consumption information for use in conservation planning. Marysville has meters on all service connections. Marysville has a formal tracking system to monitor the dates of meter installation and repair in order to make informed decisions regarding meter calibration, repair, and replacement needs.

### 3. System Leak Detection and Repair

Operating an efficient physical system that minimizes leaks demonstrates a commitment to sound financial and resource management. Marysville is proactive about leak control, even though it is not required to have a water loss control action plan since its leakage is low. Marysville relies on system break history, pipeline condition assessments, and future demand needs to identify and prioritize rehabilitation and replacement projects. In addition to these practices, Marysville owns leak detection equipment and performs periodic leak detection surveys to monitor performance of various parts of the system. As discussed in Section 3.2.3, Marysville's 2004-2006 average distribution system leakage was 6 percent of production and purchases, and the 2006 number was 2 percent. This result is low by industry standards, well within the 10 percent or less requirement of the new Rule, and demonstrates that Marysville is successfully managing leaks.

### 4. Conservation Pricing

Rates can be used to encourage conservation action by customers. Rates typically consist of a fixed charge and a variable charge. There are four basic rate structures for the variable charge: uniform, declining block, increasing block, and seasonal. Both increasing blocks and seasonal rates are considered conservation pricing. Increasing blocks charge more per unit of consumption with additional consumption. Seasonal rates charge more per unit of consumption during the peak season.

Marysville's rates are based on meter size. For each meter size, customers pay a flat charge that includes a certain volume of allowable water use. Customers using more than the allowance are charged an "overage rate" for every 1,000 gallons of water. A 20 percent increase in the "overage rate" is charged to residential customers using more than a certain volume of water in the summer months.

This rate structure has some elements that promote conservation, as well as other elements that do not promote conservation. The rate structure promotes conservation in that it incorporates a seasonal rate element (the 20 percent increase to the "overage rate"). However, if the flat fee is divided by the gallons in the allowance, the resulting cost per 1,000 gallons is higher than the "overage rate" in most cases. This effectively operates as a declining block structure, which does not promote conservation.

### 5. Bills Showing Consumption History

Customer bills providing historical consumption data allow customers to understand how their use varies throughout the year and from year to year. This information helps customers make informed choices about how they manage their water use, including implementing conservation. Marysville's customer bills include historical consumption data showing consumption for the previous 12 billing cycles.

### 6. Toilet Rebates

Marysville offers $50 toilet rebates to single family customers as an incentive to replace older toilets with more efficient 1.6 gallons per flush models. Marysville typically spends approximately $3,000 annually on this program, which results in approximately 60 toilet replacements annually.

### 7. School-Based Education

As part of the regional EWUC program, Marysville participates in school-based education programs including classroom presentations, teacher workshops, and classroom educational materials. The classroom presentations are facilitated by trained instructors with curriculum designed for elementary, middle school and high school students. The presentations are marketed to teachers through newsletters and other communications. The presentations were redesigned in 2005 to keep the content fresh and relevant, which resulted in a significant increase in the number of presentations. The teacher workshops assist teachers educate students about water resource issues including conservation. Teachers participate in activities, experiments, and field trips and can receive continuing education credits or clock hours. The classroom educational materials include a broad collection of items such as books, videos, posters and other supplies.

### 8. Public Outreach

As part of the regional EWUC program, Marysville engages in general public outreach intended to build and reinforce a water conservation ethic among customers. These outreach efforts include brochures, a summer watering calendar, transit advertising, and other regional efforts.

Marysville distributes several educational brochures developed by Everett and its wholesale partners. For example, the “Everyday Conservation” brochure provides conservation tips for inside and outside the home, the “Smart Watering” brochure contains information on efficient lawn and garden watering techniques, and the “Growing Healthy Soil” brochure has information on how soil can be improved as a means of reducing watering. These brochures are made available at various public facilities including City Hall, the Public Works building, and libraries.

Marysville also distributes a summer watering calendar each year that encourages residential customers to water every third day (staggered, based on their street address). This effort helps to reduce the daily peak demand for water in the summer by reducing the amount of watering that occurs on a given day. The calendar is mailed to all customers each spring.

Transit advertising is employed to help convey conservation messaging. Billboards promoting various conservation themes have been posted on buses during the summer months when demand peaks. It is estimated these billboards are seen by over 75 percent of the residents in the service areas of Everett and its wholesale partners each year.

Marysville, through EWUC, plays an active role in regional organizations that promote water conservation. EWUC has been an active member of the Partnership for Water Conservation, and its predecessor the Water Conservation Coalition of Puget Sound, for over a decade.

Marysville also conducts a water patrol on several of the hottest days during the summer to educate customers about efficient irrigation practices and promote other elements of Marysville’s conservation program.

### 9. Indoor Retrofit Kits

As part of the regional EWUC program, Marysville has offered free indoor water conservation kits to residential customers since 2001. The kits target homes constructed prior to 1993 and are designed to encourage consumers to upgrade their fixtures to the 1993 efficiency standards. In 1993, the National Plumbing Code of 1991 was adopted in Washington State and increased

the efficiency standards for household water fixtures. The kits are marketed through advertisements in local newspapers and bill inserts.

The kits include a low-flow showerhead, a kitchen faucet aerator, two bathroom faucet aerators, a toilet tank water displacement bag, toilet leak detection tablets, a gauge to measure losses from household leaks, and a conservation brochure. Approximately 3,600 indoor kits have been distributed within Marysville's service area between 2001 and 2006.

### 10. Outdoor Irrigation Kits

As part of the regional EWUC program, Marysville has offered free outdoor water conservation kits to residential customers since 2001. The kits target households with irrigated landscape areas, primarily single-family homes that do not have automatic irrigation systems. The kits are designed to encourage consumers to reduce watering and other outdoor water use. Studies indicate most households overwater their landscape areas by 15 to 20 percent. The kits are marketed through advertisements in local newspapers and bill inserts.

The kits include an automatic shut-off watering timer, a hose nozzle, a gauge to measure rainfall and/or sprinkler output, a package of hose washers to reduce leaks, and a conservation brochure. Approximately 4,000 outdoor kits have been distributed within Marysville's service area between 2001 and 2006.

### 11. School Irrigation System Audits

As part of the regional EWUC program, Marysville began offering a school irrigation audit and upgrade program in 2002. The program is targeted at schools with large irrigation demands. Most schools have large sports fields that require significant watering in the summer. The irrigation demand at schools with multiple fields can account for three-quarters of their annual water consumption. The irrigation audits are designed to improve the efficiency of irrigation systems, resulting in significant water savings.

The audits are conducted by a professional irrigation system auditor and identify equipment upgrades and/or operational changes that will result in decreased water use. Average savings are estimated to be 20 to 25 percent of the annual irrigation demand. Financial assistance, in the form of a 50 percent cost share, is available to provide incentives to the schools to follow through on the audit recommendations.

### 12. Pre-Rinse Sprayheads

As part of the regional EWUC program, Marysville participated in a program in 2005 to replace pre-rinse sprayheads in food service establishments. The program was a joint effort with Puget Sound Energy and the Snohomish County PUD and was modeled after a similar, successful effort in Seattle/King County. Under the program, a contractor was hired to market the program and install the sprayheads. The contractor also installed aerators on other faucets at the participating facilities. The program was jointly funded by the three sponsoring agencies.

Each sprayhead is estimated to save about 100 gallons of water a day. Each faucet aerator installed is estimated to save 30 gallons of water a day. Through the end of 2005, 1,340 sprayheads and 520 aerators were installed throughout the entire Everett retail and wholesale service area. The exact number installed in Marysville is unknown; however since Marysville

represents 7 percent of the total Everett system, it is reasonable to assume approximately 7% of the devices were installed in Marysville.

### 4.2.2. Estimated Savings

The estimated conservation savings Marysville has achieved in the past six years are shown in Table 4-3. The table shows both new savings added each year, as well as cumulative savings. It is estimated that the program saved 157,767 gallons per day by the end of 2006. It should be noted that these are the savings that are quantifiable from the measures listed in Table 4-2. The other measures in that table save water, however the savings are difficult to quantify. For example, providing consumption history on bills can motivate customers to use water more efficiently, however it is difficult to quantify those savings.

**Table 4-3 Estimated Savings Achieved by Existing Program**

| Measure | Savings (gpd) | | | | | |
|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Toilet Rebates – 1.6 gpf[1] | 1,620 | 1,620 | 1,620 | 1,620 | 1,620 | 1,620 |
| School-Based Education & Public Outreach[2] | 58,100 | 58,100 | 58,100 | 58,100 | 58,100 | 58,100 |
| Indoor Retrofit Kits[2] | 4,040 | 11,000 | 14,000 | 15,300 | 8,970 | 8,970 |
| Outdoor Irrigation Kits[2] | 1,333 | 1,667 | 2,667 | 3,667 | 2,333 | 2,133 |
| School Irrigation System Audits[2] | 0 | 962 | 481 | 962 | 962 | 0 |
| Pre-Rinse Sprayheads[2] | 0 | 0 | 0 | 0 | 10,500 | 0 |
| Annual Total | 65,093 | 73,349 | 76,868 | 79,649 | 82,485 | 70,823 |
| Cumulative Total | 65,093 | 80,342 | 99,110 | 120,658 | 145,043 | 157,767 |

1. Based on 60 rebates per year.

2. Based on information from the City of Everett.

## 4.3. 2009-2014 Conservation Program

### 4.3.1. Goals

The goals of a conservation program should reflect the drivers of why a utility is pursuing conservation. Conservation drivers can include meeting regulatory requirements, minimizing impacts on water resources, decreasing operating costs, deferring capital costs, and obtaining new supply. The conservation driver(s) applicable to any one utility depend on that utility's specific supply situation and cost structures.

Marysville's conservation program is primarily driven by meeting regulatory requirements and minimizing impacts on water resources. Marysville adopted its first conservation goal under the new Water Use Efficiency Rule at a City Council meeting and public hearing on December 10, 2007. That goal covered a planning period of 2008-2013. Marysville's conservation goal was then shifted forward one year in order to match the six-year planning period of this WCP, which is 2009-2014. Therefore, Marysville's new official goal is to save 129,000 gpd on an annual basis (as opposed to peak season) at full implementation of the six year program by the end of 2014. This new goal was established using the public process that was used to adopt this

WCP, including a public hearing at the June 23, 2009 Marysville Planning Commission meeting and another public hearing at the July 27, 2009 Marysville City Council meeting.

## 4.3.2. Measures

Marysville's conservation program for 2009-2014 will consist of the 13 measures shown in Table 4-4. These measures have been selected due to a combination of factors including applicability to Marysville's service area, customer acceptance, cost effectiveness, and/or savings potential. Descriptions of each measure are discussed below. It should be noted that Marysville will continue to use source meters, service meters, and system leak detection and repair, although those activities are not counted as official conservation "measures" under the new conservation Rule.

**Table 4-4 2009-2014 Conservation Program**

| Measure | Sectors[1] | | | Local or Regional | Relationship to Current Program |
|---|---|---|---|---|---|
| | SF | MF | ICI | | |
| 1. Conservation Pricing[2] | X | X | | Local | Continuation |
| 2. Bills Showing Consumption History | X | X | X | Local | Continuation |
| 3. Toilet Rebates – 1.6 gpf | X | | | Local | Continuation |
| 4. Customer AMR-Based Leak Detection | X | X | X | Local | New |
| 5. School-Based Education | n/a | | | Regional | Continuation |
| 6. Public Outreach | n/a | | | Regional | Continuation |
| 7. Indoor Retrofit Kits | X | X | | Regional | Modification |
| 8. Outdoor Irrigation Kits | X | X | | Regional | Modification |
| 9. Toilet Leak Detection | X | X | X | Regional | Modification |
| 10. Toilet Rebates - HETs | X | X | X | Regional | New |
| 11. Clotheswasher Rebates | X | X | X | Regional | New |
| 12. School Irrigation System Audits | | | X | Regional | Modification |
| 13. Commercial Indoor Audits | | | X | Regional | New |

1. SF = single family, MF = multifamily, ICI = industrial, commercial, institutional.

2. Marysville's rate structure has elements that promote conservation, as well as elements that do not.

### 1. Conservation Pricing

Marysville plans to continue using its current rate structure, including the seasonal rates element, as described in Section 4.2.1.

### 2. Bills Showing Consumption History

Marysville will continue to provide consumption history on customer bills, as described in Section 4.2.1.

### 3. Toilet Rebates – 1.6 gpf

Marysville will continue its locally administered program of providing rebates on 1.6 gallons per flush toilets, as described in Section 4.2.1.

### 4. Customer AMR-Based Leak Detection

In 2007, Marysville began a multi-year effort to replace all service meters with new Automatic Meter Reading (AMR). In addition to other benefits, these new meters trigger an automatic alert when consumption is dramatically higher than historical consumption, thereby allowing Marysville to alert customers about possible leaks. Marysville replaced 2,000 meters in 2007 and anticipates it will replace 10,000 meters in 2008 and 2009 and the remainder in 2010.

### 5. School-Based Education

As part of the regional EWUC program, Marysville will continue to participate in school-based education programs including classroom presentations, teacher workshops, and classroom educational materials, as described in Section 4.2.1.

### 6. Public Outreach

As part of the regional EWUC program, Marysville will continue to participate in public outreach programs including brochures, summer lawn watering calendar, transit advertising, and other regional efforts, as described in Section 4.2.1.

### 7. Indoor Retrofit Kits

This measure is a modification of the indoor retrofit kits, described in Section 4.2.1, that Marysville has offered as part of the regional EWUC program. This measure applies to the single-family and multi-family sectors, both existing and new customers. Different versions of the kit will be distributed to each sector. The single-family kits consist of 2.0 gpm showerheads and 1.0 gpm bathroom faucet aerators. Those flow rates are more efficient than the maximum allowed under the plumbing code. The multi-family kits includes those measures and 2.2 gpm kitchen faucet aerators, which are treated as bringing customers up to code, even though technically the maximum flow rate allowed under the plumbing code is slightly higher at 2.5 gpm. Kitchen faucet aerators are only included in the multi-family kits since the measure analysis concluded that the majority of the single-family sector has already been brought up to code due to natural replacement and distribution of the previous kits, which were targeted primarily to single-family customers.

### 8. Outdoor Irrigation Kits

This measure is a modification of the outdoor irrigation kits, described in Section 4.2.1, that Marysville has offered as part of the regional EWUC program. This measure applies to the single-family and multi-family sectors, both existing and new customers. These are free outdoor irrigation kits with devices and information to improve the irrigation efficiency of residential customers that manually irrigate their landscaping. Historically, the kits have included items such as a watering timer and shut-off device, a spring-loaded hose nozzle, a rain gauge, hose washers, and a conservation brochure. While the exact contents of the new kits has not been determined, the contents will be slightly different than the previous outdoor kits.

### 9. Toilet Leak Detection

As part of the regional EWUC program, Marysville will expand one component of the previous EWUC indoor kits. This measure provides free toilet leak detection dye tablets for customers to determine if their toilets leak and provides detailed information on how to fix leaks. This

measure applies to single-family and multi-family sectors, both existing and new customers, and businesses with tank style toilets. Only tank style toilets are targeted since most leaks occur in that type of toilet, usually via flapper leaks.

**10. Toilet Rebates – HETs**

As part of the regional EWUC program, Marysville, through EWUC, will begin offering $100 rebates for customers to replace less efficient toilets with high efficiency toilets (HETs) in tank style toilets. HETs are technically defined as toilets flushing at a maximum of 1.28 gpf. However, a flush volume of 1.0 gpf is used for this measure since most models flush at this volume. HETs include both dual flush toilets and pressure assist tank style toilets. This measure assumes dual flush toilets are used for the single-family and multi-family sectors and pressure assist toilets for the commercial sector. The target audience is existing and new customers with tank style toilets, in the single-family, multi-family, and commercial sectors. EWUC chose to focus on HET toilets, rather than the standard 1.6 gpf toilets, to obtain higher savings, avoid free riders, and go beyond current code requirements.

**11. Clotheswasher Rebates**

As part of the regional EWUC program, Marysville, through EWUC, will begin offering $100 rebates for customers to replace less efficient residential-capacity clothes washers with more efficient models. This measure is applied to the single-family and multi-family sectors, both existing and new customers, and commercial laundromats. For multi-family, this measure targets both clothes washers in individual households and common laundry areas. This measure is applied to both existing and new customers. The measure targets customers who are ready to purchase a new machine and is not intended to accelerate replacement before the normal lifespan ends.

**12. School Irrigation System Audits**

This measure is a modification of the school irrigation audit and upgrade program, described in Section 4.2.1, that Marysville has offered as part of the regional EWUC program. This measure provides free irrigation audits to schools to improve the efficiency of their irrigation systems. Efficiencies can be achieved through hardware improvements or operational changes. The audits are performed by a professional landscape irrigation auditor. This measure is applied to existing customers in the commercial sector. The financial assistance that had been provided to implement audit recommendations has been eliminated in order to reduce program costs.

**13. Commercial Indoor Audits**

As part of the regional EWUC program, Marysville, through EWUC, will begin offering indoor audits to commercial customers. This is a modified version of a measure which Everett has been implementing in its retail service area. This measure provides free indoor audits to commercial customers to determine efficiencies that could be achieved through hardware improvements or operational changes. The audits are performed by a professional auditor. This measure is applied to the commercial sector, both existing and new customers.

## 4.3.3. Estimated Savings

The estimated savings of the 2009-2014 conservation program are shown in Table 4-5. At full implementation of the program at the end of 2014, the program is estimated to save 129,000

## Table 4-5 Estimated Savings for 2009-2014 Conservation Program

| | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | Savings (gpd) | Units | Savings (gpd) | Units | Savings (gpd) | Units | Savings (gpd) | Units | Savings (gpd) | Units | Savings (gpd) | Units | Savings (gpd) |
| Toilet Rebates - 1.6 gpf[1] | 60 | 1,620 | 60 | 1,620 | 60 | 1,620 | 60 | 1,620 | 60 | 1,620 | 60 | 1,620 | 360 | 9,720 |
| School-Based Education & Public Outreach[2,3] | n/a | 44,030 | n/a | 45,080 | n/a | 46,200 | n/a | 47,110 | n/a | 47,110 | n/a | 47,110 | n/a | 47,110 |
| Indoor Retrofit Kits[3] | 578 | 5,180 | 578 | 5,180 | 578 | 5,180 | 578 | 5,180 | 578 | 5,180 | 578 | 5,180 | 3,465 | 31,080 |
| Outdoor Irrigation Kits[3] | 525 | 3,430 | 263 | 1,750 | 263 | 1,750 | 263 | 1,750 | 263 | 1,750 | 263 | 1,750 | 1,838 | 12,180 |
| Toilet Leak Detection[3] | 753 | 1,610 | 403 | 784 | 403 | 753 | 403 | 784 | 403 | 784 | 403 | 784 | 2,769 | 5,530 |
| Toilet Rebates - HETs3 | 113 | 1,190 | 113 | 1,190 | 113 | 1,190 | 113 | 1,190 | 113 | 1,190 | 113 | 1,190 | 678 | 7,140 |
| Clotheswasher Rebates[3] | 113 | 1,680 | 113 | 1,680 | 113 | 1,680 | 113 | 1,680 | 113 | 1,680 | 113 | 1,680 | 678 | 10,080 |
| School Irrigation System Audits[3] | 1 | 350 | 1 | 350 | 1 | 210 | 1 | 210 | 1 | 210 | 1 | 210 | 5 | 1,680 |
| Commercial Indoor Audits[3] | 2 | 700 | 2 | 700 | 2 | 700 | 2 | 770 | 2 | 770 | 2 | 770 | 12 | 4,410 |
| Annual Subtotal | n/a | 59,790 | n/a | 58,334 | n/a | 59,454 | n/a | 60,294 | n/a | 60,294 | n/a | 60,294 | n/a | 128,930 |
| Cumulative | n/a | 59,790 | n/a | 74,094 | n/a | 88,468 | n/a | 102,562 | n/a | 115,746 | n/a | 128,930 | | |

1. Based on 3.5 gpf pre-code toilets, 1.6 gpf code toilets, 5.1 flushes per person per day, 2.8 people per single family household, and 60 rebates a year.

2. Education savings are not cumulative over the six years since a continuous effort must be made to maintain savings each year.

3. Based on the EWUC regional conservation program in the 2007 Everett Comprehensive Water Plan. Assumes 7 percent of the EWUC savings will be achieved in Marysville, since Marysville represents 7 percent of the EWUC demand (2007 Everett Comprehensive Water Plan; Table 3-11). The EWUC program is for 2007-2012. It is assumed that EWUC will continue programs beyond 2012, therefore the 2012 numbers are used for 2013 and 2014 as well.

gpd. The savings achieved by the program, and the corresponding progress towards reaching Marysville goal of saving 129,000 gpd by the end of 2014, will be estimated by tracking the number of devices and rebates distributed and multiplying them by their per unit savings, as provided by Everett staff. The number of devices and rebates planned for the program is included in Table 4-5.

Figure 4-1 depicts how the savings grow over the course of the six year conservation program. The savings are generally expected to be achieved evenly over the six year planning period. The apparent "jump" in the first year is due to two reasons. First, the education savings are not cumulative, since they must be re-enforced each year. Those savings, which are a large portion of the overall savings, are essentially repeated each year rather than increased each year. Second, the toilet leak detection program will be rolled out to existing customers in the first year, and new customers to the utility will be added in the subsequent years.

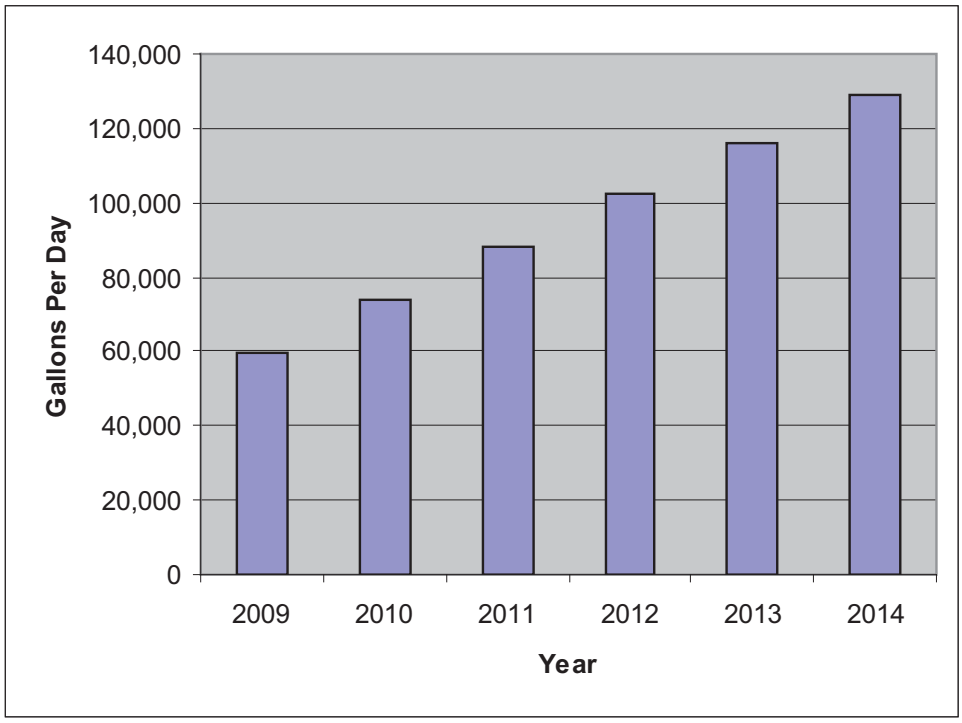



**Figure 4-1 Estimated Savings for 2009-2014 Conservation Program**

## 4.3.4. Impact to Demand

Marysville's demand will be reduced by the expected savings from the conservation program. The demand forecast presented in Section 3.3 includes two forecasts: one without additional conservation and one reflecting the savings from the conservation program.

The conservation adjustment was accomplished by reducing the water use factors in 2009-2014 to reflect the estimated savings from the conservation program included in this chapter. Table 4-6 provides specific details on those adjustments. Here is an example for 2009. The conservation program is anticipated to save 59,790 gpd in 2009. The 2009 retail sales without additional conservation are projected to be 5,454,771 gpd. The 2009 savings are therefore 1.1 percent of the 2009 retail sales without additional conservation. Therefore, the 2009 water use

factors were reduced by 1.1 percent from the 2008 water use factors. The water use per single family household was decreased from 188 gpd to 185.9 gpd. Similarly, the water use per multifamily household drops from 160 gpd to 158.2 gpd and the water use per employee drops from 90 gpd to 89 gpd.

**Table 4-6 Demand Reduction Due to Conservation**

| Calendar Year | Plan Year | Cumulative Savings (gpd) | Projected Retail Sales[1] (gpd) | Savings as % of Projected Retail Sales[1] | Water Use Factors (gpd) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Per Single Family Household | Per Multifamily Household | Per Employee |
| 2008 | n/a | n/a | n/a | n/a | 188.0 | 160.0 | 90.0 |
| 2009 | 1 | 59,790 | 5,454,771 | 1.1% | 185.9 | 158.2 | 89.0 |
| 2010 | 2 | 74,094 | 5,558,792 | 1.3% | 185.5 | 157.9 | 88.8 |
| 2011 | 3 | 88,468 | 5,692,792 | 1.6% | 185.1 | 157.5 | 88.6 |
| 2012 | 4 | 102,562 | 5,826,792 | 1.8% | 184.7 | 157.2 | 88.4 |
| 2013 | 5 | 115,746 | 5,960,792 | 1.9% | 184.3 | 156.9 | 88.3 |
| 2014 | 6 | 128,930 | 6,094,792 | 2.1% | 184.0 | 156.6 | 88.1 |
| 2015-2028 | 7 -20 | n/a | n/a | n/a | 184.0 | 156.6 | 88.1 |

1. These are the retail sales without additional conservation.

Over the course of the conservation program, the single family water use factor shifts from 188 gpd per single family household in 2008 to 184 gpd by 2014. The multifamily water use factor shifts from 160 gpd per multifamily household in 2008 to 156.6 gpd by 2014. The non-residential water use factor shifts from 90 gpd per employee in 2008 to 88.1 gpd by 2014.

Marysville plans to continue conservation efforts beyond 2014. However, since the conservation goals beyond 2014 are not defined at this time, the water use factors are then held constant for all years beyond 2014.

# 5. System Analysis

This chapter provides an evaluation of the water system's ability to meet current and projected (i.e., through the 20-year planning period, or 2028) water supply needs. Source and storage capacity analyses are presented, followed by an evaluation of the distribution system piping network. Required system improvements are also described throughout the chapter.

## 5.1. Source Capacity Analysis

### 5.1.1. Design Criteria

According to DOH planning requirements, sources of supply must be sufficient to meet maximum day demands (MDD). This requirement applies to each pressure zone within a system, as well as for the entire system. The source capacity analysis presented below examines the ability of the City of Marysville's (Marysville) existing sources of supply to meet this requirement. The analysis is conducted by comparing Marysville's water demand forecast, presented in Chapter 3, with current source capacities. All evaluations assume 24-hour-per-day source operation, unless otherwise noted.

### 5.1.2. Source Capacity Evaluation

As described in Chapter 1, Marysville's water system is comprised of two service areas: the North System and the South System. These two portions of the system receive water supply from different sources. Therefore, the source capacity analysis (i.e., comparison of supply versus demand) has been conducted for various pressure zone combinations within these two areas. Descriptions of the pressure zone combinations considered, and the results of the analysis, are provided below.

**North System**

Tables 5-1 through 5-3 provide the details of the analysis.

- **Full North System (including pressure zones: North 240, 327, 460, and North 510)**. The sources of water supply for the entire North System include the Stillaguamish Ranney Well Collector, the Edward Springs Wells, and the Lake Goodwin Well. As summarized in Table 5-1, the current capacities of these sources provide an adequate supply for these zones beyond 2028.
- **North System - 460 and 327 Zones**. The only water sources available to these two higher zones are the Edward Springs Booster Pump Station and the Lake Goodwin Well. However, the Booster Pump Station is currently relied on only for emergency fire flows. Therefore, the primary source of supply is the Lake Goodwin Well. As summarized in Table 5-2, the current capacity of the well is sufficient to provide adequate supply for these zones beyond 2028.
- **North System - North 510 and 360 Zones**. These are future zones that will require a new pump station to provide supply. As summarized in Table 5-3, the future pump station will be required to supply approximately 311,000 gpd (or 216 gpm) in 2028.

## Table 5-1 Evaluation of Source Adequacy for Marysville's Full North System

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[5] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 7,649 | 11,538 | 16,527 | 17,891 |
| Average Day Demand (gpd) | 1,438,079 | 2,169,191 | 3,107,007 | 3,363,529 |
| Maximum Day Demand (gpd) | 2,444,734 | 3,687,624 | 5,281,913 | 5,718,000 |
| ***Evaluation of Existing Sources*** | | | | |
| Available Existing Source (gpd) | | | | |
| Stillaguamish Ranney Well Collector[2] | 3,200,000 | 3,200,000 | 3,200,000 | 3,200,000 |
| Edward Springs Wells[3] | 2,140,000 | 2,140,000 | 2,140,000 | 2,140,000 |
| Lake Goodwin Well (350 gpm)[4] | 378,000 | 378,000 | 378,000 | 378,000 |
| Total Available Source (gpd) | 5,718,000 | 5,718,000 | 5,718,000 | 5,718,000 |
| **Source Surplus/(Deficiency) (gpd)** | **3,273,266** | **2,030,376** | **436,087** | **0** |

Notes:
1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. For the Stillaguamish source, the total available source is equivalent to the capacity of the WTP, which is 3.2 mgd.
3. The total available source is equivalent to the total water rights (for primary rights only, on a maximum annual volume basis) associated with the Edward Springs source.
4. The Lake Goodwin Well is limited to 350 gpm (for operations purposes) and is assumed to operate for 18 hours a day for this analysis.
5. Maximum ERUs to be served with Existing Sources, based on maximum production rate.
   Max ERUs = [Total Existing Source / (ERU Water Use Factor * Peaking Factor)].
   ERU Water Use Factor = 188 gpd/ERU.
   Peaking Factor = 1.7.

## Table 5-2 Evaluation of Source Adequacy for North System - 460 and 327 Zones

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[4] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 207 | 407 | 808 | 1,183 |
| Average Day Demand (gpd) | 38,868 | 76,480 | 151,841 | 222,353 |
| Maximum Day Demand (gpd) | 66,076 | 130,016 | 258,130 | 378,000 |
| ***Evaluation of Existing Sources*** | | | | |
| Available Existing Source (gpd) | | | | |
| Edward Springs Booster Pump Station (2,000 gpm)[2] | 0 | 0 | 0 | 0 |
| Lake Goodwin Well (350 gpm)[3] | 378,000 | 378,000 | 378,000 | 378,000 |
| Total Available Source (gpd) | 378,000 | 378,000 | 378,000 | 378,000 |
| **Source Surplus/(Deficiency) (gpd)** | **311,924** | **247,984** | **119,870** | **0** |

Notes:
1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. Station contains two pumps at 1,000 gpm each. The combined capacity of the station is 2,000 gpm while both pumps are operating. However, the Edward Springs Booster Pump Station is used to provide fire flow to the 460 Zone and the 327 Zone.
3. The Lake Goodwin Well is limited to 350 gpm (for operations purposes) and is assumed to operate for 18 hours a day for this analysis.
4. Maximum ERUs to be served with Existing Sources, based on maximum production rate.
   Max ERUs = [Total Existing Source / (ERU Water Use Factor * Peaking Factor)].
   ERU Water Use Factor = 188 gpd/ERU.
   Peaking Factor = 1.7.

**Table 5-3 Evaluation of Source Adequacy for North System – North 510 and 360 Zones (Future Zones)**

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[3] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 0 | 0 | 965 | 0 |
| Average Day Demand (gpd) | 0 | 0 | 181,464 | 0 |
| Maximum Day Demand (gpd) | 0 | 0 | 308,489 | 0 |
| ***Evaluation of Existing Sources*** | | | | |
| Available Existing Source (gpd)[2] | | | | |
| No Existing Sources | 0 | 0 | 0 | 0 |
| Total Available Source (gpd) | 0 | 0 | 0 | 0 |
| **Source Surplus/(Deficiency) (gpd)[4]** | **0** | **0** | **(308,489)** | **0** |

Notes:

1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. A facility does not yet exist to serve these future zones.
3. Maximum ERUs to be served with Existing Sources, based on maximum production rate.
   Max ERUs = [Total Existing Source / (ERU Water Use Factor * Peaking Factor)].
   ERU Water Use Factor = 188 gpd/ERU.
   Peaking Factor = 1.7.
4. Marysville plans to install a booster pump station at the Wade Road Reservoir site (North 240 Zone) to provide water to future North 510 Zone customers. Water will flow from the North 510 Zone to the 360 Zone through PRVs. A new storage reservoir is also planned for the future North 510 Zone.

### South System

Tables 5-4 through 5-5 provide the details of this analysis.

- **Full South System (including pressure zones: 170, 203, South 240, 260, 360, and South 510)**. All water used in the South System is obtained from the Everett-Marysville Pipeline (i.e., the JOA Transmission Main). Backup sources exist, including Marysville's own Highway 9 and Sunnyside Wells, and various interties with other utilities. However, these are considered emergency supplies only, and therefore do not factor into the source capacity analysis. As summarized in Table 5-4, the current contract limits associated with Marysville's share of water from the JOA Transmission Main, are adequate to meet demands beyond 2028.
- **South System – South 510 Zone**. The only water source for this zone is the Cedarcrest Pump Station. As summarized in Table 5-5, the current capacity of the pump station is sufficient to provide the needed supply beyond 2028. When the Soper Hill area currently owned by Snohomish PUD is annexed, Marysville plans to decommission the Cedarcrest Pump Station and serve the South 510 Zone with a new pump station (see Project PS-4 in Chapter 9). This proposed pump station will have three pumps (two for normal operations and one for redundancy) that will provide 700 gpm at a head of 130 feet. Therefore, if two pumps are operating for 18 hours per day, the pump station will provide 1,500,000 gallons, which is adequate to provide supply for the South 510 Zone in 2014 and 2028.

### Source Improvements

Therefore, the only improvement required to address source capacity needs is the addition of a future pump station to provide supply to the North 510 Zone. For planning purposes, a capital

improvement project involving a pump station with a capacity of 300 gpm is included in the Capital Improvement Program (see Chapter 9).

### Table 5-4 Evaluation of Source Adequacy for Marysville's Full South System

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[3] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 19,177 | 23,674 | 31,704 | 41,145 |
| Average Day Demand (gpd) | 3,605,257 | 4,450,661 | 5,960,320 | 7,735,294 |
| Maximum Day Demand (gpd) | 6,128,937 | 7,566,125 | 10,132,544 | 13,150,000 |
| ***Evaluation of Existing Sources*** | | | | |
| Available Existing Source (gpd) | | | | |
| JOA Supply Pipeline[2] | 13,150,000 | 13,150,000 | 13,150,000 | 13,150,000 |
| Total Available Source (gpd) | 13,150,000 | 13,150,000 | 13,150,000 | 13,150,000 |
| **Source Surplus/(Deficiency) (gpd)** | **7,021,063** | **5,583,875** | **3,017,456** | **0** |

Notes:
1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. Available source based upon contract limits.
3. Maximum ERUs to be served with Existing Sources, based on maximum production rate.
   Max ERUs = [Total Existing Source / (ERU Water Use Factor * Peaking Factor)].
   ERU Water Use Factor = 188 gpd/ERU.
   Peaking Factor = 1.7.

### Table 5-5 Evaluation of Source Adequacy for South 510 Zone

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[4] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 1,308 | 2,949 | 4,417 | 4,731 |
| Average Day Demand (gpd) | 245,851 | 554,438 | 830,427 | 889,412 |
| Maximum Day Demand (gpd) | 417,947 | 942,544 | 1,411,725 | 1,512,000 |
| ***Evaluation of Existing Sources*** | | | | |
| Available Existing Source (gpd) | | | | |
| Cedarcrest Booster Pump Station (1,000 gpm)[2] | 2,160,000 | 0 | 0 | 0 |
| Soper Hill Pump Station (700 gpm)[3] | 0 | 1,512,000 | 1,512,000 | 1,512,000 |
| Total Available Source (gpd) | 2,160,000 | 1,512,000 | 1,512,000 | 1,512,000 |
| **Source Surplus/(Deficiency) (gpd)** | **1,742,053** | **569,456** | **100,275** | **0** |

Notes:
1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. Station contains three pumps at 1,000 gpm each. For this analysis, two pumps are assumed to be operating at one time, pumping 18 hours a day. This pump station will be decommissioned when the Soper Hill Pump Station is put in service.
3. Station contains three pumps at 700 gpm each. For this analysis, two pumps are assumed to be operating at one time, pumping 18 hours a day. This pump station is a proposed CIP project (PS-4); the capacity will need to be re-evaluated during the design phase.
4. Maximum ERUs to be served with Existing Sources, based on maximum production rate.
   Max ERUs = [Total Existing Source / (ERU Water Use Factor * Peaking Factor)].
   ERU Water Use Factor = 188 gpd/ERU.
   Peaking Factor = 1.7.

# 5.2. Storage Capacity Analysis

## 5.2.1. Design Criteria

According to DOH requirements, water system storage volume is comprised of five separate components:

- Operating volume
- Equalizing volume
- Fire flow volume
- Standby volume
- Dead volume

These required volume components are illustrated in Figure 5-1. All storage components are described in more detail below.

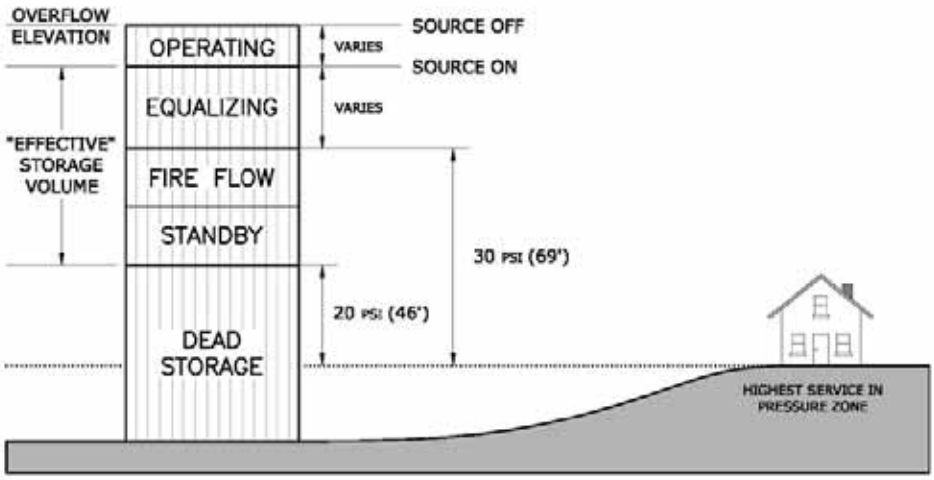



**Figure 5-1. Storage Components**

**Operating and Dead Storage Volumes**

Operating volume is the water that lies between low and high water storage elevations set by Marysville operations staff to control system pumps and flow control valves. Dead volume is the volume at the bottom of the tank that cannot be used because it is physically too low to provide sufficient pressures. Operational and dead volumes are subtracted from total storage to determine the effective storage available for equalizing, standby, and fire flow.

**Equalizing Volume**

Equalizing volume is the total volume needed to moderate daily fluctuations in diurnal demands during periods when the demand exceeds the capacity of the supply system. Equalizing volume requirements are greatest on the day of peak demand. Operation of a properly balanced system results in replenishment of storage facilities during times of day when the demand curve is below the capacity of the supply system, and depletion of storage facilities when the demand exceeds the supply capacity. The equalizing volume of a storage tank must be located at an

elevation that provides a minimum pressure of 30 pounds per square inch (psi) to all customers served by the tank.

At a minimum, Marysville reserves a storage volume equal to five percent of MDD to account for equalization.

**Fire Flow Volume**

The required fire flow volume for a given pressure zone is calculated as the required fire flow multiplied by the required duration, as established by the local fire authority. Required fire flows and durations vary across Marysville's service area. The maximum fire flow volume considered in this analysis is 2,500 gpm for two hours, which applies to portions of Marysville where commercial and multi-family development exists. Single-family residential fire flow requirements are generally 1,000 gpm for one hour.

The fire flow volume of a storage tank must be located at an elevation that provides a minimum pressure of 20 psi to all customers served by the tank. Marysville assumes "nesting" of standby and fire flow storage, with the larger used for the total required storage volume for these two components, as allowed for by DOH.

**Standby Volume**

Standby volume is required to supply reasonable system demands during a foreseeable system emergency or outage. A key concept is that establishing standby volume involves planning for reasonable system outages – those that can be expected to occur under normal operating conditions, such as a pipeline failure, power outage or valve failure. Major system emergencies, such as those created by an earthquake, are intended to be covered by emergency system operations planning, since construction of sufficient reserve volume to accommodate sustained system demands under emergency conditions is not economically feasible.

DOH has established guidelines for determining minimum required standby volume. This component is calculated as the greater of: two times the average day demand, less multi-source credit; or 200 gallons times the number of ERUs served by the storage facility. The multi-source credit is applicable only for pressure zones that have multiple sources of supply, and allows the required standby storage volume in such instances to be reduced. The credit assumes the largest source of supply is out of service; thus, it is calculated as the total source available to a particular pressure zone, or zone combination, less the capacity of the largest source. No credit is allowed for zones having only one source of supply.

## 5.2.2. Storage Capacity Evaluation

The storage capacity evaluation is based upon two primary calculations:

1. Comparison of available versus required storage located at an elevation that provides at least 30 psi to the highest customer in the zone. This evaluates the ability of existing storage facilities to provide required operational and equalizing storage volumes under current and future conditions.
2. Comparison of available versus required storage located at an elevation that provides at least 20 psi to the highest customer in the zone. This evaluates the ability of existing storage facilities to provide required operational, equalizing, standby, and fire flow storage volumes under current and future conditions.

These two calculations are conducted for each pressure zone, or combination of pressure zones, served by the system's reservoirs. Based upon the locations of Marysville's reservoirs, and the interconnectedness of the various pressure zones via pressure reducing valves (PRVs), multiple pressure zone combinations, organized according to the North and South service areas, were considered in this analysis. Descriptions of these pressure zone combinations, and the results of the analysis, are provided below.

**North System**

Tables 5-6 through 5-8 provide the details of the analysis.

- **North 240 Zone**. The Edward Springs and Wade Road Reservoirs provide storage for this zone. As summarized in Table 5-6, the capacities of the current reservoirs provide adequate storage volume beyond 2028.
- **North System – 327 Zone**. The 327 Zone Reservoir provides storage for this zone. As summarized in Table 5-7, the capacity of the reservoir is sufficient to provide the needed storage volume beyond 2028.
- **North System - North 510 and 360 Zones**. These future zones will require a new reservoir to provide storage. As summarized in Table 5-8, the future reservoir will be required to provide at least approximately 400,000 gallons of effective storage in 2028. This does not take into account additional dead storage volume that may be incorporated in the reservoir design.

## Table 5-6 Evaluation of Storage Adequacy for the North 240 Zone

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[11] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 7,443 | 11,131 | 14,754 | 26,262 |
| Average Day Demand (gpd) | 1,399,211 | 2,092,711 | 2,773,702 | 4,937,294 |
| Maximum Day Demand (gpd) | 2,378,658 | 3,557,608 | 4,715,294 | 8,393,400 |
| Available Source (gpd) | | | | |
| Stillaguamish Ranney Well Collector[2] | 3,200,000 | 3,200,000 | 3,200,000 | 3,200,000 |
| Edward Springs Wells[3] | 2,140,000 | 2,140,000 | 2,140,000 | 2,140,000 |
| Total Available Source (gpd) | 5,340,000 | 5,340,000 | 5,340,000 | 5,340,000 |
| Multi-Source Credit (gpd)[4] | 3,756,000 | 3,756,000 | 3,756,000 | 3,756,000 |
| **Required Storage Calculations** | | | | |
| Operational Storage (gal)[5] | 2,028,571 | 2,028,571 | 2,028,571 | 2,028,571 |
| Equalizing Storage (gal)[6] | 118,933 | 177,880 | 239,823 | 852,841 |
| Standby Storage (gal)[7] | 1,494,305 | 2,233,847 | 2,961,995 | 6,118,588 |
| Fire Flow Storage (gal)[8] | 300,000 | 300,000 | 300,000 | 300,000 |
| **Required Storage** | | | | |
| Greater than 30 psi at highest meter (gal)[9] | 2,147,504 | 2,206,452 | 2,268,394 | 2,881,412 |
| Greater than 20 psi at highest meter (gal)[10] | 3,641,810 | 4,440,299 | 5,230,389 | 9,000,000 |
| **Existing Storage Greater Than 30 psi (gal)** | | | | |
| Edward Springs Reservoir | 5,267,692 | 5,267,692 | 5,267,692 | 5,267,692 |
| Wade Road Reservoir | 1,128,791 | 1,128,791 | 1,128,791 | 1,128,791 |
| Total Existing Storage at 30 psi (gal) | 6,396,484 | 6,396,484 | 6,396,484 | 6,396,484 |
| **Storage Surplus/(Deficiency) at 30 psi (gal)** | **4,248,979** | **4,190,032** | **4,128,089** | **3,515,071** |
| **Existing Storage Greater Than 20 psi (gal)** | | | | |
| Edward Springs Reservoir | 6,000,000 | 6,000,000 | 6,000,000 | 6,000,000 |
| Wade Road Reservoir | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Total Existing Storage at 20 psi (gal) | 9,000,000 | 9,000,000 | 9,000,000 | 9,000,000 |
| **Storage Surplus/(Deficiency) at 20 psi (gal)** | **5,358,190** | **4,559,701** | **3,769,611** | **0** |

Notes:

1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. For the Stillaguamish source, the total available source is equivalent to the capacity of the WTP, which is 3.2 mgd.
3. The total available source is equivalent to the total water rights (for primary rights only, on a maximum annual volume basis) associated with the Edward Springs source.
4. Multi-source credit assumes largest source is out of service (in this case, one pump at Stillaguamish WTP High Service Pump Station, decreasing capacity to 2,200 gpm).
5. Required operational storage is based on storage tank level when pump turns on.
6. Required equalization storage is the greater of either [(PHD - Total Available Source) * 150 minutes] or [5% of MDD].
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Aug 2001 WSDM)
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU. Includes standby storage for 460 Zone.
8. Required fire flow storage = 2,500 gpm x 2 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.
11. Maximum ERUs supported by Available Storage.

## Table 5-7 Evaluation of Storage Adequacy for North System – 327 Zone

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[10] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 178 | 369 | 751 | 1,535 |
| Average Day Demand (gpd) | 33,432 | 69,375 | 141,268 | 288,532 |
| Maximum Day Demand (gpd) | 56,835 | 117,937 | 240,156 | 490,504 |
| Available, Existing + Future Source (gpd) | | | | |
| Lake Goodwin Well (350 gpm)[2] | 378,000 | 378,000 | 378,000 | 378,000 |
| Total Available Source (gpd) | 378,000 | 378,000 | 378,000 | 378,000 |
| Multi-Source Credit (gpd)[3] | 0 | 0 | 0 | 0 |
| **Required Storage Calculations** | | | | |
| Operational Storage (gal)[4] | 50,370 | 50,370 | 50,370 | 50,370 |
| Equalizing Storage (gal)[5] | 2,842 | 5,897 | 12,008 | 52,566 |
| Standby Storage (gal)[6] | 66,864 | 138,750 | 282,536 | 577,063 |
| Fire Flow Storage (gal)[7] | 60,000 | 60,000 | 60,000 | 60,000 |
| **Required Storage** | | | | |
| Greater than 30 psi at highest meter (gal)[8] | 53,212 | 56,267 | 62,378 | 102,937 |
| Greater than 20 psi at highest meter (gal)[9] | 120,076 | 195,017 | 344,914 | 680,000 |
| **Existing Storage Greater Than 30 psi (gal)** | | | | |
| 327 Zone Reservoir | 195,670 | 195,670 | 195,670 | 195,670 |
| Total Existing Storage at 30 psi (gal) | 195,670 | 195,670 | 195,670 | 195,670 |
| **Storage Surplus/(Deficiency) at 30 psi (gal)** | **142,457** | **139,402** | **133,291** | **92,733** |
| **Existing Storage Greater Than 20 psi (gal)** | | | | |
| 327 Zone Reservoir | 680,000 | 680,000 | 680,000 | 680,000 |
| Total Existing Storage at 20 psi (gal) | 680,000 | 680,000 | 680,000 | 680,000 |
| **Storage Surplus/(Deficiency) at 20 psi (gal)** | **559,924** | **484,983** | **335,086** | **0** |

Notes:

1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. The Lake Goodwin Well is limited to 350 gpm (for operations purposes) and is assumed to operate for 18 hours a day for this analysis.
3. No multi-source credit is available since there is only one source in this zone.
4. Required operational storage is based on storage tank level when pump turns on.
5. Required equalization storage is the greater of either [(PHD - Total Available Source) * 150 minutes] or [5% of MDD].
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Aug 2001 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 1,000 gpm x 1 hour.
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.
10. Maximum ERUs supported by Available Storage.

## Table 5-8 Evaluation of Storage Adequacy for North System – North 510 and 360 Zones (Future Zones)

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[11] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 0 | 0 | 965 | 0 |
| Average Day Demand (gpd) | 0 | 0 | 181,464 | 0 |
| Maximum Day Demand (gpd) | 0 | 0 | 308,489 | 0 |
| Available Source (gpd)[2] | | | | |
| Future Booster Pump Station | 0 | 0 | 308,489 | 0 |
| Total Available Source (gpd) | 0 | 0 | 308,489 | 0 |
| Multi-Source Credit (gpd)[3] | 0 | 0 | 0 | 0 |
| **Required Storage Calculations** | | | | |
| Operational Storage (gal)[4] | 0 | 0 | 0 | 0 |
| Equalizing Storage (gal)[5] | 0 | 0 | 29,471 | 0 |
| Standby Storage (gal)[6] | 0 | 0 | 362,928 | 0 |
| Fire Flow Storage (gal)[7] | 0 | 0 | 60,000 | 0 |
| **Required Storage** | | | | |
| Greater than 30 psi at highest meter (gal)[8] | 0 | 0 | 29,471 | 0 |
| Greater than 20 psi at highest meter (gal)[9] | 0 | 0 | 392,399 | 0 |
| **Existing Storage Greater Than 30 psi (gal)** | | | | |
| No Existing Storage | 0 | 0 | 0 | 0 |
| Total Existing Storage at 30 psi (gal) | 0 | 0 | 0 | 0 |
| **Storage Surplus/(Deficiency) at 30 psi (gal)[10]** | **0** | **0** | **(29,471)** | **0** |
| **Existing Storage Greater Than 20 psi (gal)** | | | | |
| No Existing Storage | 0 | 0 | 0 | 0 |
| Total Existing Storage at 20 psi (gal) | 0 | 0 | 0 | 0 |
| **Storage Surplus/(Deficiency) at 20 psi (gal)[10]** | **0** | **0** | **(392,399)** | **0** |

Notes:

1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. Future source assumed to be equal to demand.
3. No multi-source credit is available since there is only one source in this zone combination.
4. Required operational storage is based on storage tank level when pump turns on.
5. Required equalization storage is the greater of either [(PHD - Total Available Source) * 150 minutes] or [5% of MDD].
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Aug 2001 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 1,000 gpm x 1 hour.
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.
10. Marysville plans to build a new reservoir to serve the future 510 zone that will address the storage deficiency identified in this table.
11. Maximum ERUs supported by Available Storage.

## South System

Tables 5-9 through 5-11 provide the details of the analysis.

- **South System (Except 170 Zone and South 510 Zone)**. The Getchell and Sunnyside Reservoirs provide storage for the entire South System, except for the South 510 Zone. The 170 Zone also is provided storage by the Cedarcrest Reservoir. Therefore, the first analysis considered for the South System only applies to the Getchell and Sunnyside Reservoirs and the pressure zones that are served

solely by them. As summarized in Table 5-9, the capacities of these reservoirs are adequate to provide required storage volumes beyond 2028.

- **South System (Except South 510 Zone)**. This analysis is very similar to the previous one, but includes the 170 Zone. Therefore, the storage volumes provided by the Cedarcrest Reservoir are also considered. As summarized in Table 5-10, the capacities of the Getchell, Sunnyside, and Cedarcrest Reservoirs are sufficient to provide the needed storage volumes for the entire South System (excluding the South 510 Zone) beyond 2028.
- **South 510 Zone Only**. The Highway 9 Reservoir is the sole source of storage for this zone. As summarized in Table 5-11, the capacity of this reservoir is adequate to provide required storage volumes through 2014, but there is a slight deficiency by 2028. Toward the end of the 20-year planning period, the existing reservoir is anticipated to be deficient in its ability to support standby and fire flow storage by approximately 30,000 gallons.

**Storage Improvements**

Therefore, the only identified improvement required to address storage capacity needs is the addition storage in the South 510 Zone. For planning purposes, a capital improvement project involving an additional Highway 9 Reservoir with a capacity of 1.8 MG is included in the Capital Improvement Program (see Chapter 9).

## Table 5-9 Evaluation of Storage Adequacy for South System - 360, 260, South 240, and 203 Zones

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[10] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 5,294 | 6,503 | 9,304 | 20,688 |
| Average Day Demand (gpd) | 995,231 | 1,222,647 | 1,749,207 | 3,889,388 |
| Maximum Day Demand (gpd) | 1,691,893 | 2,078,500 | 2,973,652 | 6,611,960 |
| Available Source (gpd) | | | | |
| JOA Supply Pipeline[2] | 13,150,000 | 13,150,000 | 13,150,000 | 13,150,000 |
| Total Available Source (gpd) | 13,150,000 | 13,150,000 | 13,150,000 | 13,150,000 |
| Multi-Source Credit (gpd)[3] | 0 | 0 | 0 | 0 |
| **Required Storage Calculations** | | | | |
| Operational Storage (gal)[4] | 890,625 | 890,625 | 890,625 | 890,625 |
| Equalizing Storage (gal)[5] | 84,595 | 103,925 | 148,683 | 330,598 |
| Standby Storage (gal)[6] | 1,990,462 | 2,445,294 | 3,498,414 | 7,778,777 |
| Fire Flow Storage (gal)[7] | 300,000 | 300,000 | 300,000 | 300,000 |
| **Required Storage** | | | | |
| Greater than 30 psi at highest meter (gal)[8] | 975,220 | 994,550 | 1,039,308 | 1,221,223 |
| Greater than 20 psi at highest meter (gal)[9] | 2,965,682 | 3,439,844 | 4,537,722 | 9,000,000 |
| **Existing Storage Greater Than 30 psi (gal)** | | | | |
| Getchell Reservoir | 6,000,000 | 6,000,000 | 6,000,000 | 6,000,000 |
| Sunnyside Reservoir | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Total Existing Storage at 30 psi (gal) | 9,000,000 | 9,000,000 | 9,000,000 | 9,000,000 |
| **Storage Surplus/(Deficiency) at 30 psi (gal)** | **8,024,780** | **8,005,450** | **7,960,692** | **7,778,777** |
| **Existing Storage Greater Than 20 psi (gal)** | | | | |
| Getchell Reservoir | 6,000,000 | 6,000,000 | 6,000,000 | 6,000,000 |
| Sunnyside Reservoir | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Total Existing Storage at 20 psi (gal) | 9,000,000 | 9,000,000 | 9,000,000 | 9,000,000 |
| **Storage Surplus/(Deficiency) at 20 psi (gal)** | **6,034,318** | **5,560,156** | **4,462,278** | **0** |

Notes:

1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. Available source based upon contract limits.
3. No multi-source credit is available since there is only one source in this zone.
4. Required operational storage is based on storage tank level when pump turns on.
5. Required equalization storage is the greater of either "(PHD - Total Available Source) * 150 minutes" or "5% of MDD."
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Aug 2001 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 2,500 gpm x 2 hours.
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.
10. Maximum ERUs supported by Available Storage.

## Table 5-10 Evaluation of Storage Adequacy for South System - 360, 260, South 240, 203, and 170 Zones

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[10] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 17,869 | 20,725 | 27,287 | 27,786 |
| Average Day Demand (gpd) | 3,359,406 | 3,896,223 | 5,129,894 | 5,223,706 |
| Maximum Day Demand (gpd) | 5,710,990 | 6,623,580 | 8,720,819 | 8,880,300 |
| Available Source (gpd) | | | | |
| JOA Supply Pipeline[2] | 13,150,000 | 13,150,000 | 13,150,000 | 13,150,000 |
| Total Available Source (gpd) | 13,150,000 | 13,150,000 | 13,150,000 | 13,150,000 |
| Multi-Source Credit (gpd)[3] | 0 | 0 | 0 | 0 |
| **Required Storage Calculations** | | | | |
| Operational Storage (gal)[4] | 1,240,625 | 1,240,625 | 1,240,625 | 1,240,625 |
| Equalizing Storage (gal)[5] | 285,550 | 331,179 | 436,041 | 444,015 |
| Standby Storage (gal)[6] | 6,718,812 | 7,792,447 | 10,259,787 | 10,447,411 |
| Fire Flow Storage (gal)[7] | 300,000 | 300,000 | 300,000 | 300,000 |
| **Required Storage** | | | | |
| Greater than 30 psi at highest meter (gal)[8] | 1,526,175 | 1,571,804 | 1,676,666 | 1,684,640 |
| Greater than 20 psi at highest meter (gal)[9] | 8,244,987 | 9,364,251 | 11,936,453 | 12,132,051 |
| **Existing Storage Greater Than 30 psi (gal)** | | | | |
| Getchell Reservoir | 6,000,000 | 6,000,000 | 6,000,000 | 6,000,000 |
| Sunnyside Reservoir | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Cedarcrest Reservoir | 439,744 | 439,744 | 439,744 | 439,744 |
| Total Existing Storage at 30 psi (gal) | 9,439,744 | 9,439,744 | 9,439,744 | 9,439,744 |
| **Storage Surplus/(Deficiency) at 30 psi (gal)** | **7,913,569** | **7,867,940** | **7,763,078** | **7,755,104** |
| **Existing Storage Greater Than 20 psi (gal)** | | | | |
| Getchell Reservoir | 6,000,000 | 6,000,000 | 6,000,000 | 6,000,000 |
| Sunnyside Reservoir | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Cedarcrest Reservoir | 3,132,051 | 3,132,051 | 3,132,051 | 3,132,051 |
| Total Existing Storage at 20 psi (gal) | 12,132,051 | 12,132,051 | 12,132,051 | 12,132,051 |
| **Storage Surplus/(Deficiency) at 20 psi (gal)** | **3,887,065** | **2,767,800** | **195,598** | **0** |

Notes:

1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. Available source based upon contract limits.
3. No multi-source credit is available since there is only one source in this zone.
4. Required operational storage is based on storage tank level when pump turns on.
5. Required equalization storage is the greater of either "(PHD - Total Available Source) * 150 minutes" or "5% of MDD."
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Aug 2001 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 2,500 gpm x 2 hours.
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.
10. Maximum ERUs supported by Available Storage.

## Table 5-11 Evaluation of Storage Adequacy for South 510 Zone

| | Year | | | |
|---|---|---|---|---|
| | 2007 | 2014 | 2028 | Max[11] |
| Projected ERUs and Demand[1] | | | | |
| Equivalent Residential Units (ERU's) | 1,308 | 2,949 | 4,417 | 4,291 |
| Average Day Demand (gpd) | 245,851 | 554,438 | 830,427 | 806,673 |
| Maximum Day Demand (gpd) | 417,947 | 942,544 | 1,411,725 | 1,371,344 |
| Available Source (mgd) | | | | |
| Cedarcrest Booster Pump Station (1,000 gpm)[2] | 2,160,000 | 0 | 0 | 0 |
| Soper Hill Pump Station (700 gpm)[3] | 0 | 1,512,000 | 1,512,000 | 1,512,000 |
| Total Available Source (gpd) | 2,160,000 | 1,512,000 | 1,512,000 | 1,512,000 |
| Multi-Source Credit (gpd)[4] | 2,160,000 | 1,512,000 | 1,512,000 | 1,512,000 |
| **Required Storage Calculations** | | | | |
| Operational Storage (gal)[5] | 124,201 | 124,201 | 124,201 | 124,201 |
| Equalizing Storage (gal)[6] | 20,897 | 47,127 | 70,586 | 68,567 |
| Standby Storage (gal)[7] | 261,544 | 589,827 | 883,432 | 858,163 |
| Fire Flow Storage (gal)[8] | 300,000 | 300,000 | 300,000 | 300,000 |
| **Required Storage** | | | | |
| Greater than 30 psi at highest meter (gal)[9] | 145,098 | 171,328 | 194,787 | 192,768 |
| Greater than 20 psi at highest meter (gal)[10] | 445,098 | 761,155 | 1,078,220 | 1,050,931 |
| **Existing Storage Greater Than 30 psi (gal)** | | | | |
| Highway 9 Reservoir | 334,387 | 334,387 | 334,387 | 334,387 |
| Total Existing Storage at 30 psi (gal) | 334,387 | 334,387 | 334,387 | 334,387 |
| **Storage Surplus/(Deficiency) at 30 psi (gal)** | **189,289** | **163,059** | **139,600** | **141,619** |
| **Existing Storage Greater Than 20 psi (gal)** | | | | |
| Highway 9 Reservoir | 1,050,931 | 1,050,931 | 1,050,931 | 1,050,931 |
| Total Existing Storage at 20 psi (gal) | 1,050,931 | 1,050,931 | 1,050,931 | 1,050,931 |
| **Storage Surplus/(Deficiency) at 20 psi (gal)** | **605,833** | **289,775** | **(27,289)** | **0** |

Notes:

1. Projected demands as presented in Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (188 gpd/ERU).
2. Station contains three pumps at 1,000 gpm each. For this analysis, two pumps are assumed to be operating at one time, pumping 18 hours a day. This pump station will be decommissioned when the Soper Hill Pump Station is put in service.
3. Station contains three pumps at 700 gpm each. For this analysis, two pumps are assumed to be operating at one time, pumping 18 hours a day. This pump station is a proposed CIP project (PS-4); the capacity will need to be re-evaluated during the design phase.
4. Multi-source credit assumes largest source is out of service (in this case, one pump at Cedarcrest Booster Pump Station, decreasing capacity to 2,000 gpm). In the case of the Soper Hill Pump Station, the capacity would decrease to 1,400 gpm (2 pumps at 700 gpm each).
5. Required operational storage is based on storage tank level when pump turns on.
6. Required equalization storage is the greater of either [(PHD - Total Available Source) * 150 minutes] or [5% of MDD].
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Aug 2001 WSDM)
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 2,500 gpm x 2 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.
11. Maximum ERUs supported by Available Storage.

# 5.3. Distribution System Analysis

## 5.3.1. Analysis Methodology

As required by DOH, Marysville's water system was analyzed and deficiencies were identified for the following two conditions: peak hour demands, and maximum day demands plus fire flow. As part of this Water Comprehensive Plan update, Marysville's existing model was rebuilt using InfoWater software, which his developed by MWHSoft, Incorporated. All modeling calculations were performed within the InfoWater software.

## 5.3.2. System Components

The InfoWater software allows all pipes and junction nodes in Marysville's distribution system to be entered into one complete model, which consists of approximately 10,300 pipes and 9,700 junction nodes, along with pressure reducing stations, reservoirs, and pump stations.

Current GIS information was provided by Marysville for the model build. For the pipe network, pipes with the same diameter, material and as-built information were dissolved into one pipe for the model. Fire hydrants (and their associated hydrant service lines) were included in the model so Marysville could more realistically model available fire flow within the system. Tools within the software were used to check the pipe network for the following data inconsistencies:

- Gaps between pipes that should be connected
- Pipes that cross each other that should be connected
- Areas were parallel pipes exist (and there should only be a single pipe)
- Pipes connected to each other that have a diameter discrepancy of greater than 6 inches

Working with Marysville staff, the data inconsistencies identified above were reviewed and resolved. Once the pipe network was finalized; nodes were created and LIDAR information was used to generate elevation information for each model node.

The last step in the model build included addition of model facilities including tanks, valves, pump stations and source information. As built information was used (when available) to input each of the facilities into the model. Dimensions of the reservoirs and configuration of the pump stations were checked and adjusted based on record drawings. Facility controls, pump curves, PRV settings and boundary conditions (e.g., flow control valves settings) were set based on discussions with Marysville staff and review of SCADA information. Prior to using the newly updated model for analysis, demands must be allocated within the model and the system must be calibrated for existing conditions. Both of these tasks were conducted as part of the Water Comprehensive Plan update and are described in detail below.

## 5.3.3. Water Demand Allocation

Chapter 3 presents information on water demands for Marysville's water system for the existing system and provides an estimate of projected water demands for the 6-year and 20-year planning horizons. For the hydraulic model, the demand forecast numbers were used to determine the total demand for customers within Marysville's retail service area and for the Everett water that is wheeled through the Marysville system to the Tulalip Tribe and Snohomish PUD.

Demand allocation (i.e., spatial distribution of demand within the system) was determined by evaluating customer billing information. Customers within the distribution system are typically billed according to metered water use. An average water use per meter (or customer) was developed from historical billing information. These averages were then associated to model nodes if the meters are geocoded (i.e., assigned to a parcel within the system's GIS).

For Marysville, twelve months of customer billing data from 2007 were compiled, and an average water use (in gpm) was calculated for each customer currently consuming water within the Marysville service area. GIS tools were used to 'locate' customer meters within the Marysville retail service area. Utilizing the automated process of geocoding and some additional manual address matching, approximately 95 percent of the nearly 17,000 customer accounts were spatially located in GIS.

GIS tools were then used to assign the average day demand or water use for each customer to the nearest designated model node designated as a demand node. Nodes located on a transmission line or near a storage reservoir, pump station or PRV station were not included as demand nodes within the hydraulic model. A thorough review of the system was conducted, checking to see if demands were assigned to nodes in a reasonable manner. All of the demands assigned to a particular node were summed up and a total average day demand was associated to demand nodes within the model.

After the demand allocation process was conducted, the total historical system demand was adjusted with multipliers for each pressure zone to match the demand forecast numbers presented in Chapter 3. Demands were developed for average day, maximum day and peak hour conditions. Model demands included a global adjustment for non-revenue water. Demand allocation was assumed to be the same for the existing system, six-year and twenty-year planning horizons within portions of the retail service area that is currently served. For areas within the retail service area that will be served in the future, infrastructure was added to the model and the total projected demand for the area was split evenly amongst model nodes.

### 5.3.4. Calibration

A critical step in the development of a hydraulic model, prior to using it as a tool to analyze system performance, is calibration. Calibration consists of measuring pressure and flows in the field and comparing them with the same pressures and flows simulated in the model. For steady-state model calibration, a total of 26 hydrant tests were conducted by Marysville staff between February 5 and 15, 2008. The test locations were selected to provide adequate coverage for each pressure zone and to maximize the friction losses across the system by placing the test locations as far from sources of water for each pressure zone as possible. Figure 5-2 shows graphically the location of each of the hydrant tests conducted for model calibration.

For the hydrant test, a pressure gage was placed on the "residual" hydrant and pressure was measured under normal operating (where no hydrant was flowing) or "static" conditions. Once the pressure was recorded, a second hydrant was opened and the flow at this hydrant was measured using a pitot gage. While the second hydrant was open, the pressure was observed and recorded (once the gage readings stabilized) at the residual hydrant.

To conduct calibration, the system operations or boundary conditions are recorded during the time the hydrant tests are conducted. Boundary conditions of concern typically include system demands, reservoir levels, pump station flows, PRV settings (or flows if recorded) and wholesale (or wheeled) customer meter flows. For the south service area, SCADA information

was used to determine flow into Marysville from the City of Everett, flow into the Cedarcrest and Sunnyside Reservoirs, and levels for all reservoirs. In addition, SCADA information was available measuring flow wheeled to the Tulalip Tribe and Snohomish PUD. For the north service area, SCADA information was used to set boundary conditions for water level and flow entering the system from the Wade Road and Edward Springs Reservoir. The Stillaguamish High Service Pump Station was not in service during the time of calibration. PRV settings were established based on discussions with Marysville staff regarding normal operating conditions. Demands were allocated as described above.

Adjustments of model demands, controls and friction factors (based on pipe age and material) were made within the system to achieve steady state calibration. Table 5-12 contains the field data collected for the hydrant tests and the results of the model simulations. Test 22 was not conducted due because an adequate location for disposal of water was not available at this hydrant location. Results for hydrant tests 18, 19 and 20 were not considered because the static pressure readings were higher than the hydraulic grade of the zone. This discrepancy was likely due to one of two things: either an operator misread the pressure gage in the field or the settings of the PRVs feeding the South 240 Zone are higher than what Marysville staff reported. Marysville is checking into the PRV settings; the results are considered invalid for calibration purposes.

Comparing the model results with the field measurements for static pressures indicates the overall accuracy of the model node elevations, tank elevations and PRV settings under normal demand conditions. As shown in Table 5-12, all of but one of the simulated model pressures considered were within 4 psi of the observed field pressures, which indicates a reasonable match between modeled and observed conditions. A difference of 6 psi was observed between the static pressure in the field and in the model for hydrant test 25, which is still considered reasonably well calibrated.

Comparing the modeled and observed drop in pressure between static conditions and those when a hydrant is flowing aids in determining whether the model piping is connected correctly and whether appropriate friction factors have been used. Table 5-12 shows that for each of the twenty three tests considered for calibration, the pressure drop between static and residual conditions between the model and what was observed in the field was less than 6 psi for each test. In general, a threshold of 5 psi is used to determine whether the model results are in good agreement with the field measurements. Of the twenty three tests, only three of the tests had differences of 5 psi or higher. For the purposes of comprehensive planning, Marysville's model is considered to be well calibrated for steady state conditions.

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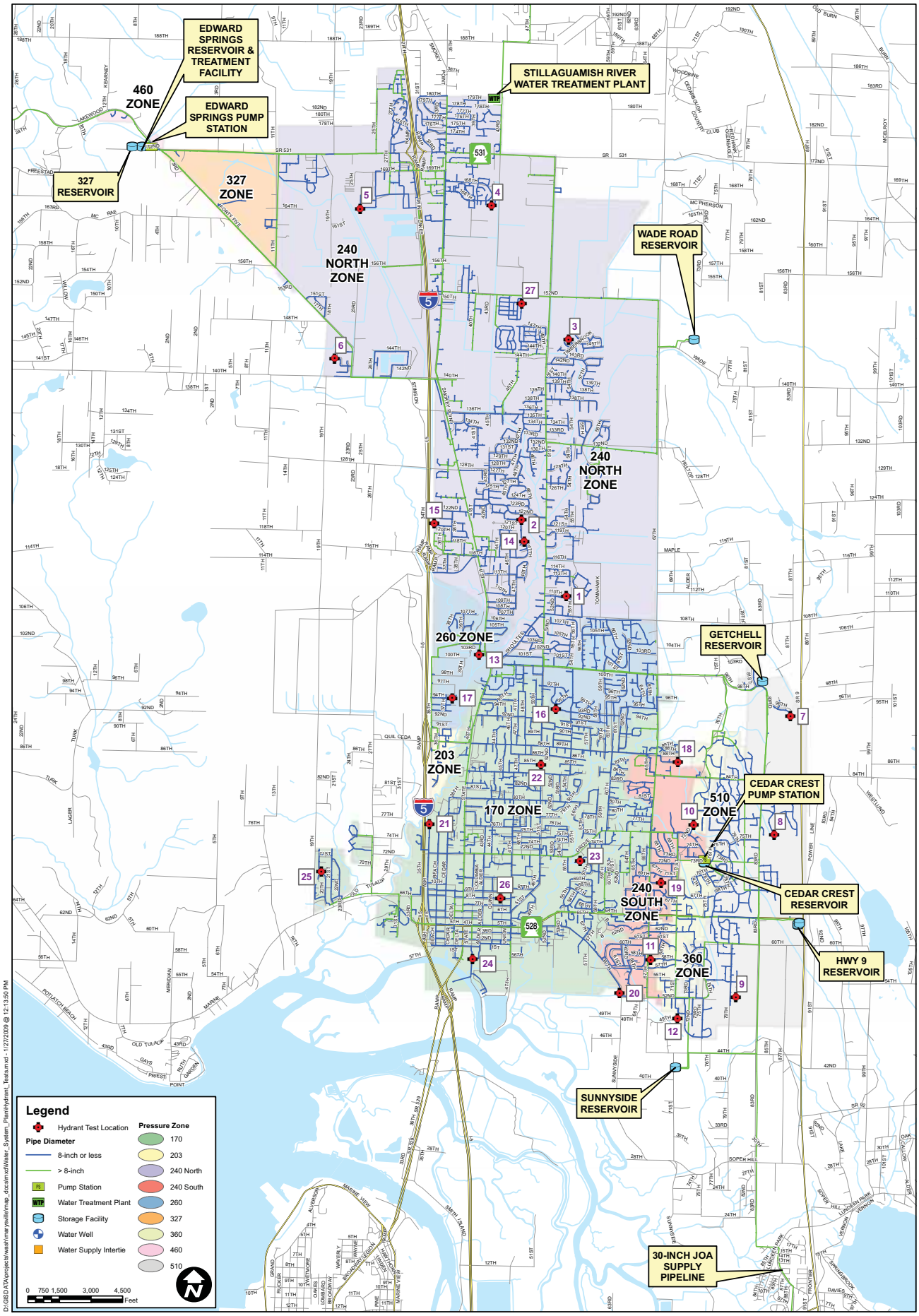



## *Fire Hydrant Test Locations*

*Figure 5-2*

**Table 5-12 Calibration Results**

| Hydrant Test No. | Pressure Zone | Gage Node ID | Gage Node Elev (ft) | Field Static Pressure (psi) | Model Static Pressure (psi) | Static Pressure Difference (psi) | Flow Hydrant Elevation (ft) | Fire Flow (gpm) | Field Residual Pressure (psi) | Model Residual Pressure (psi) | Residual Pressure Difference (psi) | Field Pressure Drop | Model Pressure Drop | Difference in Field and Model Pressure Drops |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **North 240** | 1356 | 79.42 | 65 | 66.4 | -1.4 | 82.04 | 680 | 58 | 57.7 | 0.3 | 7.0 | 8.7 | -1.7 |
| **2** | **North 240** | 1318 | 79.2 | 65 | 66.5 | -1.5 | 78.03 | 697 | 53 | 51.3 | 1.7 | 12.0 | 15.2 | -3.2 |
| **3** | **North 240** | 1641 | 101.23 | 58 | 57.1 | 0.9 | 100.09 | 589 | 49 | 46.7 | 2.3 | 9.0 | 10.4 | -1.4 |
| **4** | **North 240** | 1725 | 116.77 | 51 | 50.8 | 0.2 | 116.66 | 713 | 42 | 43.6 | -1.6 | 9.0 | 7.2 | 1.8 |
| **5** | **North 240** | 2070 | 114.52 | 52 | 51.8 | 0.2 | 114.86 | 481 | 29 | 26.0 | 3.0 | 23.0 | 25.8 | -2.8 |
| **6** | **North 240** | 2127 | 105.98 | 60 | 56.1 | 3.9 | 107.45 | 627 | 45 | 44.2 | 0.8 | 15.0 | 11.9 | 3.1 |
| **7** | **510** | 2967 | 385.32 | 54 | 53.21 | 0.79 | 381.91 | 680 | 46 | 45.19 | 0.8 | 8.0 | 8.0 | 0.0 |
| **8** | **510** | 3134 | 357.21 | 66 | 65.2 | 0.8 | 353.05 | 790 | 60 | 57 | 3.0 | 6.0 | 8.2 | -2.2 |
| **9** | **510** | 600 | 395.99 | 50 | 47.6 | 2.4 | 379.59 | 790 | 45 | 40.76 | 4.2 | 5.0 | 6.8 | -1.8 |
| **10** | **360** | 1080 | 139.13 | 94 | 94.58 | -0.58 | 124.86 | 833 | 76 | 81.9 | -5.9 | 18.0 | 12.7 | 5.3 |
| **11** | **360** | 6 | 178.95 | 76 | 73.7 | 2.3 | 121.77 | 1075 | 65 | 62.7 | 2.3 | 11.0 | 11.0 | 0.0 |
| **12** | **360** | 39 | 249.67 | 43 | 44.7 | -1.7 | 235.54 | 589 | 38 | 40.8 | -2.8 | 5.0 | 3.9 | 1.1 |
| **13** | **260** | 976 | 61.13 | 86 | 84.92 | 1.08 | 59.25 | 961 | 80 | 76.36 | 3.6 | 6.0 | 8.6 | -2.6 |
| **14** | **260** | 1322 | 74.38 | 81 | 79.2 | 1.8 | 73.60 | 713 | 54 | 48.36 | 5.6 | 27.0 | 30.8 | -3.8 |
| **15** | **260** | 3017 | 76.23 | 80 | 78.17 | 1.83 | 74.12 | 790 | 52 | 49.35 | 2.7 | 28.0 | 28.8 | -0.8 |
| **16** | **260** | 1151 | 72.08 | 80 | 80.44 | -0.44 | 69.06 | 860 | 66 | 63.64 | 2.4 | 14.0 | 16.8 | -2.8 |
| **17** | **260** | 913 | 54.07 | 90 | 87.9 | 2.1 | 53.81 | 925 | 84 | 80.06 | 3.9 | 6.0 | 7.8 | -1.8 |
| **18** (1) | **South 240** | 1065 | 80.64 | 81 | 67.5 | 13.5 | 74.94 | 804 | 73 | 57.1 | 15.9 | 8.0 | 10.4 | -2.4 |
| **19** (1) | **South 240** | 452 | 90.09 | 81 | 64.05 | 16.95 | 112.94 | 745 | 64 | 60.4 | 3.6 | 17.0 | 3.7 | 13.4 |
| **20** (1) | **South 240** | 593 | 44.33 | 98 | 83 | 15 | 44.33 | 790 | 64 | 67.69 | -3.7 | 34.0 | 15.3 | 18.7 |
| **21** | **170** | 167 | 35.24 | 57 | 56.12 | 0.88 | 36.07 | 760 | 49 | 48.14 | 0.9 | 8.0 | 8.0 | 0.0 |
| **22** (2) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **23** | **170** | 314 | 55.7 | 46 | 47.21 | -1.21 | 55.87 | 645 | 39 | 36.93 | 2.1 | 7.0 | 10.3 | -3.3 |
| **24** | **170** | 2140 | 7.93 | 68 | 68.41 | -0.41 | 9.03 | 860 | 61 | 63.4 | -2.4 | 7.0 | 5.0 | 2.0 |
| **25** | **170** | 1430 | 32.29 | 64 | 57.32 | 6.68 | 31.60 | 589 | 33 | 32.52 | 0.5 | 31.0 | 24.8 | 6.2 |
| **26** | **170** | 248 | 33.63 | 58 | 57.26 | 0.74 | 36.83 | 627 | 43 | 36.65 | 6.4 | 15.0 | 20.6 | -5.6 |
| **27** | **North 240** | 1967 | 107.33 | 57 | 54.5 | 2.5 | 107.78 | 713 | 50 | 49.6 | 0.4 | 7.0 | 4.9 | 2.1 |

Notes:

1. Test results for hydrant test 18, 19 and 20 are not valid. Field results indicate that PRV settings feeding the South 240 Zone are higher than what City staff indicated. The hydraulic grade calculated in the field was 270 feet; City staff is investigating the settings.
2. Hydrant test 22 was not conducted.

## 5.3.5. Modeling Scenarios

Marysville has an extensive distribution system with approximately 292 miles of pipe. Some of these pipes were installed more than 40 years ago and are reaching the end of their useful lives. Aging infrastructure, inadequately sized or dead-end pipes and increasing demands all contribute to areas of low pressure during peak hour demands and substandard fire flows at locations or areas where the existing system cannot provide adequate service during existing and future maximum day demand conditions. The model was used to identify improvements that would increase the distribution system capacity to meet the required level of service for static pressures and fire flows.

In accordance with WAC 246-290-230, a minimum pressure of 30 psi must be maintained at all customer connections under peak hour demand (PHD) conditions with equalizing storage depleted in the reservoirs. A minimum of 20 psi must be maintained for fire flows under MDD conditions with equalizing and fire flow storage depleted. If these criteria could not be met, improvements were identified and through an iterative trial-and-error process, implemented until pressure criteria could be satisfied with a minimum of total pipe and facility additions.

A number of steady state hydraulic analyses were completed for each pressure zone for existing (2008), six-year (2014), and twenty-year (2028) demand conditions. These considered peak hour demand and fire flow demand (MDD plus fire flow) conditions. Table 5-13 describes the modeling scenarios conducted, and the sequence within which they were performed. The results of the peak hour and fire flow analyses are described in greater detail below.

**Table 5-13 Modeling Scenarios**

| Description | Demand | Purpose |
|---|---|---|
| Existing Year Peak Hour | 2008 Peak Hour Demand | Evaluate system |
| Existing Year Fire Flow | 2008 Maximum Day Demand plus fire flow | Evaluate system |
| Plan Year 6 Peak Hour | Plan Year 6 Peak Hour Demand | Evaluate system performance and develop CIP for peak hour conditions |
| Plan Year 6 Fire Flow | Plan Year 6 Maximum Day Demand plus fire flow | Evaluate system performance and develop CIP for Plan Year 6 fire flow conditions |
| Plan Year 20 Peak Hour | Plan Year 20 Peak Hour Demand | Evaluate system and develop CIP for Plan Year 20 peak hour conditions |
| Plan Year 20 Fire Flow | Plan Year 20 Maximum Day Demand plus fire flow | Evaluate system performance and develop CIP for Plan Year 20 fire flow conditions |

## 5.3.6. Peak Hour Analysis Results

Peak hour analyses were run for each of the modeling scenarios shown in Table 5-13. Initial tank levels for all reservoirs and tanks were set at a level such that the equalizing and operating portions of storage were depleted.

For the existing system, under peak hour conditions, some small areas of high and low pressures were observed in the system. Areas of low pressure present in the system include the following:

- local area near the Edward Springs and Wade Road Reservoirs
- local area near the Sunnyside, Getchell, Highway 9 and Cedarcrest Reservoirs;
- along the transmission line from the Sunnyside Reservoir into the distribution system near the intersection of 52nd Street NE and 73rd Ave NE (near the PRV station that separates the 510 Zone from the 360 Zone); and
- near the intersection of 69th Drive NE and 64th Street NE (on the edge of the 360 Zone and South 240 Zone).

Low pressures in these areas are due to high ground elevations as compared to the local hydraulic grade.

One large area of high pressure was also observed under peak hour conditions for the existing system. Model results showed pressures along the western edge of the South 510 Zone were greater than 90 psi. If pressures are above 80 psi, it is generally recommended that PRVs be installed on service lines to lower the pressure entering the house or other type of facility. The topography along the boundary of the 510 and 360 pressure zones vary significantly and therefore a large area of high pressures was observed. No capital projects were recommended for this area of high pressure. Marysville should install PRVs on service lines if any new developments are to be built in this area along the boundary of the 510 and the 360 pressure zones.

The same areas of low and high pressure are observed during the peak hour analyses for the 2014 and 2028 model runs. The areas of low pressure are small and all but one area are located near facilities, where there is typically limited service to customers. In addition, the pressures observed are generally between 20 and 30 psi and therefore no improvements are recommended within the system.

### 5.3.7. Fire Flow Analysis Results

Fire flow analyses are run as steady state evaluations, which evaluate system conditions at a single point in time. For the Marysville system, a batch fire flow analysis was run within each pressure zone using a requirement of 1,000 gpm for all hydrants that are located within residential zoned parcels and 2,500 gpm for hydrants that fall within non-residential zoned land. Only nodes at the end of hydrant lines (which simulate actual hydrants in the system) were included in the fire flow analyses.

Available fire flow is the amount of water that can be withdrawn from a single hydrant without dropping the pressure throughout the zone to less than 20 psi. Thus, a pressure somewhat remote from the flowing hydrant could limit available fire flow. Fire flow simulations assume that water levels in the storage reservoirs are set with equalizing, operating and fire flow storage completely depleted.

For the existing system, model results were shown to Marysville staff for areas that were not able to provide either 1,000 gpm for residential areas or 2,500 gpm for non-residential areas within the system. Per direction from Marysville staff, improvements were developed for large areas within the system that available fire flow was less than 1.000 gpm. While not every node having less than 1,000 gpm of available fire flow has been addressed, the large areas of inadequate fire flow observed during the analyses will be reduced or eliminated with the recommended improvement. It was not the intent of this analysis to rectify fire flow deficiencies

at every node. Therefore, the approach of identifying improvements to address large areas of wide-spread deficiencies was deemed appropriate for this planning level of analysis.

In general, only a few areas in the existing system had available fire flow of less than 1,000 gpm. Eight areas in the 170 Zone were identified and projects were developed to improve fire flow for that local area. The deficiencies were typically due to an undersized water line (as water lines less than 8-inches are physically unable to provide 1,000 gpm) or a dead-end line. In all cases, recommendations were made to replace the existing undersized line with an 8-inch diameter pipe. The recommended projects are described in greater detail in Chapter 9.

Fire flow analyses for the 2014 system identified two areas in the North 240 Zone that could not provide the required fire flow of 1,000 gpm. Two projects were developed including a replacement of undersized line with an 8-inch diameter pipe and are described in Chapter 9.

Fire flow analyses were also run for the 2028 system, with no new significant areas of inadequate fire flow being observed. The projects implemented in the existing system and the 2014 system to improve available fire flow were sufficient to maintain fire flow availability for the 2028 demand conditions.

# 6. System Reliability, Water Rights, and Source Water Protection

This chapter provides information about water system reliability, including water rights and source of supply, and source water protection for the City of Marysville (Marysville) water system.

## 6.1. System Reliability Analysis

The Water Comprehensive Plan (Plan) summarizes efforts Marysville has made to ensure an adequate quantity of water can be provided at all times. Marysville can ensure that customers are supplied by a reliable source of drinking water by implementing the following:

*Access to an adequate quantity of water to meet customer demands* – These efforts are described in the Source of Supply Analysis and Water Rights Evaluation included in this chapter.

*Provision of a reliable supply during adverse events such as drought or emergency* – This chapter includes information on Marysville's drought planning and emergency response planning efforts.

*Adequate planning for and development of facilities* – Facility development since 2002 has been described in Chapter 1 (System Description) of the Plan. Additionally, Chapter 5 (System Analysis) of the Plan details Marysville's facility needs in order to meet criteria for fire flows, and increasing customer demands during the planning period.

*A water supply which meets water quality requirements* - Marysville provides a safe drinking water supply by managing and protecting its sources, drinking water treatment processes, and meeting federal and state drinking water requirements. Marysville's efforts to protect and manage drinking water sources are summarized in this chapter. Marysville's compliance with drinking water requirements is described in Chapter 7 (Water Quality Compliance Program) of this Plan.

## 6.2. Source of Supply Analysis

A source of supply analysis is required by DOH for water systems that will be pursuing water rights within 20 years to meet the demand forecast. Based on review of Marysville's water rights, purchased water and projected demands, Marysville has adequate water supply to meet water demand for the next 20 years.

The following information is provided with respect to sources of supply, source alternatives and water system facilities:

- *Water Sources* – Marysville's water sources, including surface water, ground water, and purchased supply, are described in this chapter.
- *Water Conservation Program* – Marysville's water conservation program is described in Chapter 4 (Conservation) of the Plan.

- *Interties* – Since the early 1990s, Marysville has planned to meet a large share of future needs through water purchased from the City of Everett and delivered through the Everett-Marysville pipeline. This continues to be a key strategy for the next 20 years. In addition, Marysville has emergency interties and agreements with other communities. These agreements are described in Chapter 2 (Related Plans, Policies and Agreements).
- *Water Reuse* – Water reuse involves intensive treatment of municipal wastewater and use of that water to meet non-potable needs such as agricultural irrigation, landscape irrigation, industrial uses, or aquifer recharge. Marysville owns and operates a wastewater treatment system that could potentially provide water for reclamation and reuse. However, to implement this approach, significant investments would be needed to install advanced treatment technology and a separate delivery system to pipe water from the treatment plant to customers that can put it to use. At this time, there are no plans to implement a reuse strategy, as existing water sources appear adequate to meet future needs. Marysville has discussed various scenarios for water reuse that could potentially be implemented in the future. Marysville will periodically evaluate opportunities for reuse in the future, particularly with regard to landscape and turf irrigation.
- *Facility analysis* – Chapter 5 (System Analysis) provides information analyzing the ability of the water system facilities to perform under various operating conditions. System deficiencies and recommended improvements are covered in that chapter as well.

## 6.3. Water Rights Evaluation

Marysville holds eleven water right certificates and one water right permit for use as municipal water supply. These include six certificates for primary water rights, for the Stillaguamish Ranney Collector, Edward Springs, the Lake Goodwin Well, and the Highway 9 well; and five certificates and one permit for supplemental water rights, including additional wells at Edward Springs, the Sunnyside wells, and the Cedarcrest LaJoy well.

An analysis of Marysville's water right certificates and associated Reports of Examination (ROEs) revealed several inconsistencies in the historical accounting of approved annual quantities as Marysville's water rights have been issued over the years. The most recent ROE was developed for Marysville's application for Permit G1-25182P, which was evaluated by Ecology in 1996. Ecology has indicated that the accounting of water right quantities available to Marysville which is included in this ROE is the most current, and is considered by Ecology to be accurate (personal communication with Dan Swenson, Department of Ecology, November 26, 2007). Therefore, for the purpose of this water rights evaluation, Marysville's primary water rights authorize the diversion or withdrawal of a maximum annual quantity (Qa) of 8,472 acre-feet per year (afy), as documented in the ROE for Permit G1-25182 P. This amount is equivalent to 7.56 million gallons per day (mgd). Ecology considers the maximum instantaneous quantity (Qi) for each primary and supplemental water right to be additive; as such, Marysville's water rights authorize a maximum instantaneous diversion / withdrawal of up to 8,749 gpm, which is equivalent to 19.49 cfs or 12.60 mgd.

Table 6-1 provides a summary of information pertaining to Marysville's water rights. Details pertaining to each certificate and permit are provided below. Copies of Marysville's water rights are provided in Appendix 6-1.

### 6.3.1. Detailed Description of Water Rights

- *Surface Water Certificate 184* – This certificate, with a priority date of July 14, 1921, authorizes the diversion of up to 0.8 cubic feet per second (cfs) (360 gpm) from an unnamed tributary to the Stillaguamish River, which is part of the Edward Springs source, for domestic use. The maximum annual quantity allowed under this water right is 576 afy. This water right represents a primary source of supply for Marysville.
- *Surface Water Certificate 2180* – This certificate, with a priority date of November 14, 1931, authorizes the diversion of up to 2.3 cfs (1,032 gpm) from Edwards Creek, which is part of the Edward Springs source, for domestic use. The maximum annual quantity allowed under this water right is 1,656 afy. This water right represents a primary source of supply for Marysville.
- *Groundwater Certificate 286-A* – This certificate, with a priority date of January 12, 1946, authorizes the withdrawal of up to 300 gpm (0.7 cfs) from a well (#1) associated with the Edward Springs source for domestic use. This water right is intended to be utilized for four months out of the year to supplement the spring supply. The maximum annual quantity allowed under this water right is 160 afy. This water right represents a primary source of supply for Marysville.
- *Groundwater Certificate 1152-A* – This certificate, with a priority date of March 7, 1952, authorizes the withdrawal of additional water from the well (#1) associated with Certificate 286. This water right represents a supplemental source of supply because the ROE stated that Marysville's existing water rights exceeded projected demand at the time the certificate was issued. This certificate is thus intended to authorize withdrawal from Well #1 throughout the year. The total maximum withdrawal allowed under this water right is 300 gpm (0.7 cfs). The maximum annual withdrawal allowed under this right is 320 afy.
- *Groundwater Certificate 2096-A* – This certificate, with a priority date of March 7, 1952, authorizes the withdrawal of up to 500 gpm (1.1 cfs) from a well (#2) associated with the Edward Springs source for domestic use. This water right is authorized as a supplemental source of supply. The maximum annual withdrawal allowed under this right is 800 afy.
- *Groundwater Certificate 4155-A* – This certificate, with a priority date of May 5, 1955, authorizes the withdrawal of up to 57 gpm (0.1 cfs) from a well (Cedarcrest La Joy #1) for domestic use. This water right is authorized as a supplemental source of supply. The maximum annual withdrawal allowed under this right is 91 afy.
- *Groundwater Certificate 3100-A* – This certificate, with a priority date of February 14, 1956, authorizes the withdrawal of up to 1,000 gpm ( 2.2 cfs) from a well (Sunnyside Well #1) for domestic use. This water right is authorized as a supplemental source of supply. The maximum annual withdrawal allowed under this right is 1,344 afy.
- *Groundwater Certificate 5469-A* – This certificate, with a priority date of July 27, 1964, authorizes the withdrawal of up to 1,000 gpm (2.2 cfs) from a well (Sunnyside Well #2) for domestic use. This water right is authorized as a supplemental source of supply. The maximum annual withdrawal allowed under this right is 1,176 afy.

## Table 6-1 City of Marysville Water Rights Certificates and Permits

| Certificate/ Permit Number | Priority Date | Primary/ Supplemental | Quantity[1] | | Source Name | Point of Diversion/ Withdrawal | Purpose of Use |
|---|---|---|---|---|---|---|---|
| | | | Maximum Instantaneous Quantity (Qi) | Maximum Annual Quantity (Qa) | | | |
| SWC 184 | 7/14/21 | Primary | 0.8 cfs (360 gpm) | 576 afy | Edward Springs | Unnamed Stream | Domestic Supply |
| SWC 2180 | 11/14/31 | Primary | 2.3 cfs (1,032 gpm) | 1,656 afy | Edward Springs | Edwards Creek | Municipal Supply |
| GWC 286-A | 1/12/46 | Primary | 300 gpm (0.7 cfs) | 160 afy | Edward Springs | Well (#1) | Municipal Supply |
| GWC 1152-A | 3/7/52 | Supplemental | 300 gpm (0.7 cfs) | 320 afy | Edward Springs | Well (#1) | Municipal Supply |
| GWC 2096-A | 3/7/52 | Supplemental | 500 gpm (1.1 cfs) | 800 afy | Edward Springs | Well (#2) | Municipal Supply |
| GWC 4155-A | 5/5/55 | Supplemental | 57 gpm (0.1 cfs) | 91 afy | Cedar-crest LaJoy | Well (#1) | Municipal Supply |
| GWC 3100-A | 2/14/56 | Supplemental | 1,000 gpm (2.2 cfs) | 1,344 afy | Sunnyside | Well (#1) | Municipal Supply |
| GWC 5469-A | 7/27/64 | Supplemental | 1,000 gpm (2.2 cfs) | 1,176 afy | Sunnyside | Well (#2) | Municipal Supply |
| GWC 6980-A | 6/19/67 | Primary | 550 gpm (1.2 cfs) | 880 afy | Lake Goodwin | Well (#1) | Municipal Supply |
| G1-00675C | 7/14/70 | Primary | 2,250 gpm (5.0 cfs) | 3,600 afy | Stillaguamish River | Ranney Well | Municipal Supply |
| G1-23487C | 10/17/79 | Primary | 1,000 gpm (2.2 cfs) | 1,600 afy | Highway 9 | Well | Municipal Supply |
| G1-25182 P | 2/16/88 | Supplemental | 400 gpm (0.9 cfs) | 451 afy | Edward Springs | Well (#3) | Municipal Supply |
| Total Maximum Annual Quantity (Qa) of primary water rights[2] | | | | 8,472 afy (7.56 mgd) | - | - | - |
| Total Maximum Instantaneous Quantity (Qi) of primary and supplemental water rights[3] | | | | | | 8,749 gpm (19.49 cfs) (12.60 mgd) | - |

[1] Quantities shown, including Qi and Qa, are from the Report of Examination (ROE) associated with Permit 25182. The quantities reported in this ROE are considered by Ecology to be the most current accounting of Marysville's water rights (personal communication with Dan Swenson, Department of Ecology, November 26, 2007).

[2] The total maximum annual quantity (Qa) reported in this ROE of 8,472 afy is less than the total Qa reported previously in the ROE associated with Certificate 675 of 10,625 afy.

[3] The total maximum instantaneous quantity (Qi) reported includes the total Qi from all primary and supplemental water rights. Ecology considers the Qi from both primary and supplemental rights to be additive, as long as the total diversion / withdrawal by Marysville does not exceed the authorized total Qa of 8,472 afy (personal communication with Dan Swenson, Department of Ecology, November 26, 2007).

- *Groundwater Certificate 6980-A* – This certificate, with a priority date of June 19, 1967, authorizes the withdrawal of up to 550 gpm from a well (Lake Goodwin #1) for domestic use. The maximum annual withdrawal allowed under this right is 880 afy. This water right represents a primary source of supply for Marysville.
- *Groundwater Certificate G1-00675C* – This certificate, with a priority date of July 14, 1970, authorizes the withdrawal of up to 2,250 gpm (5.0 cfs) from a ranney well on the Stillaguamish River for domestic use. The maximum annual quantity allowed under this water right is 3,600 afy. This water right represents a primary source of supply for Marysville.
- *Groundwater Certificate G1-23487C* – This certificate, with a priority date of October 17, 1979, authorizes the withdrawal of up to 1,000 gpm (2.2 cfs) from a well (Highway 9) for domestic use. The maximum annual withdrawal allowed under this right is 1,600 afy. This water right is authorized as a primary source of supply for Marysville.
- *Permit G1-25182 P* – This permit, with a priority date of February 16, 1988, authorizes the withdrawal of up to 400 gpm (0.9 cfs) from a well (#3) associated with the Edward Springs source for domestic use. This water right is authorized as a supplemental source of supply. The maximum annual quantity allowed under this water right is 451 afy.

### 6.3.2. Purchased Water Supply

Marysville receives a large portion of its water from the Everett-Marysville pipeline through the Joint Operating Agreement No. 1 (JOA). Marysville has purchased 63.65 percent of the capacity of the Everett-Marysville Pipeline, which is equivalent to 13.15 mgd, or 9,132 gpm (20.35 cfs) on an instantaneous basis and 14,728 afy on an annual basis. Additional detail about the JOA is provided in Chapter 2.

### 6.3.3. Comparison of Water Rights with Water Demand

The total quantity of water available to Marysville on an annual basis, including Marysville's primary water rights and water purchased through the JOA, is 23,200 afy. This quantity is equivalent to 20.71 mgd. On an instantaneous basis, the total quantity available from Marysville's primary and supplemental water rights and purchased water is 17,881 gpm, which is equivalent to 39.84 cfs or 25.75 mgd.

As described in Chapter 3, the existing (2007) Average Day Demand (ADD) is 6.17 mgd, which equates to 6,910 afy, with a Maximum Day Demand (MDD) of 9.73 mgd, which equates to 15.05 cfs on a continuous basis. The six-year forecast period (2014) indicates an ADD of 12.34 mgd, which equates to 13,820 afy, with a Maximum Day Demand (MDD) of 17.0 mgd, which equates to 26.3 cfs on a continuous basis. The 20-year (2028) forecast indicates an ADD of 16.58 mgd, which equates to 18,569 afy, and a MDD of 22.92 mgd, which equates to 35.46 cfs on a continuous basis.

By comparing Marysville's existing water rights to the existing and projected demands for the typical six-year and 20-year planning periods, it can be seen that Marysville has adequate existing water rights to meet these projected demands. Tables 6-2 and 6-3 provide a summary of the existing and forecasted status of Marysville's water rights.

## Table 6-2 City of Marysville Existing Water Rights Status

| Certificate/ Permit Number | Priority Date | Primary/ Supplemental | Quantity | | Existing (2007) Consumption | | Existing (2007) Water Rights Status (Excess/Deficiency) | |
|---|---|---|---|---|---|---|---|---|
| | | | Maximum Instantaneous Quantity (Qi) | Maximum Annual Quantity (Qa) | Maximum Instantaneous Quantity (Qi) | Maximum Annual Quantity (Qa) | Maximum Instantaneous Quantity (Qi) | Maximum Annual Quantity (Qa) |
| SWC 184 | 7/14/21 | Primary | 0.8 cfs | 576 afy | n/a | n/a | n/a | n/a |
| SWC 2180 | 11/14/31 | Primary | 2.3 cfs | 1,656 afy | n/a | n/a | n/a | n/a |
| GWC 286-A | 1/12/46 | Primary | 0.7 cfs | 160 afy | n/a | n/a | n/a | n/a |
| GWC 1152-A | 3/7/52 | Supplemental | 0.7 cfs | (320 afy) | n/a | n/a | n/a | n/a |
| GWC 2096-A | 3/7/52 | Supplemental | 1.1 cfs | (800 afy) | n/a | n/a | n/a | n/a |
| GWC 4155-A | 5/5/55 | Supplemental | 0.1 cfs | (91 afy) | n/a | n/a | n/a | n/a |
| GWC 3100-A | 2/14/56 | Supplemental | 2.2 cfs | (1,344 afy) | n/a | n/a | n/a | n/a |
| GWC 5469-A | 7/27/64 | Supplemental | 2.2 cfs | (1,176 afy) | n/a | n/a | n/a | n/a |
| GWC 6980-A | 6/19/67 | Primary | 1.2 cfs | 880 afy | n/a | n/a | n/a | n/a |
| G1-00675C | 7/14/70 | Primary | 5.0 cfs | 3,600 afy | n/a | n/a | n/a | n/a |
| G1-23487C | 10/17/79 | Primary | 2.2 cfs | 1,600 afy | n/a | n/a | n/a | n/a |
| G1-25182 P | 2/16/88 | Supplemental | 0.9 cfs | (451 afy) | n/a | n/a | n/a | n/a |
| Total Water Rights[1] | | | 19.49 cfs (12.60 mgd) | 8,472 afy (7.56 mgd) | n/a | n/a | n/a | n/a |
| Joint Operating Agreement (JOA) | | | 20.35 cfs (13.15 mgd) | 14,741 afy (13.15 mgd) | n/a | n/a | n/a | n/a |
| TOTAL[1] | | | 39.84 cfs (25.75 mgd) | 23,200 afy (20.71 mgd) | 15.05 cfs (9.73 mgd) | 6,910 afy (6.17 mgd) | +24.79 cfs (16.02 mgd) | +16,290 afy (14.54 mgd) |

[1] Total Instantaneous Quantity (Qi) includes primary and supplemental water rights; Total Annual Quantity (Qa) includes only primary water rights.

## Table 6-3 City of Marysville Forecasted Water Rights Status

| Certificate/ Permit Number | Priority Date | Primary/ Supplemental | Quantity | | Forecasted 2028 Demand | | Forecasted Water Rights Status (Excess/Deficiency) | |
|---|---|---|---|---|---|---|---|---|
| | | | Maximum Instantaneous Quantity (Qi) | Maximum Annual Quantity (Qa) | Maximum Instantaneous Quantity (Qi) | Maximum Annual Quantity (Qa) | Maximum Instantaneous Quantity (Qi) | Maximum Annual Quantity (Qa) |
| SWC 184 | 7/14/21 | Primary | 0.8 cfs | 576 afy | n/a | n/a | n/a | n/a |
| SWC 2180 | 11/14/31 | Primary | 2.3 cfs | 1,656 afy | n/a | n/a | n/a | n/a |
| GWC 286-A | 1/12/46 | Primary | 0.7 cfs | 160 afy | n/a | n/a | n/a | n/a |
| GWC 1152-A | 3/7/52 | Supplemental | 0.7 cfs | (320 afy) | n/a | n/a | n/a | n/a |
| GWC 2096-A | 3/7/52 | Supplemental | 1.1 cfs | (800 afy) | n/a | n/a | n/a | n/a |
| GWC 4155-A | 5/5/55 | Supplemental | 0.1 cfs | (91 afy) | n/a | n/a | n/a | n/a |
| GWC 3100-A | 2/14/56 | Supplemental | 2.2 cfs | (1,344 afy) | n/a | n/a | n/a | n/a |
| GWC 5469-A | 7/27/64 | Supplemental | 2.2 cfs | (1,176 afy) | n/a | n/a | n/a | n/a |
| GWC 6980-A | 6/19/67 | Primary | 1.2 cfs | 880 afy | n/a | n/a | n/a | n/a |
| G1-00675C | 7/14/70 | Primary | 5.0 cfs | 3,600 afy | n/a | n/a | n/a | n/a |
| G1-23487C | 10/17/79 | Primary | 2.2 cfs | 1,600 afy | n/a | n/a | n/a | n/a |
| G1-25182 P | 2/16/88 | Supplemental | 0.9 cfs | (451 afy) | n/a | n/a | n/a | n/a |
| Total Water Rights[1] | | | 19.49 cfs (12.60 mgd) | 8,472 afy (7.56 mgd) | n/a | n/a | n/a | n/a |
| Joint Operating Agreement (JOA) | | | 20.35 cfs (13.15 mgd) | 14,741 afy (13.15 mgd) | n/a | n/a | n/a | n/a |
| TOTAL[1] | | | 39.84 cfs (25.75 mgd) | 23,200 afy (20.71 mgd) | 35.46 cfs (22.92 mgd) | 18,569 afy (16.58 mgd) | +4.38 cfs (2.83 mgd) | +4,631 afy (4.13 mgd) |

[1] Total Instantaneous Quantity (Qi) includes primary and supplemental water rights; Total Annual Quantity (Qa) includes only primary water rights.

## 6.4. Contingency and Drought Planning

Marysville has developed a comprehensive Contingency Plan for Water Supply Disruptions During Emergencies (Contingency Plan). A full copy of the Contingency Plan is contained in Appendix 6-2. The Contingency Plan, developed in 2002, supplements Marysville's Emergency Response Plan, which covers all city services.

In brief, the Contingency Plan addresses the following topics:

- Hazard analysis, covering both natural and human-caused hazards;
- Vulnerability Assessment, addressing the vulnerability of key water system components to the hazards identified;
- Mitigation plan, addressing facility protection and backup systems;
- Preparedness planning, including linkage to Marysville's Emergency Response Plan; and
- Training of city personnel to respond to emergencies affecting the water system.

Marysville benefits from the fact that it has several independent sources of supply in different locations. These include surface water, ground water, and purchased water from the City of Everett. Furthermore, Marysville has backup wells and interties with adjacent systems that can provide water under emergency conditions. These multiple sources offer considerable flexibility and will allow uninterrupted deliveries during most emergency situations. Marysville also has a Mutual Aid Agreement with neighboring jurisdictions that addresses sharing of personnel and equipment during water and/or wastewater system emergencies.

These features of supply reliability and flexibility are most applicable to Marysville's North System, which has multiple primary as well as emergency supplies. By contrast, Marysville's South System has only one primary source of supply (the Everett-Marysville pipeline), and two emergency wells (Sunnyside and Highway 9), each with a rated capacity of approximately 1,000 gpm. Distribution storage reservoirs provide additional backup supply for a limited amount of time.

Due to its lower level of supply reliability, a source and storage contingency analysis has been developed for the South System. Summarized in Table 6-4, this analysis identifies the length of time the system can rely upon emergency sources and standby storage before demand reduction or other emergency responses are required. The analysis considers multiple scenarios: one assuming both emergency wells are available at full capacity, a second assuming only one well is available, and a third assuming that no emergency supplies are available. For each scenario, current and forecast 20-year demand conditions are considered. Two key assumptions in this analysis are:

- Water supply from the North System is not available to the South System.
- Water stored in all reservoirs in the South System is available to all pressure zones in that system (i.e., the Cedarcrest Pump Station remains in service and can pump water from lower zones to higher ones).

## Table 6-4 Source and Storage Contingency Analysis – South System

| | Scenario 1 Two Backup Wells | | Scenario 2 One Backup Well | | Scenario 3 No Backup Wells | |
|---|---|---|---|---|---|---|
| | 2008 | 2028 | 2008 | 2028 | 2008 | 2028 |
| Average Day Demand (gpd) (1) | 3,605,257 | 5,960,320 | 3,605,257 | 5,960,320 | 3,605,257 | 5,960,320 |
| Backup Supply Capacity (gpd) (2) | 2,880,000 | 2,880,000 | 1,440,000 | 1,440,000 | 0 | 0 |
| Backup Supply Deficiency (gpd) (3) | 725,257 | 3,080,320 | 2,165,257 | 4,520,320 | 3,605,257 | 5,960,320 |
| Total Storage (gallons) (4) | 14,200,000 | 14,200,000 | 14,200,000 | 14,200,000 | 14,200,000 | 14,200,000 |
| Fire Flow Storage (gallons) (5) | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 |
| Operational Storage (gallons) (6) | 1,364,826 | 1,364,826 | 1,364,826 | 1,364,826 | 1,364,826 | 1,364,826 |
| Storage Available for Emergency Standby (gallons) (7) | 12,535,174 | 12,535,174 | 12,535,174 | 12,535,174 | 12,535,174 | 12,535,174 |
| Number of Days Where Standby Storage Can Meet Backup Supply Deficiency (days) (8) | 17.3 | 4.1 | 5.8 | 2.8 | 3.5 | 2.1 |

Notes:
gpd = gallons per day
(1) Per water demand forecast for South System.
(2) Emergency well capacity, varies by scenario:
Scenario 1 - Both the Sunnyside and Highway 9 wells are available, at a capacity of 1,000 gpm each.
Scenario 2 - Only one well (Sunnyside or Highway 9) is available, at a capacity of 1,000 gpm.
Scenario 3 - Neither emergency well is available.
(3) (Average Day Demand) less (Backup Supply Capacity).
(4) Total storage volume in South System reservoirs (Highway 9, Getchell, Sunnyside, and Cedarcrest).
(5) Storage volume that must be maintained for fire suppression, based upon a maximum fire flow requirement of 2,500 gpm for 2 hours.
(6) Volume of storage used during normal operating conditions, based on source start/stop levels. Assumed to be depleted at the start of emergency conditions.
(7) (Total Storage) less (Fire Flow Storage + Operating Storage). This volume of storage ("emergency standby storage") differs from "standby storage" as defined by DOH and which is considered in the storage analysis presented in Chapter 5. As discussed in Chapter 5, standby storage (defined as being twice the average day demand, or 200 gallons per ERU at a minimum) must be available at an elevation that provides 20 psi to the highest customer. Such pressure requirements are not considered in this "worst case" contingency analysis. Therefore, entire tank volumes (less fire flow and operational storage) are considered available for emergency needs.
(8) (Storage Available for Emergency Standby) divided by (Backup Supply Deficiency).

As noted in the table, if both backup wells are available, the South System can continue to meet full demands for 17 days before demand reduction or additional supplies would be needed. By 2028, the length of time the system can rely upon standby storage is reduced to four days. Under the scenario wherein no backup supplies are available, standby storage is sufficient to meet three days of demand currently, and two days in 2028.

Marysville intends to utilize this information in planning for system operations and demand reductions during short-term supply emergencies. This analysis will also inform long-term supply contingency planning decisions. For further details on the Contingency Plan, refer to Appendix 6-2.

Marysville has also developed a separate plan for responding to droughts. Marysville's City Council adopted the *Drought Response Plan* in 2001. This Plan was developed to conserve available water supply, protect the integrity of Marysville's water system, and minimize the adverse impacts of water supply shortage conditions. The Drought Response Plan, which has been included in Appendix 6-3, includes the following elements:

- Description of possible water supply shortage scenarios,
- Data needed to identify and manage a drought situation,
- Coordination with other purveyors that may be affected, and
- Establishment of four stages of response water supply shortage conditions, according to severity of the drought.

For each water shortage response stage, Marysville has clearly defined communications protocols, internal operating adjustments, and supply and demand management strategies to be carried out as a response.

In addition to these planning efforts, Marysville monitors water levels at each well quarterly to determine the potential for a supply shortage and to check for long-term trends in water levels. According to the data, Marysville's wells have not experienced any long-term trends that would suggest reduced system reliability.

## 6.5. Emergency Response Plan

Marysville developed a Water System Emergency Response Plan (ERP) in December 2004. This ERP documents responses to water system emergency scenarios, including specific emergencies such as microbial contamination, chemical contamination, and hazardous materials spills. For each scenario, Marysville has established immediate actions, notifications, and follow-up actions.

In addition to scenario-specific actions, Marysville's ERP establishes:

- Chain of command,
- Emergency notification,
- Communication protocols,
- Alternative water sources,
- Procedures for return to normal operations,
- Training and rehearsals, and
- Improvement projects related to emergency response.

## 6.6. Source Water Protection

As an owner/operator of drinking water sources of supply, Marysville is responsible for meeting requirements for source water protection. Marysville protects the Stillaguamish source of supply through its Watershed Control Plan and protects the Edward Springs, Edward wells and other groundwater sources through a Wellhead Protection Plan.

### 6.6.1. Watershed Control Plan

Marysville has developed a Watershed Control Plan (WCP) for the Stillaguamish Ranney Well Collector, a source of supply categorized as "groundwater under the direct influence (GUI) of surface water" by the Washington State Department of Health (DOH). Typically, the Washington Administrative Code (WAC) source protection requirements for GUI are limited to a Wellhead Protection Program (WHPP). However, the Stillaguamish source collects water from a shallow well directly beneath the Stillaguamish River and, according to DOH, is "highly susceptible" to contamination. As such, the DOH Regional Engineer requested that Marysville prepare a WCP, rather than a WHPP, for the source in 2001 (Heneghan 2001). The WCP was developed in 2002 to meet the source water protection requirements defined in WAC 246-290-135(4).

To meet requirements in WAC 246-290-135, systems must update their watershed control plans every six years as part of updating the Comprehensive Water Plan. The Watershed Control Plan Update has been included as Appendix 6-4 to this Plan. The Update reviews source water quality, land use, potential point sources of contamination, and watershed management activities carried out between 2002 and 2007. Finally, the Update summarizes Marysville's watershed management activities planned for the future.

### 6.6.2. Wellhead Protection Plan

All Group A Public Water Systems with ground water production sources are required to develop and implement a Wellhead Protection Program in accordance with Washington Administrative Code (WAC) 246-290-135(3). The purpose of a Wellhead Protection Plan (WHPP) is to document and summarize the Wellhead Protection Program and to create a plan for appropriate improvements to wellhead protection. Each Group A public water system must submit a complete and appropriate WHPP to the Washington Department of Health (DOH) as a required component of a Water Comprehensive Plan or Small Water System Management Program. Marysville originally developed a WHPP in 2002.

As part of the Water Comprehensive Plan development process, the WHPP has been updated. The WHPP Update has been included as Appendix 6-5 to this Plan. The Update reviews land use, potential point sources of contamination, and wellhead protection activities carried out between 2002 and 2007. Finally, the Update summarizes Marysville's wellhead protection activities planned for the future.

A significant driver for Marysville's Wellhead Protection Program activities is the unfiltered status of the Edward Springs supply. Because of this, Marysville is required to submit an annual report summarizing the effectiveness of their source water protection program, compliance with 11 criteria to remain unfiltered (per WAC 246-290-690), and significant changes in the system's ability to comply with the criteria to remain unfiltered. Marysville's other well sources are of limited capacity or are designated as emergency supplies.

# 7. Water Quality Review and Regulatory Compliance

## 7.1. Introduction

This chapter provides a review of current state and federal drinking water regulations pursuant to the Safe Drinking Water Act (SDWA) and an assessment of the City of Marysville's (Marysville) compliance status based on water quality data and information collected for the period 2001 to 2006. This chapter also summarizes applicable anticipated regulations and their potential implications to Marysville. The approach used to achieve these objectives includes the following:

- A brief description of State and Federal regulatory framework
- An overview of Marysville's sources of supply;
- Description of current state and federal drinking water regulations;
- Description of upcoming regulations that could impact Marysville's system;
- Review of existing monitoring plans, practices, and water quality data;
- Assessment of existing compliance status and potential future compliance issues; and
- Proposed action plan for continued compliance.

## 7.2. Description of State and Federal Regulatory Framework

Marysville collects and pumps water from four primary sources of supply and two secondary sources of supply. Primary sources are those that provide water during normal operating conditions. Secondary sources are intended for use in the event of emergencies, high demand, or when primary sources are off-line. Of these sources of supply, two are considered groundwater under the influence (GUI) of surface water, three are groundwater sources, and one is purchased surface water from the City of Everett. Details regarding reliable capacity of each supply are provided in Chapter 1 – System Description. Marysville is responsible for monitoring and compliance with all SDWA and state regulations pertaining to source water quality that are applicable to groundwater under the influence (GUI) of surface water and groundwater systems, as well as distribution system water quality requirements.

### 7.2.1. Safe Drinking Water Act

The federal regulatory framework directing water quality is the SDWA of 1974 and its 1986 and 1996 amendments. The SDWA and amendments, as administered by the United States Environmental Protection Agency (EPA), have significant impacts on the operation and monitoring of the Marysville water systems.

The regulatory impacts to Marysville include requirements for disinfection, bacteriological quality, disinfection by-products, and source and system water quality monitoring.

### 7.2.2. Washington Administrative Code

The State law that incorporates the SDWA and its amendments is Chapter 246-290 of the Washington Administrative Code (WAC 246-290). The Washington State Department of Health (DOH) is the primacy agency responsible for ensuring state drinking water laws are implemented and enforced. The Marysville system (ID #WA53 51900C) is classified as Group A public water systems that regularly serves 15 or more residential connections or a system that serves 25 or more people per day for 60 or more days per year. Marysville is required to meet drinking water quality regulations and conform to sampling and reporting requirements for Group A systems.

Effective drinking water quality regulations applicable to Marysville during the 2001-2006 review period are listed in Table 7-1. These regulations are classified as pertaining to the source water, distribution system, or other effective rules. Anticipated regulations are discussed separately at the end of this chapter

## 7.3. System and Supply Overview

Marysville collects or receives water from several sources. The service area is physically divided by valves into north and south zones. The north service area is served by Marysville water from the Stillaguamish River, the Edward Springs facilities and the Lake Goodwin Well; customers in the south service area receive water from the City of Everett through the JOA agreement. The Stillaguamish source is classified as a filtration required source because of historic high turbidity levels and the inability to control activity in the watershed. The Stillaguamish River Water Treatment Plant was built and commissioned in 2006. The primary treatment process is a filtration process utilizing low-pressure, submerged membrane technology.

Marysville operates the Edward Springs source under the filtration avoidance clause of the SWTR through development of a Watershed Management Plan and other improvements that include chlorine disinfection and CT compliance improvements constructed in 2004, fencing and signage at the watershed perimeter, and water quality monitoring at the source. A UV disinfection system is scheduled for installation at the Edward Springs source in 2011.

The Lake Goodwin Well also contributes to the north service area. Lake Goodwin Well water may be isolated to a few homes or mixed with other north end supplies at the Edward Springs Reservoir, depending on valve settings. The Lake Goodwin Well is the source for the new 327 pressure zone in the north part of Marysville's service area.

For the south service area, Marysville purchases treated water from the City of Everett. The groundwater sources and imported surface water supplies routinely used for drinking water service are all chlorinated.

Two groundwater sources (Sunnyside Well No. 2 and Highway 9 Well) are used only for emergency purposes.

**Table 7-1 Safe Drinking Water Act Rules**

| Rule | Parameters Regulated | Regulatory Milestone Effective Date |
|---|---|---|
| ***Effective Source Water Quality Regulations*** | | |
| Phase I Rules | Volatile Organic Compounds | January 1989 |
| Phase II and V Rules | Inorganic and Synthetic Organic Compounds | January 1993 |
| Arsenic Rule | Arsenic | January 2006 |
| Radionuclides Rule | Combined radium, gross alpha, beta and photon emitters, and uranium | December 2003 |
| Surface Water Treatment Rule | Turbidity, *Giardia lamblia*, enteric viruses, *Legionella*, Heterotrophic bacteria | December 1990 |
| Interim Enhanced Surface Water Treatment Rule | Turbidity, *Cryptosporidium* | February 1999 |
| Long Term 2 Enhanced Surface Water Treatment Rule | *Cryptosporidium* | March 2006 |
| Groundwater Rule | Viruses, fecal indicators | December 2009 |
| Filter Backwash Recycling Rule | Filter backwash | June 2001 |
| ***Effective Distribution System Water Quality Regulations*** | | |
| Lead and Copper Rule and Revisions | Lead, copper, water quality parameters | December 1992, December 2007 |
| Total Coliform Rule | Total and fecal coliform, *E. coli* | December 1990 |
| Stage 1 Disinfectants/Disinfection By-Products Rule | Trihalomethanes, haloacetic acids, chlorine residual, total organic carbon, others | February 1999 |
| Stage 2 Disinfectants/Disinfection By-Products Rule | Trihalomethanes, haloacetic acids | March 2006 |
| ***Other Effective Regulations*** | | |
| Consumer Confidence Reports Rule | Requires annual report addressing drinking water quality | September 1998 |
| Operator Certification | Requires minimum standards for operator certification by State | February 2001 |

Marysville's regulatory responsibilities vary by source. Marysville is responsible for source and treatment monitoring of its groundwater and GUI sources. Additionally, Marysville is responsible for monitoring and compliance with all SDWA and WAC regulations pertinent to distribution systems. However, Marysville is not responsible for monitoring the source or treatment of water it purchases from the City of Everett.

## 7.4. Effective Source Water Quality Regulations, Status and Recommendations

This section summarizes effective water quality regulations that pertain to the sources and are applicable to Marysville during the 2001-2006 review period. If 2007 data were available, these data were also included in this evaluation. A discussion of each rule and Marysville's status follows.

## 7.4.1. Phase I, II, and V Rules

### Regulatory Summary

Monitoring requirements and maximum contaminant levels (MCLs) for inorganic (IOC), synthetic organic (SOC), and volatile organic (VOC) compounds are addressed by federal Organic, Synthetic Organic and Inorganic Chemicals Phases I, II and V Rules and WAC 246-290-300. Under the Phase II and V Rules, MCLs are set for 16 IOCs, 32 SOCs, and 21 VOCs. Monitoring requirements are determined by DOH based on a vulnerability assessment. WAC 246-290-300 requires that these compounds be monitored at each source on 12 to 36 month sampling cycles depending on the contaminant and source type.

As part of the Phase II Rule, systems with a significant amount of asbestos-cement (AC) pipe must conduct periodic asbestos monitoring in the distribution system. In Washington State, DOH has historically required systems that contain more than 10% AC pipe to comply with the monitoring requirement. These systems must collect one sample in the distribution system at a tap served by AC pipe and under conditions where asbestos contamination is most likely to occur.

### Marysville Status

*North Service Area*

Marysville has maintained compliance with the primary drinking water regulations in the North service area. Water quality data collected from January 30, 2001 to June 6, 2007 and analyzed for IOC levels in sources that supply the North service area are summarized in Table 7-2.

The Lake Goodwin Well has generally good water quality with the exception of elevated iron and manganese, which is typical for groundwaters in the "Marysville Trough" region (Hammond, Collier & Wade-Livingston Assoc., Inc., 1997). Water quality data for the Edward Springs sources also indicate elevated levels of manganese. A review of water quality monitoring data for IOC, VOC, and SOC contaminants indicate that Marysville has remained in compliance with all regulated primary chemicals.

Table 7-3 provides a summary of SOC monitoring results for the North service area of the Marysville system. No SOCs were detected in samples collected from August 14, 2001 to October 12, 2004. Results of VOC analyses for samples collected from January 30, 2001 to June 19, 2007 are summarized in Table 7-4. Results indicate that most samples exhibited non-detectable levels of VOCs, except for two samples collected on January 30, 2001. A sample collected from the Edwards Spring Well No. 2 exhibited dichloromethane at a concentration of 0.864 μg/L and a sample collected from the Edwards Springs Water exhibited a dichloromethane concentration of 0.501 μg/L. The analytical reporting limit for dichloromethane was reported by the laboratory as 0.500 μg/L and the MCL for dichloromethane is 5 μg/L. As such, these analytical results do not appear to pose a significant concern currently for Marysville.

## Table 7-2 Source Water Inorganic Chemical (2001 to 2007) – North Service Area

| Parameter | MCL (mg/L) | Source^^^ | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lake Goodwin Well (S05) | Edward Springs Sources | | | | Stillaguamish Ranney Well (S04) |
| | | | Well #1^ (S10) | Well #2 (S06) | Well #3 (S09) | Shallow Collection System (S01) | |
| ***Regulated Primary Inorganic Chemicals*** | | | | | | | |
| Antimony | 0.006 | ND | ND | ND | ND | ND[a] | ND |
| Arsenic | 0.010 | 0.004-0.00418 | 0.00354-0.006 | 0.005[a,b]-0.00870 | 0.005[a,b]-0.00859 | 0.005[a] | ND |
| Asbestos | * | | | | | | |
| Barium | 2.0 | ND-0.0207 | ND | ND | ND | ND[a] | ND |
| Beryllium | 0.004 | ND | ND | ND | ND | ND[a] | ND |
| Cadmium | 0.005 | ND | ND | ND | ND | ND[a] | ND |
| Chromium | 0.1 | ND | ND-0.00422 | ND-0.00217 | ND | ND[a] | ND |
| Copper | ** | ND-0.00166 | ND | ND | ND-0.00106 | ND[a] | ND |
| Cyanide | 0.2 | ND | ND | ND | ND | ND[a] | ND |
| Fluoride | 4.0^^ | ND-0.110 | ND | 0.135-0.147 | 0.122-0.133 | ND[a] | ND |
| Lead | ** | ND | ND | ND | ND-0.00197 | ND[a] | ND |
| Mercury | 0.002 | ND | ND | ND | ND | ND[a] | ND |
| Nickel | 0.1 | ND | ND | ND-0.00111 | ND | ND[a] | ND |
| Nitrate (as N) | 10.0 | ND | ND-2.80 | ND-2.82 | ND-1.83[b] | 2.02[a] -3.06 | ND-0.64 |
| Nitrite (as N) | 1.0 | ND | ND | ND | ND | ND[a] | ND |
| Selenium | 0.05 | ND | ND | ND | ND | ND[a] | ND |
| Sodium | *** | 6-6.66 | 4.88-6 | 6.53-8.09[b] | 6.52-8.09[b] | 6[a] | ND |
| Thallium | 0.002 | ND | ND | ND | ND | ND[a] | ND |
| ***Regulated Secondary Inorganic Chemicals*** | | | | | | | |
| Chloride | 250.0 | ND-3.24 | ND-3.76 | 2.94-3.54 | 3.21-3.57 | ND[a] | ND-3.70 |
| Iron | 0.3 | ND-0.424 | ND | ND-0.173 | ND-0.208 | ND[a] | ND |
| Manganese | 0.05 | 0.050-0.0590 | 0.0443-0.068 | 0.0412-0.0691 | 0.0609-0.0631 | 0.019[a] | ND |
| Silver | 0.1 | ND | ND | ND | ND | ND[a] | ND |
| Sulfate | 250.0 | ND-4.95 | ND-4.79 | 1.46-2.97 | 3.10-4.58 | ND[a] | ND |
| Zinc | 5.0 | ND | ND | ND | ND-0.748 | ND[a] | ND |
| ***Other*** | | | | | | | |
| Turbidity | 1.0 NTU | ND-0.02 | ND | ND-0.20[b] | ND-0.02[b] | ND[a] | ND-0.45 |
| Hardness | | 48.1-52.9 | 52-62.6 | 39.0-60.7[b] | 44.5-60.7[b] | 57[a] | 42.8-59.6 |
| Conductivity | 700 μmhos/cm | 132-136 | 151-167 | 111-159[b] | 122-159[b] | 157[a] | 101-122 |
| TDS | 500 mg/L | 96 | 110 | 100-120 | 100-120 | | 77 |
| Color | 15 units | ND-7 | ND-5.00 | 5.00 | 5.00 | 7[a] | ND-6 |

* 7 million fibers per liter (longer than 10 microns)
** Action levels are 0.025 mg/L for lead and 1.3 mg/L for copper at the 90th percentile in the distribution system.
*** EPA recommended level is 20 mg/L for consumers that may be restricted for daily sodium intake in their diets.
^ Laboratory reports that specified "Edwards Springs Water" were assumed to be collected from Well #1.
^^ Per WAC 246-290-310, fluoride secondary MCL is 2.0 mg/L.
^^^ All parameters reported in units of mg/L, unless indicated otherwise in the column labeled MCL.
[a] Based on laboratory analysis of a blend of S01, S06, and S09.
[b] Based on laboratory analysis of a blend of S06 and S09.

## Table 7-3 Source Water Synthetic Organic Chemical (2001 to 2007) – North Service Area

| Parameter | MCL (mg/L) | Source^ | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lake Goodwin Well (S05) | Edward Springs Sources | | | | Stillaguamish Ranney Well (S04) |
| | | | Well #1^^ (S10) | Well #2 (S06) | Well #3 (S09) | Shallow Collection System (S01) | |
| Alachlor (Lasso) | 0.002 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Aldicarb (Temik) (2) | NA | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Aldicarb sulfone (2) | NA | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Aldicarb sulfoxide (2) | NA | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Atrazine | 0.003 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Benzo[a]pyrene | 0.0002 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Carbofuran (1) | 0.04 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Chlordane | 0.002 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| 2,4-D | 0.07 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Dalapon | 0.2 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Di(2-ethylhexyl)adipate | 0.4 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Di(2-ethylhexyl)phthalate | 0.006 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Dibromochloropropane (1) | 0.0002 | | | | | | |
| Dinoseb | 0.007 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| 2,3,7,8-TCDD (Dioxin) (1) | $3x10^{-8}$ | | | | | | |
| Diquat (1) | 0.02 | | | | | | |
| Endothall (1) | 0.1 | | | | | | |
| Endrin | 0.002 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Ethylene dibromide (1) | 0.00005 | | | | | | |
| Glyphosate[1] (Rodeo, Round-up) | 0.7 | | | | | | |
| Heptachlor | 0.0004 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Heptachlor epoxide | 0.0002 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Hexachlorocyclopentadiene | 0.05 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Hexacholorbenzene | 0.001 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Lindane (BHC-gamma) | 0.0002 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Methoxychlor | 0.04 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Oxamyl (Vydate) | 0.2 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Pentachlorophenol | 0.001 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Picloram | 0.5 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Polychlorinated biphenyls | 0.0005 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Simazine | 0.004 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| Toxaphene | 0.003 | ND | ND | ND[a] | ND[a] | ND[a] | ND |
| 2,4,5-TP (Silvex) | 0.05 | ND | ND | ND[a] | ND[a] | ND[a] | ND |

NA = Not applicable
ND = Not detected
(1) Waived until December 2007.
(2) The USEPA has placed a stay on the MCL included in the Phase II Rule.
^ All parameters reported in units of mg/L, unless indicated otherwise in the column labeled MCL.
^^ Laboratory reports that specified "Edwards Springs Water" were assumed to be collected from Well #1.
[a] Based on laboratory analysis of a blend of Edward Springs sources S01, S06, and S09.
[b] Based on laboratory analysis of a blend of Edward Springs sources S06 and S09.

## Table 7-4 Source Water Volatile Organic Chemical (2001 to 2007) – North Service Area

| Parameter | MCL (mg/L) | Source^ | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lake Goodwin Well (S05) | Edward Springs Sources | | | | Stillaguamish Ranney Well (S04) |
| | | | Well #1^^ (S10) | Well #2 (S06) | Well #3 (S09) | Shallow Collection System (S01) | |
| 1,1 – Dichloroethylene | 0.007 | ND | ND | ND | ND | ND | ND |
| 1,1,1-Trichloroethane | 0.2 | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | 0.005 | ND | ND | ND | ND | ND | ND |
| 1,2,4-Trichlorobenzene | 0.07 | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloroethane | 0.006 | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloropropane | 0.005 | ND | ND | ND | ND | ND | ND |
| Benzene | 0.005 | ND | ND | ND | ND | ND | ND |
| Carbon tetrachloride | 0.005 | ND | ND | ND | ND | ND | ND |
| cis-1,2-Dichloroethylene | 0.07 | ND | ND | ND | ND | ND | ND |
| Dichloromethane (methylene chloride) | 0.005 | ND | ND | 0.000864-ND | ND | 0.000501-ND | ND |
| Ethylbenzene | 0.7 | ND | ND | ND | ND | ND | ND |
| Monochlorobenzene (chlorobenzene) | 0.1 | ND | ND | ND | ND | ND | ND |
| o-Dichlorobenzene | 0.6 | ND | ND | ND | ND | ND | ND |
| p-Dichlorobenzene | 0.075 | ND | ND | ND | ND | ND | ND |
| Styrene | 0.1 | ND | ND | ND | ND | ND | ND |
| Tetrachloroethylene | 0.005 | ND | ND | ND | ND | ND | ND |
| Toluene | 1 | ND | ND | ND | ND | ND | ND |
| trans-1,2-Dichloroethylene | 0.1 | ND | ND | ND | ND | ND | ND |
| Trichloroethylene | 0.005 | ND | ND | ND | ND | ND | ND |
| Vinyl chloride | 0.002 | ND | ND | ND | ND | ND | ND |
| Xylenes (total) | 10 | ND | ND | ND | ND | ND | ND |

NA = Not applicable
ND = Not detected
^ All parameters reported in units of mg/L, unless indicated otherwise in the column labeled MCL.
^^ Laboratory reports that specified "Edwards Springs Water" were assumed to be collected from Well #1.
[a] Based on laboratory analysis of a blend of Edward Springs sources S01, S06, and S09.

### *South Service Area*

The City of Everett is responsible for ensuring compliance with the Phase I, II, and V regulations for the Everett supply. Water quality data from 2007 Comprehensive Water Plan that summarizes the IOC, SOC and VOC levels of Everett water are provided in Tables 7-5 through 7-7. Results indicate that the imported water from the City of Everett meets the water quality requirements of the Phase I, II, and V Rules.

## Table 7-5 Source Water Primary Inorganic Chemicals – South Service Area

| Parameter | MCL | Units | Everett's Monitoring Results - Range Shown for 2000 – 2005 |
|---|---|---|---|
| Antimony | 6 | µg/L | ND |
| Arsenic | 50 | µg/L | ND |
| Asbestos | 7 | million fibers/liter (longer than 10 microns) | ND |
| Barium | 2 | mg/L | ND – 0.005 mg/L |
| Beryllium | 4 | µg/L | ND |
| Cadmium | 5 | µg/L | ND |
| Chromium | 0.1 | mg/L | ND |
| Cyanide | 0.2 | mg/L | ND |
| Fluoride | 4.0 | mg/L | 0.22 – 1.62 |
| Mercury | 2 | µg/L | ND -0.0001 |
| Nickel | 0.1 | mg/L | ND |
| Nitrate | 10.0 | mg/L (as N) | 0.016 – 0.5 |
| Nitrite | 1.0 | mg/L (as N) | ND |
| Selenium | 50 | µg/L | ND |
| Sodium (1) | NA | mg/L | 4 – 9.9 |
| Thallium | 2 | µg/L | ND |

ND = Not detected
(1) The USEPA has established a recommended drinking water equivalent level 20 mg/L for sodium. This is a non-enforceable guidance level. Additionally, in 2003, the USEPA made a regulatory determination for sodium, indicating that setting an MCL would not provide "a meaningful opportunity to reduce health risk."

## Table 7-6 Source Water Synthetic Organic Chemicals – South Service Area

| Parameter | MCL (mg/L) | Everett's Monitoring Results - Range Shown for 2000 – 2005 |
|---|---|---|
| Alachlor (Lasso) | 0.002 | ND |
| Aldicarb (Temik) (2) | NA | ND |
| Aldicarb sulfone (2) | NA | ND |
| Aldicarb sulfoxide (2) | NA | ND |
| Atrazine | 0.003 | ND |
| Benzo[a]pyrene | 0.0002 | ND |
| Carbofuran (1) | 0.04 | ND |
| Chlordane | 0.002 | ND |
| 2,4-D | 0.07 | ND |
| Dalapon | 0.2 | ND |
| Di(2-ethylhexyl)adipate | 0.4 | ND |
| Di(2-ethylhexyl)phthalate | 0.006 | ND |

| Parameter | MCL (mg/L) | Everett's Monitoring Results - Range Shown for 2000 – 2005 |
|---|---|---|
| Dibromochloropropane (1) | 0.0002 | ND |
| Dinoseb | 0.007 | ND |
| 2,3,7,8-TCDD (Dioxin) (1) | $3x10^{-8}$ | ND |
| Diquat (1) | 0.02 | ND |
| Endothall (1) | 0.1 | ND |
| Endrin | 0.002 | ND |
| Ethylene dibromide (1) | 0.00005 | ND |
| Glyphosate[1] (Rodeo, Round-up) | 0.7 | ND |
| Heptachlor | 0.0004 | ND |
| Heptachlor epoxide | 0.0002 | ND |
| Hexachlorocyclopentadiene | 0.05 | ND |
| Hexacholorbenzene | 0.001 | ND |
| Lindane (BHC-gamma) | 0.0002 | ND |
| Methoxychlor | 0.04 | ND |
| Oxamyl (Vydate) | 0.2 | ND |
| Pentachlorophenol | 0.001 | ND |
| Picloram | 0.5 | ND |
| Polychlorinated biphenyls | 0.0005 | ND |
| Simazine | 0.004 | ND |
| Toxaphene | 0.003 | ND |
| 2,4,5-TP (Silvex) | 0.05 | ND |

NA = Not applicable
ND = Not detected
(1) Waived until December 2007.
(2) Everett is required to monitor for these SOCs. However, the USEPA has placed a stay on the MCL included in the Phase II Rule.

Although not required by DOH, Marysville staff conducts annual monitoring of nitrate in emergency wells located in the south service area (Sunnyside Well No. 2 and Highway 9 Well).

### Table 7-7 Source Water Volatile Organic Chemicals – South Service Area

| Parameter | MCL (mg/L) | Everett's Monitoring Results - Range Shown for 2000 – 2005 |
|---|---|---|
| 1,1 – Dichloroethylene | 0.007 | ND |
| 1,1,1-Trichloroethane | 0.2 | ND |
| 1,1,2-Trichloroethane | 0.005 | ND |
| 1,2,4-Trichlorobenzene | 0.07 | ND |
| 1,2-Dichloroethane | 0.005 | ND |
| 1,2-Dichloropropane | 0.005 | ND |
| Benzene | 0.005 | ND |
| Carbon tetrachloride | 0.005 | ND |

| Parameter | MCL (mg/L) | Everett's Monitoring Results - Range Shown for 2000 – 2005 |
|---|---|---|
| cis-1,2-Dichloroethylene | 0.07 | ND |
| Dichloromethane (methylene chloride) | 0.005 | ND |
| Ethylbenzene | 0.7 | ND |
| Monochlorobenzene (chlorobenzene) | 0.1 | ND |
| o-Dichlorobenzene | 0.6 | ND |
| p-Dichlorobenzene | 0.075 | ND |
| Styrene | 0.1 | ND |
| Tetrachloroethylene | 0.005 | ND |
| Toulene | 1 | ND |
| trans-1,2-Dichloroethylene | 0.1 | ND |
| Trichloroethylene | 0.005 | ND |
| Vinyl chloride | 0.002 | ND |
| Xylenes (total) | 10 | ND |

ND = Not detected

### Recommendation for Continued Compliance with Primary Regulations

Continue to monitor all sources for any notable changes in water quality.

## 7.4.2. Arsenic Rule

### Regulatory Summary

The original arsenic MCL of 0.05 mg/L was established as part of the 1975 National Interim Primary Drinking Water Regulations. After years of additional health effects research and cost/benefit analysis, the EPA published the final Arsenic Rule in January 2001 with an effective date of January 2006. The Arsenic Rule revised the arsenic MCL downward to 0.010 mg/L and it identifies several best available treatment technologies for compliance. Compliance with the new MCL is based on the running annual average of monitoring results at each entry point to the distribution system. The rule makes arsenic monitoring requirements consistent with monitoring for other IOCs regulated under the Phase II/V standardized monitoring framework. However, if arsenic is detected above the MCL in any individual sample, the system must increase the frequency of monitoring at that sampling point to quarterly.

### Marysville Status

A review of arsenic monitoring data indicates that Marysville's existing water sources (for both the north and south service areas) exhibit arsenic concentrations less than the MCL. As such, Marysville is in compliance with the arsenic rule.

**Recommendation for Continued Compliance with Arsenic Rule**

Continue to monitor arsenic levels in all sources.

## 7.4.3. Radionuclides Rule

### Regulatory Summary

The original Radionuclides Rule became effective in 1978. The rule was revised in December 2000, with an effective date of 2003. The revised rule includes MCLs for radium-226 and radium-228, referred to as combined radium (5 pCi/L), adjusted gross alpha emitters (15 pCi/L), beta and photon emitters (4 mrem/year), and uranium (30 µg/L). Under this rule, monitoring for radionuclides must be conducted at each entry point to the distribution system. Systems are required to conduct initial monitoring between 2003 and 2007, unless earlier radionuclide data can be used as grandfathered data. The required monitoring frequency will depend on system contaminant levels observed during initial monitoring.

### Marysville Status

Marysville tested for radionuclides in 2001, 2004, 2005 and 2007. Marysville conducted initial monitoring for compliance with the Radionuclides Rule by sampling for gross alpha and gross beta emitters and radium 228 during two quarters in 2005. Results (Table 7-8) indicate that these parameters were not detectable in the samples. Marysville was not required to monitor uranium levels because the level of gross alpha emitters was less than 15 pCi/L. Marysville is required to sample for radionuclides sometime between 2008 and 2010, based on DOH's Water Quality Monitoring Report for the Year 2007.

**Table 7-8 Source Water Radionuclides Analysis (2001 to 2007) – North Service Area**

| Parameter | MCL | Source^ | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Edward Springs Sources | | | | |
| | | Lake Goodwin Well (S05) | Well #1 (S10) | Well #2 (S06) | Well #3 (S09) | Shallow Collection System (S01) | Stillaguamish Ranney Well (S04) |
| Beta/photon emitters | 50 pCi/L* | <2.1 | 5.5±2.1 | <2.1 | <2.1 | <2.1 | <2.1 |
| Gross alpha particle | 15 pCi/L | <1.0 | ND | <1.0 | <1.0 | <1.0 | <1.0 |
| Combined radium-226/228 | 5 pCi/L | ND | ND | ND | ND | ND | ND |
| Uranium | 30 µg/L | NA | NA | NA | NA | NA | NA |

NA = Not applicable
ND = Not detected
^ Parameters are reported in the same units as the MCL.
* MCL also expressed as 4 mrem/yr.
[a] Based on laboratory analysis of a blend of S06 and S09.
[b] Based on laboratory analysis of a blend of S06, S09, and S10.

Sampling results collected by Everett indicate that radionuclides were not detectable in Everett's system. These results apply to the south service area of Marysville. Everett is required to sample for radionuclides sometime between 2007 and 2015 (Everett 2007 Comprehensive Water Plan).

**Recommendation for Continued Compliance with Radionuclides Rule**

Continue to monitor and sample for radionuclides before the end of 2010.

## 7.4.4. Surface Water Treatment Rule (SWTR) and Interim Enhanced SWTR

**Regulatory Elements**

The Surface Water Treatment Rule (SWTR) was issued in 1989 and applies to water systems using surface water or groundwater under the influence of surface water (GUI). The SWTR addresses filtration, disinfection, and regulation of *Giardia lamblia*, viruses, Legionella, heterotrophic plate count (HPC) bacteria, chlorine residual, and turbidity levels of finished water. As a filtration required source at the Stillaguamish Ranney Well Collector, Marysville is required to comply with provisions of the SWTR addressed in WAC 246-290-650. As a GUI source at Edward Springs and associated wells, Marysville is required to comply with provisions of the SWTR addressed in WAC 246-290-686, which includes source water monitoring and quality requirements, disinfection criteria, and watershed control and protection requirements.

The Interim Enhanced Surface Water Treatment Rule (IESWTR) was issued in 2001 and builds upon the SWTR without replacing it. For filtered systems, the IESWTR strengthened filtration requirements for combined filter effluent turbidity performance, requiring turbidity to be less 0.3 NTU in at least 95 percent of turbidity measurements per month. The maximum allowable finished water turbidity was established at 1.0 NTU and systems must provide at least a 2.0-log removal of *Giardia* and *Cryptosporidium* and 1.0-log removal of viruses. For unfiltered surface water supplies, the IESWTR requires addition of *Cryptosporidium* to the watershed control program wherever *Giardia lamblia* is mentioned, which includes the identification and monitoring of activities that may have impact on microbial water quality. The IESWTR also includes disinfection profiling and microbial benchmarking provisions based on system-wide DBP levels.

### *Requirements for Filtered Systems*

The SWTR requires that an acceptable filtration technology be used and that treatment criteria are satisfied for filtered systems designed to treat surface water or GUI source. Subpart B of Part 6 of Chapter 246-290 WAC also provides requirements for filtration (WAC 246-290-660); disinfection to ensure that filtration and disinfection together achieve 3-log inactivation and removal of *Giardia lamblia* cysts and 4-log inactivation and/or removal of viruses (WAC 246-290-662); monitoring of source coliform and turbidity, filtered water turbidity, inactivation and removal of *Giardia lamblia* cysts, viruses, and *Cryptosporidium* oocysts, and residual disinfection concentrations entering and within the distribution system (WAC 246-290-664); reporting for

filtered systems (WAC 246-290-666); and requirements for watershed control (WAC 246-290-668).

### *Requirements for Unfiltered Systems*

Requirements for unfiltered systems include watershed control, source water monitoring, disinfection requirements, and distribution system water quality conditions as summarized below.

Watershed Control Program. The SWTR requires the development, documentation, and implementation of a watershed control program (WCP) for unfiltered surface supplies (WAC 246-290-690(3e)). Per the requirements of WAC 246-290-135(4), the WCP must address watershed hydrology and characteristics, land ownership, activities that may adversely affect source water quality, security and access-related issues, and monitoring provisions. Also, for unfiltered surface supplies, DOH must complete a sanitary survey once every five years and annual on-site inspections to ensure adequacy of the watershed control program (WAC 246-290-690(3f)).

Source Water Quality Conditions. For unfiltered surface supplies, the SWTR requires source water monitoring of fecal coliform density and turbidity. Per requirements in WAC 246-290-694, Marysville must collect fecal coliform samples on at least 4 separate days each week, including whenever the source water turbidity exceeds 1.0 NTU. To remain in compliance, the fecal coliform density must be less than or equal to 20/100 mL in 90% of samples for the previous six months, and the turbidity cannot exceed 5.0 NTU when the supply is used unless DOH determines that the event was:

- The result of unusual or unpredictable circumstances or;
- No more than two events occurred in the last 12 months, or no more than five events in the last 120 months.

The SWTR permits operational adjustments, including temporary source shutdown during turbidity episodes, providing that alternate supplies and/or finished water storage are available and can be used to meet system demands.

Compliance with the total coliform MCL is also a required component of filtration avoidance criteria, unless it can be shown that the violation was not related to source or treatment deficiencies.

Disinfection Requirements. For unfiltered surface waters, the SWTR treatment requirements for *Giardia lamblia* and enteric viruses must be met through disinfection. The disinfection requirements require that adequate CT (disinfectant concentration multiplied by contact time) be provided such that 3-log (99.9%) inactivation of *Giardia lamblia* and 4-log (99.99%) inactivation of enteric viruses is achieved each day, thus resulting in inactivation ratios greater than or equal to one. Regarding *Cryptosporidium*, the IESWTR required a minimum of 2-log (99%) removal for filtered systems but did not impose any removal or inactivation requirements for unfiltered systems.

Distribution System Water Quality Conditions. After treatment, the SWTR requires a minimum disinfectant residual of 0.2 mg/L at the point of entry to the distribution system at all times. Additionally, a detectable disinfectant residual must be present in at least 95% of all distribution system samples collected at the same time and location as coliform samples per WAC 246-290-

451. Alternatively, samples may be analyzed for heterotrophic bacteria. A heterotrophic bacteria level of 500 colony forming units per milliliter (cfu/mL) or less is considered equivalent to a detectable disinfectant residual.

**Marysville Status**

### *Filtered System – Stillaguamish River Water Treatment Plant*

Marysville built and commissioned a new low-pressure membrane treatment plant in 2006 at the Ranney Well Collector source in 2006. Marysville has prepared the *Stillaguamish River Water Treatment Plant Operations Plan* (November 2006), which includes procedures for CT calculations and plant performance record keeping.

Marysville demonstrates treatment effectiveness for *Giardia lamblia* cyst and *Cryptosporidium* oocysts removal by filtration (WAC 246-290-654) by particle counting. A review of performance summaries from 2006 to 2007 showed that the average finished water particle count is typically less than 20/mL. Marysville receives a 3.0-log removal credit for *Giardia* and a 3.0-log removal credit for Cryptosporidium for filtration at a rate up to 37.7 gallons per day per square foot (City of Marysville, 2006, *Stillaguamish River Water Treatment Plant Operations Plan*).

Regarding disinfection requirements, the total inactivation ratio must always be greater than one (WAC 246-290-662(4a)). Marysville's disinfection performance summaries confirm compliance. Table 7-9 summarizes Marysville's inactivation ratios for the membrane plant effluent during 2006 and 2007.

**Table 7-9 City of Marysville Giardia Inactivation Ratios**

| Year | Average Ratio | Maximum Ratio | Minimum Ratio |
|---|---|---|---|
| 2006* | 3.26 | 4.38 | 2.04 |
| 2007 | 3.19 | 9.10 | 1.45 |

* Represents data collected December 6 through 29, 2006.

Marysville continuously monitors chlorine residual at the distribution system entry point to ensure it stays above 0.2 mg/L, and at sites throughout the distribution system to ensure the presence of a disinfectant residual. Between 2006 and 2007, results indicated the presence of a disinfectant residual in all samples.

Marysville had no treatment technique violations between 2006 and 2007 and is in compliance with the Surface Water Treatment Rule. Marysville was not required to conduct disinfection profiling because disinfection byproduct (DBP) levels in Marysville system were below 64 µg/L for total trihalomethanes and below 48 µg/L for haloacetic acids.

### *Unfiltered System – Edward Springs Source*

Washington State DOH classified the spring collection system as a GUI source in March 2000. Edward Springs has a controlled access watershed and water with consistently low turbidity. Marysville operates the Edward Springs source under the filtration avoidance clause of the SWTR through development of a Watershed Management Plan and other improvements which include fencing and signage at the watershed perimeter and disinfection and CT compliance

improvements. In addition, Marysville thoroughly documents water quality history for the Edward Springs source as another requirement to continue avoiding filtration for this source. Marysville designed and built a chlorine disinfection system for the Edward Springs source in 2004. A UV disinfection system will be installed by 2011.

Table 7-10 provides a summary of Marysville's compliance status with regard to SWTR requirements. These items are further discussed in the following sections.

Significant changes to the system included the following:

- Construction of the Edward Springs Treatment Facilities Improvement Project added facilities to better operate and treat the high quality source. Operation began in 2005.
- Edward Springs Watershed improvements in 2006 included the following: raised collectors at various locations and resealed them; installed approximately 4000 feet of 6' high fence along the Lakewood Road and most of the east property line; fences were repaired as a result of several trees up rooted and blown down during snow and wind damage in November and December; raised manhole for the tele-metering for reservoir level transducer; and normal maintenance and weekly watershed patrols including cleaning the screen house.
- Edward Springs Watershed improvements in 2007 included the following: new design for the upper reservoir at Edward Springs 327 zone; improvements to the collection system for the collectors and maintenance of collectors; tracer study/baffles for the reservoir; rehabilitation of Well #1; fenced repaired as needed due to damage by wind and snow; and upgrades on tele-metering for turbidity, pH, and chlorine residuals.

Watershed Control Plan. As an unfiltered source, Marysville must prepare and submit to DOH an annual report in accordance with WAC 246-290-696(6) summarizing the effectiveness of the watershed control program. A 2006 annual report was submitted to DOH in compliance with WAC 246-290-696(6).

Marysville owns approximately 300 acres, of which a watershed area of approximately 40 acres has been determined to actually influence the Edward Springs source. As such, the Watershed Control Program specifically addresses the management program for the 40-acre watershed area and the water quality of the spring collector wells. To meet requirements in WAC 246-290-135, systems must update their watershed control plans every six years as part of updating the Comprehensive Water Plan. The Watershed Control Plan Update has been included as Appendix 6-4 to this Water Comprehensive Plan. The Update provides reviews of source water quality, land use, potential point sources of contamination, and watershed management activities conducted between 2002 and 2007. Finally, the Update summarizes Marysville's watershed management activities planned for the future.

## Table 7-10 Surface Water Treatment Rule Criteria for Filtration Avoidance – Edward Springs Source

| Parameter | Criteria | Marysville Status* |
|---|---|---|
| Turbidity | Sample for turbidity prior to disinfection every 4 hours the system serves the public or continuously with State permission. | Marysville samples continuously |
| Turbidity | System is out of compliance any time the turbidity level exceeds 5.0 NTU unless State determines that high turbidity caused by unusual or unpredictable circumstance or no more than two events occurred in past 12 months or no more than five events occurred in past 120 months. | Automatic system shutdown prevents water with elevated turbidity from entering distribution system |
| Turbidity/Coliform | Every day the turbidity measurement exceeds 1 NTU, the system must take coliform measurements before the first customer. | Marysville in compliance |
| Coliform | Must comply with limits on fecal coliform for source water (fecal coliform ≤ 20/100 mL in 90 percent of samples for previous 6 months this system served public). | Marysville in compliance |
| Disinfection | Meet disinfection requirements including specified CT times for 99.9 percent inactivation of *Giardia lamblia* cysts and 99.99 percent inactivation of enteric viruses. CT requirements vary depending upon water temperature and pH. | Marysville in compliance |
| Disinfection | CT for system must be calculated daily based upon peak daily flows to determine contact times. | Marysville in compliance |
| Disinfection | Disinfection system redundant components including an auxiliary power supply or an automatic shut-off of water to the distribution system whenever there is less than 0.2 mg/L of residual disinfectant at entrance to distribution system. | Marysville in compliance |
| Watershed Control | Must maintain a watershed control program to restrict human activities and the potential for contamination by *Giardia lamblia* cysts and *Cryptosporidium* oocysts. | Conducted according to DOH approved plan (last updated in 2001) |
| Watershed Control | Complete annual DOH watershed surveys.<br>Complete system sanitary surveys every five years. | Last annual DOH watershed report prepared for 2007 and dated April 2008. |
| Watershed Control | Must have an annual on-site inspection to assess watershed control program and disinfection treatment process | DOH performs annually |

* Based on 2006 City of Marysville SWTR Annual Report – Edward Springs Source

Watershed Water Quality. In 2005, Marysville began conducting continuous on-line monitoring of raw water quality turbidity of the Edward Springs collector wells source prior to joining with the water from the three deeper wells and prior to disinfection. Should the source turbidity exceed 0.95 NTU, the automatic bypass valve closes and diverts all of the turbid water to Cougar Creek via the treatment facility effluent channel and overflow.

Marysville also samples for fecal coliforms four days per week. This monitoring provides valuable data to evaluate any effects of Marysville's maintenance activities in the watershed, as well as the effects of unauthorized activities if any are identified to have occurred. Marysville also performs source water quality monitoring of radionuclides, secondary contaminants, inorganic compounds, volatile organic compounds, synthetic organic compounds, and arsenic in accordance with current drinking water regulations described previously.

Marysville also performs daily and weekly inspections and patrols of the watershed area and biweekly patrols of the perimeter of the 300-acre parcel. Marysville-designated Watershed Manager regulates these activities and implements corrective measures when they are required to reduce contamination risks in the watershed.

Disinfection. In 2004, Marysville built a bulk-delivery sodium hypochlorite chlorine disinfection facility with the ability to install UV disinfection at a later date for the Edward Springs system. The treatment facility is located at the Edward Springs Reservoir site. Marysville monitors daily CT inactivation ratio based on the peak flow out of the reservoir, the minimum chlorine residual measured at the reservoir outlet, and the minimum reservoir level each day. According to the 2006 Marysville SWTR Annual Report for the Edward Springs Source, Marysville calculated daily CT(calculated):CT(99.9) inactivation ratios ranging from 1.02 to 7.14 during 2006, with no inactivation ratio values less than 1.00. Based on this information, Marysville has continued to comply with WAC 246-290-690(3)(a)(i) to remain unfiltered.

UV was selected to meet the requirements of the LT2ESWTR, which requires unfiltered surface water (and unfiltered GUI) supplies to achieve a minimum of 2-log inactivation for *Cryptosporidium* by 2012. The UV system is planned to be in service by 2011.

Surface Water Quality. The outlet from the Edward Springs reservoir is considered the entry point to Marysville's distribution system. During 2006, the minimum residual chlorine concentration at the Edward Springs Reservoir was 0.51 mg/L, which was well above the minimum concentration of 0.2 mg/L required per WAC 246-290-692(4)(a). Marysville also maintains an automated system to close off the surface intake if the residual drops below a low-level set point, thus ensuring compliance with the 0.2 mg/L entry-point requirement.

Marysville collects eight chlorine residual grab samples per week from any of 11 sampling locations in the north end of the distribution system. Data collected by Marysville from January 2006 through December 2006 showed that detectable chlorine residual was maintained in the distribution system to the last customer. All samples exhibited a detectable residual, with the minimum residual reported as 0.3 mg/L. Through this monitoring, Marysville has shown that it continued to meet this criterion to remain unfiltered in 2006.

### *South Service Area – Purchased Surface Water from Everett*

South system area customers are served with water purchased from the City of Everett. As stated previously, the City of Everett is responsible for ensuring compliance with the SWTR and IESWTR regulations for the Everett supply. However, DOH has a policy that addresses

requirements for systems that purchase completely treated water form another public water system. Per this policy, Marysville is required to maintain a detectable residual within the distribution system and monitor for chlorine residual at the same time and location as total coliforms are sampled in the system (under the Total Coliform Rule). For the 2006 and 2007 timeframe, monitoring results for chlorine residual showed that Marysville was in compliance with SWTR requirements as a purchaser of treated water, per DOH policy.

**Recommendation for Continued Compliance with SWTR and Interim Enhanced SWTR**

*Filtered System – Stillaguamish River Water Treatment Plant*
No recommended changes to current program implemented by Marysville.

*Unfiltered System – Edward Springs Source*
No recommended changes to current program implemented by Marysville.

*South Service Area – Purchased Surface Water from Everett*
No recommended changes to current program implemented by Marysville.

## 7.4.5. Long Term 2 Enhanced Surface Water Treatment Rule

**Regulatory Elements**

The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) was published in the Federal Register on January 5, 2006 and became effective March 6, 2006. The rule was developed as part of the Stage 2 Microbial/Disinfection By-Products cluster, which was intended to improve public health protection against waterborne pathogens, specifically *Cryptosporidium*, while addressing risk trade-offs associated with exposure to chemical disinfectants and DBPs. *Cryptosporidium* is resistant to chlorination. The LT2ESWTR applies to public water systems that distribute or wholesale surface water or groundwater under the direct influence of surface water (e.g., Subpart H systems). It builds upon, without replacing, the requirements of the SWTR and IESWTR.

The LT2ESWTR seeks to lower the concentration of *Cryptosporidium* in finished drinking water supplies to less than one oocyst per 10,000 liters. The approach involves the identification of source water vulnerability to *Cryptosporidium* occurrence and implementation of treatment and control strategies appropriate to the level of risk. For the first time, the LT2ESWTR imposes *Cryptosporidium* treatment requirements for unfiltered surface water systems. This was mandated to ensure a comparable level of public health protection as filtered systems. The rule also contains requirements for disinfection profiling and benchmarking, as well as measures to protect uncovered finished water storage reservoirs from contamination risks.

The LT2 Rule establishes the following types of requirements:

- Two distinct rounds of source water monitoring for *Cryptosporidium* and *E. coli*

- Profiling and benchmarking requirements
- Treatment technique requirements
- Microbial toolbox for meeting inactivation requirements
- Covering finished water storage facilities
- Sanitary surveys

### *Filtered Sources*

Filtered water systems will be classified into one of four treatment categories, or bins, based on the *Cryptosporidium* monitoring results from grandfathered data or from the first two-year round of monitoring. Systems in bins associated with a higher risk for *Cryptosporidium* will be required to provide additional treatment for removal of *Cryptosporidium*. Systems may be required to add treatment to provide up to 2.5-log removal of *Cryptosporidium*, based on the requirements associated with the bin. Systems select appropriate treatment or source water management activities from the USEPA's Microbial Toolbox.

Systems that store water in open reservoirs after treatment will be required to either cover these reservoirs or provide treatment at the reservoir effluent to provide inactivation of viruses, *Giardia lamblia*, and *Cryptosporidium*.

Finally, systems will be required to conduct disinfection benchmarking when making significant changes to disinfection practices. Benchmarking aims to ensure continued compliance with both LT2 and Stage 2 Rules after implementing any necessary changes.

Systems that are consecutive systems, purchasing some or all of their water from another system, and systems that sell water wholesale must comply with the LT2 Rule on the same *schedule* based on the largest system in the combined distribution system. A combined distribution system consists of the interconnected wholesale systems and consecutive systems that receive finished water from those wholesale system(s).

### *Unfiltered Sources*

The key elements of the rule applicable to the Marysville unfiltered source (Edward Springs and associated wells) include the following:

- initial source water monitoring
- determination of mean *Cryptosporidium* concentration
- disinfection profiling and benchmarking
- implementation of treatment options from the microbial toolbox
- future source water monitoring

<u>Initial Source Water Monitoring</u>. Under the LT2ESWTR, surface water systems that serve 10,000 or more people (e.g., large systems) must conduct monthly source water monitoring of *Cryptosporidium* for 24 consecutive months. Historical data may be "grandfathered" providing it meets specific eligibility requirements established in the rule.

<u>Disinfection Requirements</u>. The LT2ESWTR requires that unfiltered surface water systems provide *Cryptosporidium* treatment via disinfection. The level of inactivation required is either 99% (2-log) or 99.9% (3-log), depending on the mean oocyst concentration determined from the initial source water monitoring period. Unfiltered systems will be required to use chlorine dioxide, ozone, or ultraviolet (UV) irradiation to meet the *Cryptosporidium* inactivation

requirement and at least two separate disinfectants in order to meet the combined *Cryptosporidium*, *Giardia lamblia*, and viral inactivation requirements. Each disinfectant must be able to achieve the total inactivation required for *Cryptosporidium*, *Giardia*, or viruses separately.

Disinfection Profiling. Disinfection profiling involves tracking the inactivation of specific pathogens over a period of time. The LT2ESWTR includes disinfection profiling and benchmarking requirements to ensure water systems maintain adequate protection against microbial pathogens as they take steps to simultaneously comply with the Stage 2 DBP Rule. Water systems will be required to develop *Giardia* and virus disinfection profiles and calculate microbial benchmarks if they plan to make a significant change to their disinfection practice following the initial source water monitoring period. A significant change is defined as moving the point of disinfectant application, changing the disinfectant, and/or changing the disinfection process.

Future Source Water Monitoring. Water systems will be required to conduct additional monitoring in the future to confirm or revise the initial assessment of source water quality. The additional monitoring will be required beginning six years after initial bin classification. Over the next several years, the EPA may modify the sampling or analytical requirements from those required for the initial round of monitoring.

## Marysville Status

### *Filtered Source – Stillaguamish Ranney Well Collector*

Marysville must collect one source water sample at the Stillaguamish Ranney Collector each month for 24 months. Sample analyses are conducted by a certified laboratory approved for analysis of *Cryptosporidium* using method EPA 1622 and/or 1623. E. coli analysis must be conducted by a certified laboratory using a method approved in the LT2 Rule. Turbidity sampling is conducted in accordance with state requirements.

As a Schedule 1 system, Table 7-11 provides a schedule of the LT2 Rule requirements for Marysville. Marysville prepared and submitted an LT2 Monitoring Plan in January, 2006.

**Table 7-11 Timeline for Marysville's LT2 Compliance**

| Milestone | Date |
|---|---|
| Final LT2 Rule was published | January 5, 2006 |
| LT2 ESWTR became effective | March 6, 2006 |
| Begin 24 months of monitoring | October 2006 |
| Submit bin classification | April 1, 2009 |
| Begin second round of monitoring | April 2015 |

### *Unfiltered Source - Edward Springs Supply*

Marysville will need to comply with the LT2ESWTR for its Edward Springs supply according to the schedule established for Schedule 1 water systems.

Initial Source Water Monitoring. Marysville has submitted its intent to provide maximum treatment for 3-log *Cryptosporidium* inactivation (assuming it retains its unfiltered status) and thus meet the monitoring avoidance criteria of the LT2ESWTR.

Disinfection Requirements. As described previously, Marysville built a chlorine disinfection system for the Edward Springs source in 2004. To retain unfiltered status of Edward Springs, Marysville will install a UV disinfection system in 2011 to comply with the additional *Cryptosporidium* treatment requirements.

Disinfection Profiling. Although Marysville will be required to provide an additional disinfectant barrier to meet the Cryptosporidium inactivation requirement, it would only be required to profile and benchmark if it elected to modify its existing chlorination practices. Marysville is not planning to modify its chlorination system and therefore is not required to perform disinfection profiling.

**Recommendations for Compliance with LT2 ESWTR**

Marysville should conduct monitoring according to the *Long Term 2 Enhanced Surface Water Treatment Rule Monitoring Plan* submitted January 2006 to ensure compliance with the requirements of the final rule for the filtered source (Stillaguamish Ranney Well Collector) and the unfiltered source (Edward Springs). No recommended changes to the current LT2 Monitoring Plan.

## 7.4.6. Groundwater Rule

**Regulatory Elements**

The Groundwater Rule (GWR), promulgated November 8, 2006, applies to all public water systems that use groundwater for all or part of the drinking water system, unless the groundwater sources are under the influence of surface water or groundwater and surface water are blended prior to treatment. The GWR contains these primary elements:

- Sanitary surveys
- Source water monitoring,
- Corrective action treatment requirements, and
- Public notification requirements.

Systems must be in compliance with all requirements except for the sanitary surveys requirement by December 1, 2009. States must conduct the first cycle of sanitary surveys by December 31, 2012.

Further details on each primary element are below.

### *Sanitary Surveys*

The GWR requirement for sanitary surveys builds on existing requirements related to the SWTR/IESWTR Rules. However, the GWR adds requirements for frequency, scope of surveys, survey documentation, and corrective actions. DOH must conduct sanitary surveys every three

years, or five years if the system meets specified performance criteria. The sanitary survey must include eight elements:

- Source
- Treatment
- Distribution system
- Finished water storage
- Pumps, pump facilities, and controls
- Monitoring, reporting, and data verification
- System management and operation
- Operator compliance with State requirements.

If DOH identifies a significant deficiency during the course of the sanitary survey, the State must notify the system within 30 days and may specify the appropriate corrective action. The groundwater system has 120 days to take the corrective action or develop a State-approved plan for being in compliance.

### *Source Water Monitoring*

Systems which do not provide 4-log treatment of viruses at groundwater sources may be required to conduct source water monitoring for fecal indicators. The GWR specifies two types of source monitoring: assessment monitoring and triggered monitoring. DOH could require systems to conduct assessment source water monitoring for fecal indicators on a case-by-case basis at each source each month for one year. Groundwater systems will be required to conduct triggered source water monitoring within 24 hours of a positive total coliform sample to determine whether the coliform presence is due to fecal contamination of the source. Triggered monitoring requires systems to collect a source water sample from each groundwater source in use when the positive sample occurred.

DOH will determine whether groundwater systems must conduct assessment source water monitoring and will specify the appropriate fecal indictor. The GWR indicates that States could require systems to monitor for *E. coli*, enterococci, or coliphage.

### *Corrective Action Treatment Requirements*

If it is determined that a system has a significant deficiency, either through the results of a sanitary survey or source water monitoring, the system will be required to implement corrective actions. The GWR specifies that corrective actions are:

- Correct significant deficiencies
- Provide an alternative source of water
- Eliminate the source of contamination
- Provide treatment that reliably achieves at least 4-log treatment of viruses.

### *Public Notification Requirements*

The GWR also establishes requirements for notifying the public according to the type of violation incurred by the groundwater system.

### Marysville's Status and Recommendation for Continued Compliance

This rule applies to Marysville's Lake Goodwin Well and Edward Springs Well Nos. 1-3. 4-log treatment of viruses and continuous chlorine residual monitoring will be provided for both sources, prior to December 2009. Marysville should notify DOH of their plan to provide 4-log disinfection prior to December 1, 2009. DOH will follow up with Marysville to verify disinfectant residual concentrations and treatment records. Beginning December 1, 2009, Marysville will be required to conduct Treatment Technique Compliance Monitoring that demonstrates continuous monitoring of disinfectant concentration. Marysville will be required to maintain the minimum disinfectant residual concentration agreed to with DOH. DOH will be required to conduct sanitary surveys every 5 years for community water systems that provide 4-log treatment of viruses.

## 7.4.7. Wellhead Protection Program

### Regulatory Summary

Per WAC 246-290-135(3), public water systems are required to implement a Wellhead Protection Program (WHPP) to protect their groundwater supplies. Source water protection programs are planning tools to be used by water utilities to identify potential sources of water contamination, and to protect existing and future drinking water supplies. The objective is to minimize risk of accidental releases of contaminants in areas contributing water to the public water supply system. The three basic elements of a source water protection plan are:

- Definition of the Wellhead Protection Area (WHPA) for the area of recharge directly contributing to a water supply. A WHPA is defined as an area contributing to a source within a specified amount of time.
- Inventory of land uses and identification of potential sources of contamination within the WHPA or watershed.
- Management strategies including emergency spill response and contingency plans to minimize or eliminate the possibility of potential contamination of the water supply.

### Marysville Status

A WHPP update has been prepared for the Marysville system, which includes a definition of the WHPA, an inventory of land use and identification of potential sources of contamination, and management strategies for protecting the water supply.

### Recommendations for Continued Compliance

Marysville should implement WHPP activities as planned pertaining to security, water quality monitoring, and education.

## 7.4.8. Filter Backwash Rule

### Regulatory Summary

The concern with recycling filter backwash water is the potential increase or reintroduction of certain contaminants at the plant effluent. Potential recycle contaminants of concern are disinfectant-resistant pathogens such as *Cryptosporidium, Giardia, Cyclospora, Toxoplasma,* and *Microsporidia*; also, total and assimilable organic carbon, and metals such as manganese, aluminum and iron. To be recycled, backwash water must be returned to the system prior to the treatment processes. The water cannot be released to the filter effluent line without first receiving treatment. Under the rule, direct filtration plants are also required to collect information on their filtration and backwash recycling systems and maintain a file of that information for potential review by DOH (WAC 246-290-660(4)).

### Marysville Status

Marysville currently operates a membrane filtration plant at the Stillaguamish River Water Treatment Plant. Backwash is not recycled at the treatment plant. As such, this Rule does not apply to the Stillaguamish Ranney Collector source.

# 7.5. Effective Distribution System Water Quality Regulations, Status and Recommendations

This section summarizes effective water quality regulations pertaining to the distribution system and applicable to Marysville during the 2001-2006 review period. A discussion of each rule and Marysville's status follows.

## 7.5.1. Lead and Copper Rule

### Regulatory Summary

Lead and copper are metals that may be found in household plumbing materials and water service lines. Lead can cause a variety of negative health impacts, including delaying physical and mental development in infants and children. Copper can cause aesthetic issues in addition to short-term and long-term negative health impacts. The Lead and Copper Rule establishes action levels, monitoring, and compliance requirements for lead and copper levels at customers' taps. To meet the established action levels, 90 percent of all samples must have lead levels equal to or less than 0.015 mg/L and copper levels equal to or less than 1.3 mg/L. If these action levels cannot be met, systems must implement public education and a corrosion control treatment strategy for meeting these levels.

### 2007 Short-Term Regulatory Revisions and Clarifications

The USEPA initiated a review of the LCR implementation across the nation in 2004. This effort was focused on determining whether national lead levels are increasing in the US. As a result of this effort, the USEPA identified several targeted changes to the existing regulation that would meet short-term goals for improving implementation of the Lead and Copper Rule. These revisions were finalized in October 2007 and became effective in December, 2007. USEPA identified a number of other issues that will be reviewed in future and potentially contribute to longer-term, comprehensive changes to the Lead and Copper Rule.

The short-term revisions (Table 7-12) are intended to enhance implementation of the Lead and Copper Rule in the areas of monitoring, treatment, customer awareness, and lead service line replacement. Additionally, these revisions focus on improving compliance with public education requirements of the Lead and Copper Rule to ensure that consumers receive meaningful and timely information that assists in limiting exposure to lead in drinking water.

**Table 7-12 Areas of LCR Revisions**

| Activity | Proposed Rule Revision |
|---|---|
| Monitoring | The revisions clarify language in the rule regarding the number of samples required and the number of sites from which samples should be collected.<br>The revisions also modify definitions for monitoring and compliance periods to make it clear that all samples must be taken within the same calendar year.<br>The revisions clarify the reduced monitoring criteria that would prevent small and medium water systems above the lead action level or large systems deemed to no longer meet Optimum Corrosion Control Treatment (OCCT) from remaining on a reduced monitoring schedule. |
| Treatment or Source Water Changes | The revisions to the LCR require water systems to provide advanced notification to the primacy agency of intended changes in treatment or source water that could impact long-term water quality. The state primacy agency must approve the planned changes using a process that will allow the states and water systems to take as much time as needed for systems and states to consult about potential problems. |
| Customer Awareness | While many water utilities may provide the results of monitoring to customers at lead and copper monitoring sites, there is no requirement in the regulations for them to do so. To address this issue, the Agency is proposing changes to the regulation that require utilities to provide a notification of tap water monitoring results for lead to owners and/or occupants of homes and buildings that are part of the utility's sampling program. |
| Public Education | While EPA requires water systems to deliver public education materials after a lead action level exceedance, there are some changes to the content, delivery and timeframe of the message. Systems must partner with additional organizations to disseminate the message to at-risk populations. In addition there are changes in the ways that information is disseminated to ensure water systems reach consumers when there is an action level exceedance. In addition EPA now requires educational statements about lead in drinking water to be included in all Consumer Confidence Reports. |
| Lead Service Line Replacement | The current regulations allow utilities to consider lead service lines that test below the action level as "replaced" for the purposes of compliance. The new revisions to the rule require utilities to reconsider previously "tested-out" lines when resuming lead service line replacement programs. |

## Marysville Status

Marysville is in compliance with the Lead and Copper Rule in the north service area and has been on a DOH-approved reduced monitoring schedule for lead and copper since the Rule became effective. Marysville is required to collect a minimum of 20 samples in the service area once every three years. Sampling occurred in 2006 in accordance with DOH requirements. Results are summarized in Table 7-13.

For the south service area, Marysville participates in the City of Everett's regional lead and copper sampling program. The City of Everett, in cooperation with other water purveyors that it supplies (including Marysville), collects samples from a minimum of 125 taps from selected locations throughout all of the distribution system carrying Everett-treated water. Six of these samples were collected from homes within Marysville's south service area in 2006.

**Table 7-13 Lead and Copper Tap Monitoring Results***

| Year | Marysville North Service Area | | Everett Regional Tap Monitoring Results (Including Marysville South Service Area) | |
|---|---|---|---|---|
| | Lead (mg/L) | Copper (mg/L) | Lead (mg/L) | Copper (mg/L) |
| 2000[b] | 0.003 | 0.77 | 0.006 | 0.19 |
| 2006 | 0.002 | 0.248 | 0.003 | 0.072 |

* The 90th percentile action level (AL) collected at the tap is 0.015 mg/L for lead and 1.3 mg/L for copper.
b Based on the maximum 90th percentiles from 1998 and 2000 data as reported in the Marysville 2002 Water System Plan Update.

### Recommendation for Continued Compliance with Primary Regulations

Continue to follow DOH direction on frequency of sampling events and number of samples. Marysville is currently preparing a LCR Compliance Monitoring Plan. Continue preparation of and update as needed the LCR Compliance Monitoring Plan.

Revisions that impact Marysville are related to public notification and consumer awareness, and can be affected by treatment and source water changes. Marysville should review existing lead and copper monitoring activities to ensure compliance with regulations and make updates to existing public notification practices as needed.

## 7.5.2. Total Coliform Rule

### Regulatory Summary

The Total Coliform Rule (TCR) requires water systems to monitor their distribution system for the presence of coliform bacteria, a surrogate used to indicate possible contamination of fecal origin. Marysville performs monitoring as outlined in their updated *Coliform Monitoring Plan* (Appendix 7-1). Monitoring is required at representative sites on a monthly basis, with the sample quantity dependant on the size of the population served. Community water systems with service populations between 50,001 and 59,000 are required to take 60 representative samples monthly throughout the system. All samples testing positive for total coliform must be followed by repeat sampling and additional testing to determine if *E. coli* is present.

Under the TCR, there are two types of violations: acute and non-acute. An acute MCL violation for coliform is based on the presence of either fecal coliform or *E. coli* in a repeat sample, or coliform presence in a repeat sample collected as a follow-up to a sample indicating the presence of fecal coliform or *E. coli*. A non-acute MCL violation for coliform occurs under the following conditions: a system that collects 40 or more coliform samples per month (corresponding to a service population of at least 33,001) has more than 5% of the routine samples taken in one month test positive for the presence of total coliform; or a system that collects fewer than 40 coliform samples per month has more than one coliform detection.

### Marysville Status

Marysville is incompliance with the Total Coliform Rule and WAC 246-290-300(3). Marysville collects at least 60 routine coliform samples per month at locations throughout the North and

South service areas, as well as entry-point coliform sampling each day that routine or repeat samples are collected. The regulatory limit of 5% of samples testing positive has never been exceeded in either service area. Data collected between 2001 and 2006 indicate the maximum percentage of positive samples was 3%.

### Recommendation for Continued Compliance with the Total Coliform Rule

Marysville should continue updating the Coliform Monitoring Plan to reflect current population and monitoring requirements. Follow developments pertaining to the TCR revision process currently underway, as described later in this section.

## 7.5.3. Stage 1 Disinfectants/Disinfection By-Products Rule

### Regulatory Elements

Disinfection by-products (DBPs) result from the reaction of natural organic matter (NOM) and various inorganic precursors with chemical disinfectants. Toxicological research has shown that many DBPs have carcinogenic and other adverse properties when ingested for long periods of time. In 1979, the EPA enacted the Total Trihalomethane Rule, which set an interim MCL for total trihalomethanes (TTHM) of 0.1 mg/L as a running annual system-wide average based on quarterly monitoring within the distribution system. This rule applied to water systems using a chemical disinfectant and serving over 10,000 customers.

In 1998, the EPA promulgated the Stage 1 Disinfectants/Disinfection By-Products (D/DBP) Rule to further reduce the DBP levels in drinking water. The Stage 1 D/DBP Rule, which applies to all CWS and NTNC water systems that apply a primary or secondary chemical disinfectant to their water supply, became effective in January 2002 for large systems (those serving 10,000 or more people) and January 2004 for small systems (those serving less than 10,000 people).

The Stage 1 D/DBP Rule established new MCLs for chlorite, bromate, and the sum of five haloacetic acids (HAA5) (0.060 mg/L), and established maximum residual disinfection levels (MRDLs) for chlorine (4.0 mg/L), chloramines, and chlorine dioxide. It also lowered the MCL for TTHM (0.080 mg/L) and set total organic carbon removal requirements for systems using conventional filtration.

### Marysville Status

DOH has directed Marysville to test for TTHM and HAA5 at 8 locations per quarter within the North service area. Four samples are collected from each of the Edward Springs and Stillaguamish service areas. The monitoring locations should represent three average residence time and one maximum residence time locations for each source. For the Edward Springs and Stillaguamish sources, one short residence time, two average residence times and one longest residence time monitoring locations were used for compliance with the Stage 1 DBP Rule. These sites were recently updated to better reflect current operating conditions in 2006 as part of Marysville's IDSE compliance process, described below under the Stage 2 Disinfectants/Disinfection By-Product Rule.

A review of DBP data collected between 2002 and 2006 (Figures 7-1 and 7-2) indicated that the North service area had been consistently in compliance with the requirements of the Stage I D/DBP Rule. The average annual TTHM level in the North System, averaging all eight sites, was 19.5 µg/L. The average annual HAA5 level in the North system, again averaging all eight sites was 14.6 µg/L.

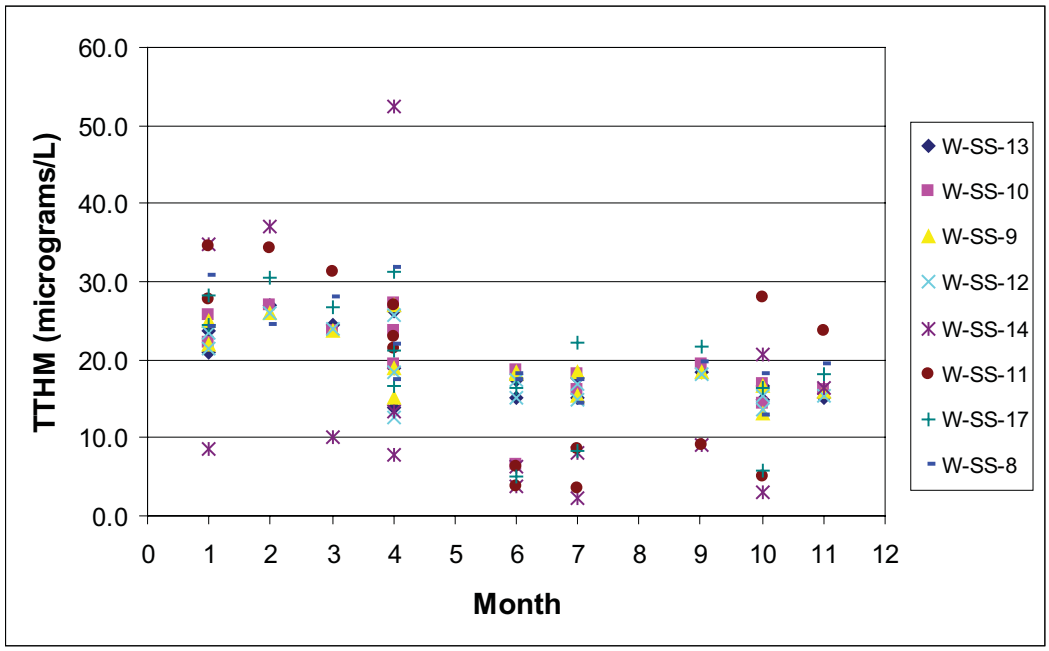



**Figure 7-1 North System TTHM Samples Collected at Eight Sites from 2002-2006**

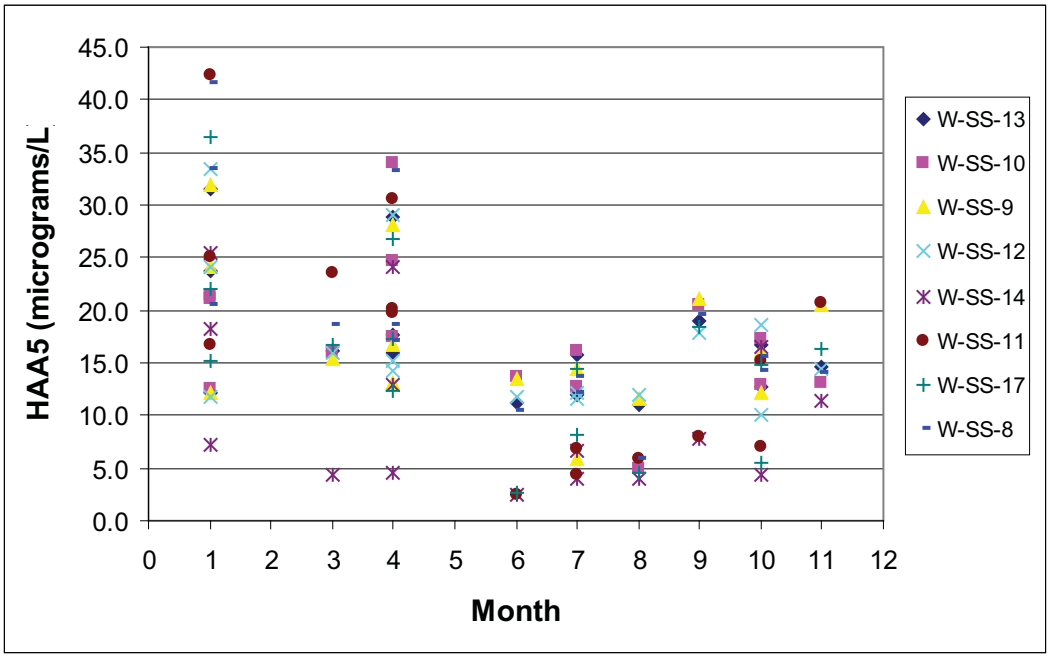



**Figure 7-2 North System HAA5 Samples Collected at Eight Sites from 2002-2006**

Marysville has prepared a written D/DBP Monitoring Plan for the North service area. The Plan includes:

- THM4, HAA5, and disinfectant monitoring locations.
- Procedure for calculating compliance with disinfectant MRDLs, as well as THM4 and HAA5 MCLs.
- Evidence that the D/DBP Monitoring Plan reflects entire distribution system and each disinfected source of supply.

DOH has interpreted the Stage 1 D/DBP Rule such that compliance is required only for systems actually conducting chlorination. Thus, DOH has determined that DBP samples are not required for purchased sources if the purchasing system does not rechlorinate. This means that no DBP samples are required from Marysville's south service area. However, Marysville collected and analyzed samples quarterly for TTHM and HAA5 at one site in the South System. Figures 7-3 and 7-4 show the data collected at a sampling station located at the 5900 block of 51st Avenue for TTHM and HAA5 in the South System, respectively. The average annual TTHM level for samples taken at 5900 51st Avenue is 35.0 micrograms/L. The average annual HAA5 level for all samples taken at the same location is 29.6 micrograms/L.

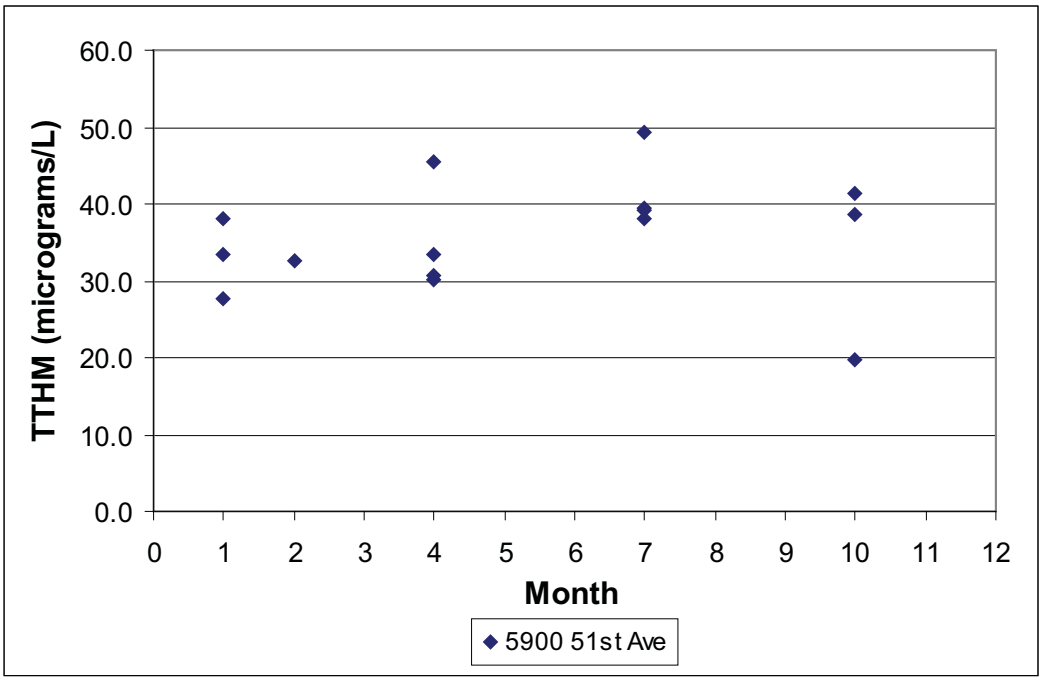



**Figure 7-3 South System TTHM Samples Collected 5900 51st Ave Site from 2002-2006**

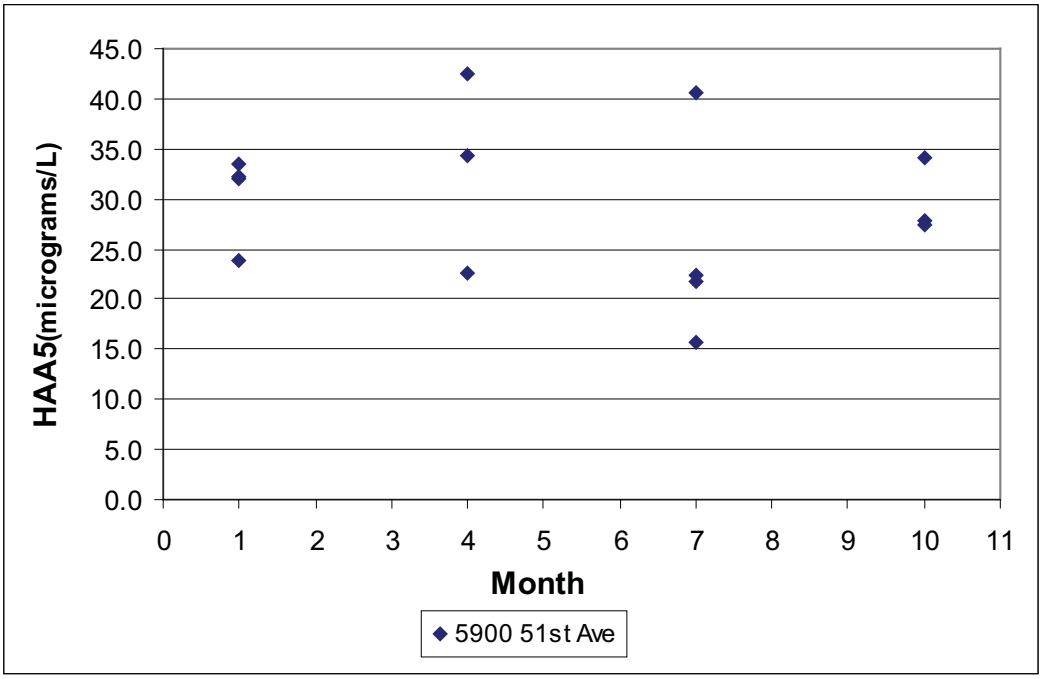



**Figure 7-4 South System HAA5 Samples Collected at 5900 51st Ave Site from 2002-2006**

**Recommendations for Compliance with Stage 1 D/DBP Rule**

Marysville recently updated its Stage 1 DBP monitoring plan to better reflect current operating conditions in the North service area. Marysville should continue monitoring according to its Stage 1 plan, and update as needed to reflect changing conditions in the North service area as needed, until the Stage 2 DBP Rule becomes effective. Marysville should continue to collect voluntary samples in its South service area to maintain an historical record of DBP levels associated with water purchased from the City of Everett.

## 7.5.4. Stage 2 Disinfectants/Disinfection By-Products Rule

The Stage 2 DBP Rule was published in the Federal Register on January 4, 2006. The rule was developed to provide more equitable protection against DBPs on a system-wide basis by changing the compliance monitoring provisions. The Stage 2 DBP Rule applies to community and NTNC water systems that serve drinking water treated with a primary or secondary chemical disinfectant. The Stage 2 DBP Rule does the following:

- Changes the method of calculating DBP regulatory compliance to a locational running annual average (LRAA) of quarterly samples, in which the system calculates a running annual average for each DBP monitoring location instead of calculating a running annual average for the entire system.
- Reestablishes the location and number of DBP monitoring sites. The rule requires systems to conduct an Initial Distribution System Evaluation (IDSE) to select Stage 2 DBP monitoring

locations in areas of the distribution system with elevated DBP levels. Additionally, the final Stage 2 DBP Rule requires systems to determine monitoring requirements based on population.

- Establishes DBP operational evaluation levels for each monitoring site which are calculated as 25% of the sum of the two previous quarter's results plus twice the current quarter's monitoring result. A system that exceeds this level is required to conduct an operational evaluation, i.e., evaluating their distribution system operations to determine ways to reduce DBP levels. The system is required to notify the state of an operational evaluation level exceedance and submit evaluation results within 90 days of the exceedance.
- Consecutive systems that purchase drinking water carrying a disinfectant are required to implement Stage 2 DBP requirements on the same schedule as the largest water system in their combined distribution system.

The first step in complying with the Stage 2 DBP Rule was to conduct an IDSE. The goal of the IDSE is to identify areas that have routinely higher DBP concentrations than other areas in the distribution system and use this information to select monitoring locations for long-term Stage 2 DBP compliance monitoring.

The Stage 2 DBP Rule compliance schedule is shown in Table 7-14.

**Table 7-14 Stage 2 DBP Rule Compliance Schedule**

| Schedule | Population of System or Largest System in Combined Distribution System | Submit IDSE Plan or 40/30 Certification by: | Complete IDSE Report | Begin Stage 2 Compliance Monitoring |
|---|---|---|---|---|
| 1 | ≥ 100,000 | Oct. 1, 2006 | Jan. 1, 2009 | Apr. 1, 2012 |
| 2 | 50,000 – 99,999 | Apr. 1, 2007 | Jul. 1, 2009 | Oct. 1 2012 |
| 3 | 10,000 – 49,999 | Oct. 1, 2007 | Jan. 1, 2010 | Oct. 1, 2013 |
| 4 | < 10,000 | Apr. 1, 2008 | July 1, 2010 | Oct. 1, 2013 |

### Marysville Status

The Marysville system is classified as Schedule 1 because Marysville purchases water from the City of Everett and is in a combined distribution system with Alderwood Water and Wastewater District. Accordingly, Marysville abides by the schedule of the largest system in the combined distribution system. As a Schedule 1 system, Marysville was required to complete a Standard Monitoring Plan by October 1, 2006. This plan was approved by EPA and Marysville began sampling per the Standard Monitoring Plan in October 2007. After completing one year of sampling, Marysville must develop an IDSE Report, which summarizes the IDSE sample collection results and recommends routine DBP monitoring locations. The IDSE Report must be completed by January 1, 2009. Routine monitoring for DBPs at 8 selected sites (selected per the protocol described in the Stage 2 Rule) will begin April 1, 2012. These monitoring locations will replace those required by the Stage 1 Rule.

### Recommendation for Compliance with Stage 2 D/DBP Rule

After completing one year of sampling by October 2008, Marysville must complete an IDSE Report and submit it to EPA by January 1, 2009. Marysville must begin routine monitoring for DBPs at the 8 selected sites on April 1, 2012 in place of monitoring per the Stage 1 Rule.

### 7.5.5. Asbestos Rule

**Regulatory Elements**

Asbestos monitoring is required as part of the Inorganic Monitoring under the Phase II Rule. Distribution system monitoring for asbestos is also required if a distribution system contains more than 10% asbestos-cement (AC) pipe. Systems with AC pipe must sample the distribution system at a tap served by the AC pipe and under conditions where contamination is most likely to occur. Monitoring under the asbestos rule is required once per nine years unless a sample exceeds the MCL of 7 million fibers per liter.

**Marysville Status**

Marysville's system contains less than 10% AC pipe and is therefore theoretically exempt from distribution system monitoring requirements of this Rule.

## 7.6. Other Effective Water Quality Regulations, Status and Recommendations

This section summarizes other effective water quality regulations applicable to Marysville during the 2001-2006 review period. A discussion of each rule and Marysville's status follows.

### 7.6.1. Consumer Confidence Reports and Public Notification Rule

**Regulatory Summary**

Under the Consumer Confidence Report (CCR) Rule promulgated in 1998, water systems are required to provide an annual CCR on the source of their drinking water and levels of any contaminants found. The annual report must be supplied to all customers and must include:

- Information on the source of drinking water;
- A brief definition of terms;
- If regulated contaminants are detected, the MCLG, MCL, and the level detected;
- If an MCL is violated, information on health effects; and
- If EPA requires it, information on levels of unregulated contaminants.
- Minimum requirements of the contents of the report per WAC 246-290-72001.

While the CCR provides annual "state-of-the-water" reports, the Public Notification Rule (PNR) directs utilities in notifying customers of acute violations when they occur. The PNR was revised in May 2000 and outlines public notification requirements for violations of MCLs, treatment techniques, testing procedures, monitoring requirements, and violations of a variance or exemption. If violations have the potential for "serious adverse effect," consumers and the State must be notified within 24 hours of the violation. The notice must explain the violation, potential health effects, corrective actions, and whether consumers need to use an alternate

water source. Notice must be made by appropriate media or posted door-to-door. Less serious violations must be reported to consumers within 30 days, in an annual report, or by mail or direct delivery service within one year depending on the severity of the violation.

**Marysville Status**

Marysville's first CCR was distributed in 1999. As required, Marysville has distributed CCRs to its customers prior to July 1 each year since 1999. As a purchaser of treated water, Marysville receives much of the water quality data that it publishes in the CCR for the south service area from the City of Everett. Marysville continues to improve the contents of its annual CCR, for example, recent enhancements to the CCR identify data as representative of either Marysville sources or the Everett-Marysville intertie supply. No acute violations have occurred since the promulgation of these rules and therefore the PNR has not been implemented.

**Recommendations for Continued Compliance with the Consumer Confidence Reporting Rule**

Consider posting CCR on Marysville's web page for easy access.

## 7.6.2. Operator Certification

The 1996 SDWA amendments require that states develop and implement an operator certification program. The regulation sets out minimum guidelines for such a certification program including operator classification and qualifications. These sections of the regulation require that:

- Each treatment facility and/or distribution system be placed under the direct supervision of a certified operator;
- Operator certification must be equal to or greater than the system classification being operated;
- All process control personnel must be certified;
- At least one certified operator be available on every shift;
- Operators must sit for, and pass, a validated exam demonstrating skills, knowledge, ability, and judgment necessary for the system classification; and
- Each operator has a high school diploma, GED, or State approved experience and training.

While the responsibility for developing the program lies with DOH, systems such as Marysville are required to bring all operators up to the level of certification as required.

**Marysville Status**

Marysville satisfies EPA and DOH operator certification requirements. As discussed in Chapter 8 Operation and Maintenance, all water system managers, supervisors, and water operators (except for standby personnel) have the appropriate water certification from DOH.

# 7.7. Anticipated Regulations

Table 7-15 provides a list of anticipated regulations, dates (some anticipated) of regulatory milestones, and regulated parameters. In addition to these anticipated regulations, Marysville can track potential regulations by keeping up-to-date with the Contaminant Candidate List (CCL). The CCL is the primary source used by the USEPA for establishing priority contaminants that may face future regulation. In February 2005, the USEPA issued the second CCL, which is comprised of 51 contaminants (9 microbial and 42 chemical) included on the previous list. In 2007, USEPA announced that it had made a preliminary regulatory determination for 11 of the 51 contaminants. The determination for all of these contaminants was that regulation was not required. Final determinations will be announced in 2008.

It is important that Marysville keep track of developments with respect to these proposed or anticipated regulations over the next six years.

**Table 7-15 Anticipated Regulations Under the Safe Drinking Water Act**

| Anticipated Regulation | Parameters Regulated | Date |
|---|---|---|
| Radon Rule | Radon | Proposed: Nov. 1999<br>Final Expected: 2008 |
| Revised Total Coliform Rule/Distribution System Rule | Total coliforms, fecal coliforms, *E. Coli, and potentially other distribution system contaminants, processes, and sources* | Proposed: Anticipated by 2009 |

## 7.7.1. Radon Rule

A proposed Radon Rule was released in October 1999 that provides two options for the maximum level of radon allowable in community water supplies. The SDWA has directed the USEPA to propose and finalize an MCL for radon-222 in drinking water, but also to make available a higher alternative MCL (AMCL) accompanied by a multimedia mitigation (MMM) program to address radon risks in indoor air. The proposed MCL is 300 pCi/L, and the proposed AMCL is 4,000 pCi/L. The drinking water standard that would apply to Marysville depends on whether or not the State develops a MMM program. The Rule is scheduled to be final in 2008.

### Marysville Status

As a groundwater source operator, Marysville needs to track the final Radon Rule and determine the best manner of compliance with the Rule. Since there has been a significant amount of time since the Rule's proposal and when it may be finalized, it is anticipated that the final regulation will be significantly different from the proposed Radon Rule. Marysville has not sampled for radon in its wells.

## 7.7.2. Total Coliform Rule Revisions/Distribution System Rule

As part of its six year review of existing regulations, USEPA has determined the need to revise the TCR. Revisions may include requirements to address finished water quality in the distribution system as well as evaluate additional or alternative monitoring strategies under the TCR that would be more cost-effective and maintain or improve public health.

The date for a proposed revised TCR and/or Distribution System Rule is uncertain at this time, but will unlikely occur prior to 2010. A Total Coliform Rule/Distribution System Federal Advisory Committee (TCRDS FAC) was convened, and an Agreement in Principal (AIP) was signed on September 18th, 2008. The charge to the FAC was to develop recommendations to EPA on revisions to the Total Coliform Rule (TCR) and on what information about distribution systems is needed to better understand and address possible public health impacts from potential degradation of drinking water quality in distribution systems.

The issues that the TCRDS Advisory Committee addressed include: TCR monitoring framework, sanitary survey provisions, definition of MCL violations and potential follow-up corrective actions, and communication of public health significance of violations. With regard to a potential Distribution System Rule, the TCRDS Advisory Committee considered the following: (1) evaluation of available data and research on aspects of distribution systems that may create risks to public health, (2) identification of priority data gaps, and (3) identification of data collection approaches (such as a data collection rule and/or additional research).

**Marysville Status**

Any developments with either rule will likely have impacts on Marysville. Revisions to the TCR will hopefully reduce monitoring and reporting burdens for water systems and states, while maintaining current levels of public health protection. It is quite possible these rules will require the use and documentation of best management practices within the distribution system, and/or monitoring associated with some of the topics covered in the Issue Papers listed above. Cross-connection control program implementation and documentation may be a primary focus.

## 7.8. Summary of Regulatory Status

A review of monitoring procedures and water quality results from 2001 to 2006 indicates Marysville was in compliance with all effective state and federal drinking water regulations during the review period. Table 7-16 provides a summary of applicable effective and promulgated regulations, Marysville's compliance status and recommendations for areas of improvement.

**Table 7-16 City of Marysville Summary of Applicable Regulations**

| Regulation | Requirements | Marysville Status | Compliance? | Recommendation |
|---|---|---|---|---|
| Phase I, II and V Regulations (IOC, VOC and SOCs) | • Monitoring | • Monitors<br>• Meets MCLs | Yes | • Continue monitoring as required |
| Arsenic Rule | • Monitoring | • Monitors<br>• Meets MCL | Yes | • Continue monitoring as required |
| Radionuclides | • Monitoring | • Monitors<br>• Meets MCLs | Yes | • Continue monitoring as required |

| Regulation | Requirements | Marysville Status | Compliance? | Recommendation |
|---|---|---|---|---|
| Surface Water Treatment Rule & Interim ESWTR | • Watershed Control Plan (Edward Springs)<br>• Monitoring | • Operates water filtration plant (Stillaguamish source)<br>• Operates an unfiltered system (Edward Springs source) | Yes | • Continue programs as currently implemented for both filtered and unfiltered sources |
| LT2 ESWTR | • Monitor watershed for Cryptosporidium & Giardia<br>• Measure turbidity with particle counters | • Operates water filtration plant<br>• Operates an unfiltered system | Yes | • Implement LT2 ESWTR Monitoring Plan submitted to EPA in January 2006 |
| Groundwater Rule | • Source monitoring<br>• Sanitary surveys | • Applies to Lake Goodwin Well and Edward Springs Well Nos. 1-3 | NA | • Keep up to date with DOH plans for Rule implementation in Washington. |
| Wellhead Protection Program | • Define WHPA<br>• Inventory<br>• Management strategies | • WHP Plan developed | Yes | • Implement WHP Plan recommendations |
| Lead and Copper | • Monitoring<br>• Public notification<br>• Treatment optimization | • Monitors<br>• Meets MCLs | Yes | • Complete preparation of formal monitoring plan<br>• Evaluate treatment or source water changes as needed<br>• Review existing monitoring activities for compliance with LCR updates |
| Total Coliform Rule | • Written Plan<br>• Monitoring | • Monitors<br>• Updating Written Plan | Yes | • Update Coliform Monitoring Plan as needed |
| Stage 1 D/DBP Rule | • Written Plan<br>• MCL Compliance | • Monitors<br>• Recently updated Plan | Yes | • Update monitoring locations as needed to reflect changing conditions in the North Service Area (modified Plan must be submitted and approved by DOH) |
| Stage 2 D/DBP Rule | • MCL compliance & increased parameter list | • Schedule 1 compliance | Yes | • Complete IDSE Monitoring<br>• Complete IDSE Report<br>• Begin routine DBP monitoring |
| CCR and Public Notification Rules | • Annual Reports<br>• Reporting as needed | Prepares annual CCR reports since 1998 | Yes | • Continue as required |

## 7.9. Laboratory Certification

Marysville uses two certified laboratories for sample analysis and a secondary laboratory. The two laboratories and their contact information are listed below.

AmTest Laboratories
14603 NE 87th Street
Redmond, WA 98052
425-885-1664

Lab/Cor, Inc.
7619 6th Ave NW
Seattle, WA 98117
206-781-0155

Edge Analytical Laboratories (secondary)
11525 Knudson Road
Burlington, WA 98231
Phone: 1-800-755-9295

## 7.10. Customer Water Quality Inquires

Marysville has a formal process to handle customer water quality inquiries. Marysville has an intake form where information is documented including the name, address, phone number, type of problem, and how long the customer has been experiencing the problem. The customer is advised that a city crew member will investigate the concern and respond back to the customer either in person, by phone or by door hanger. A service request is generated to the correct department, either water distribution or water quality, depending on the type of concern. If the concern is an emergency, the lead crew member is contacted via Nextel or phone to dispatch someone as soon as possible. After investigation of the problem, the service request is closed out by the appropriate department indicating the work that was done to resolve the concern.

From January 2002 through June 2007, a total of 1,328 water quality complaints and inquiries were documented (Table 7-17). Thirty percent of these calls were related to dirty water, 23 percent were related to low pressure, and 9 percent were related to taste and odor problems. Beginning in 2004, Marysville identified approximately 19% of inquiries related to water quality and/or fluoride. The remaining 19 percent pertained to other issues.

**Table 7-17 Customer Inquiries (January 2002 through June 2007)**

| Inquiry Type | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | Total | % |
|---|---|---|---|---|---|---|---|---|
| Dirty water | 104 | 78 | 38 | 62 | 75 | 39 | 396 | 30% |
| Taste & odor water | 32 | 27 | 16 | 22 | 12 | 11 | 120 | 9% |
| Water pressure | 27 | 38 | 96 | 87 | 38 | 20 | 306 | 23% |
| Water quality / fluoride | - | - | 51 | 93 | 74 | 36 | 254 | 19% |
| Other | 118 | 134 | - | - | - | - | 252 | 19% |
| Total | 281 | 277 | 201 | 264 | 199 | 106 | 1,328 | 100% |

# 7.11. Summary of Monitoring Requirements and Plans

Table 7-18 and Table 7-19 provide summary Monitoring Plans that coordinate source water and distribution system monitoring schedules for all Safe Drinking Water Act regulations. Table 7-18 covers the north system and Table 7-19 covers the south system. These plans provide a road map to regulatory compliance through 2012. The tables include the parameters to be monitored, sampling location, sampling frequency, and proposed actions for continued compliance. This is intended to be a guide; detailed requirements are available in WAC 246-290 and by contacting DOH. These do not include any DOH granted monitoring waivers.

*Intentionally left blank.*

## Table 7-18 Regulatory Compliance Road Map – North Service Area

| | Regulation | Parameter | Required Sites | 2008 | 2009 | 2010 | 2011 | 2012 | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Chemicals** | **Phase II and V Rules** | Inorganic Compounds (IOCs) | Sources* | Nitrate at all sources | Nitrate at all sources | Conduct full round of IOC Monitoring | Nitrate at all sources | Nitrate at all sources | IOC monitoring for Nitrate required annually. IOC monitoring for all other parameters required every three years. After 2010, next round will be 2013. |
| | | Asbestos | Distribution System | Per State, one sample required in 2008 | Per 2008 DOH WQMR, one sample required in 2009 | No activity | No activity | No activity | Theoretically not required since <10% of distribution system piping is comprised of asbestos-cement pipe. State requires one sample from area of distribution system served by AC pipe in 2009. Note: this site may be located in the North or South Service Areas. |
| | **Arsenic Rule** | Arsenic | Sources* | No activity | No activity | Conduct Monitoring | No activity | No activity | |
| | **Lead & Copper Rule** | Lead & Copper | Customer taps | No activity | Monitor at 20 locations | No activity | No activity | Monitor at 20 locations | Marysville is on reduced monitoring. Minimum of 20 samples should be collected every three years. |
| **Organic Chemicals** | **Phase I Rule** | Volatile Organic Compounds (VOCs) | Sources* | No activity | No activity | Conduct monitoring at all sources prior to December, 2010 | No activity | No activity | 1 VOC sample is required from all sources prior to December, 2010. |
| | **Phase II and V Rules** | Synthetic Organic Compounds (SOCs) | Sources* | State preparing Waiver Renewal – No Activity | 1 sample from each source for herbicides, general pesticides | 1 sample from each source for herbicides, general pesticides | Check with State regarding State Waiver renewal | Check with State regarding State Waiver renewal | State Waiver through 2010 for: Dioxin, Diquat, Endothall, EDB and other soil fumigants, Glyphosphate.<br><br>For herbicides and general pesticides, 2 samples are required every 3 years, therefore, for planning purposes, monitoring is shown for 2009 and 2010. However, State will inform Marysville of on-going waiver status in 2009. |
| **Radionuclides** | **Radionuclides Rule** | Beta/photon emitters | Sources* | Waiver received | Waiver received | Check with State | Waiver received | Waiver received | Assuming continued non-detectable results, Marysville will remain on reduced monitoring. Frequency of monitoring to be determined by the State. For planning purposes, Marysville should assume that monitoring for radionuclides will be required again by 2015. |
| | | Gross alpha | Sources* | Waiver received | Waiver received | Check with State | Waiver received | Waiver received | |
| | | Combined radium 226/228 | Sources* | No activity | No activity | Conduct monitoring | No activity | No activity | |
| **Microbiological Contaminants** | **Surface Water Treatment Rule (SWTR)** | Disinfectant residual | Distribution System Entry Points – Edward Springs Reservoir, Stillaguamish WTP Clearwell, Lake Goodwin Well<br><br>Distribution System TCR Sites | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Marysville must maintain a disinfectant residual ≥ 0.2 mg/L at entry points, and detectable residual (or HPC < 500 cfu/mL) at TCR sites, in 95% of monthly samples collected. |
| | **Long Term 2 Enhanced SWTR (LT2ESWTR)** | *Cryptosporidium, E. coli*, Turbidity | Stillaguamish Ranney Collector | Complete monthly monitoring at Stillaguamish source. | Submit data for Bin Classification by April 1 | No activity | No activity | No activity | LT2ESWTR Monitoring Plan for Stillaguamish source was submitted in January, 2006. Second round of monthly monitoring will begin in April, 2015.<br><br>Marysville has submitted its intent to provide maximum treatment for 3-log Cryptosporidium inactivation, thus meeting the monitoring avoidance criteria of the LT2ESWTR for the Edward Springs source. |
| | **Ground Water Rule (GWR)** | Coliforms and Fecal Indicators | Distribution System Entry Points – Lake Goodwin Well and Edward Springs Well Nos. 1-3 | Prepare for GWR | Prepare for GWR | Check with DOH for State-Specific Requirements | Check with DOH for State-Specific Requirements | Check with DOH for State-Specific Requirements | WA DOH recommends GWR preparation during 2008/2009. Refer to: http://www.doh.wa.gov/ehp/dw/RULES/331-390_01-15-08.pdf<br><br>Specific recommendations for preparations include: Contacting DOH to determine if 4-log inactivation of viruses is currently being provided at disinfected sources, correcting deficiencies noted in last sanitary survey, installing sampling tap at each wellhead, identifying specific areas served by each well, etc. |

**Table 7-18 Regulatory Compliance Road Map – North Service Area (Continued)**

| | Regulation | Parameter | Required Sites | 2008 | 2009 | 2010 | 2011 | 2012 | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | **Total Coliform Rule (TCR)**[1] | Total Coliforms | Distribution System TCR sites | Sample monthly | Sample monthly | Sample monthly | Sample monthly | Sample monthly | Marysville collects a total of 60 samples per month, system-wide. 28 samples are collected from the North service area each month. It is projected that Marysville will need to increase the system-wide sample pool to 70 sites per month in 2015, when the population exceeds 59,000. |
| **Disinfectants and Disinfection Byproducts** | **Stage 1 D/DBPR** | Chlorine Residual MRDL | Not required for South Service Area | Sample monthly | Sample monthly | Sample monthly | Sample monthly | Sample monthly | Ensure chlorine residual is below the maximum residual disinfectant level (MRDL) of 4mg/L. |
| | | Disinfection By-Products (TTHM, HAA5) | Eight Distribution System Locations | Sample quarterly | Sample quarterly | Sample quarterly | Sample quarterly | Refer to Stage 2 D/DBPR | Eight samples required per quarter (four from Stillaguamish and four from Edwards Springs service areas). The Running Annual Average (RAA) is used for compliance. |
| | **Stage 2 D/DBPR** | Disinfection By-Products (TTHM, HAA5) | Eight distribution system locations (system-wide) identified through IDSE process (Initial Distribution System Evaluation) | Collect data per standard IDSE monitoring plan from 2007 | Submit System-Wide IDSE Report by January, 2009 | No activity – continue with Stage 1 monitoring | No activity – continue with Stage 1 monitoring | Sample quarterly | Eight samples per quarter (system-wide) must be taken at locations identified through the IDSE. The Locational Running Annual Average (LRAA) will be used for compliance instead of Running Annual Average (RAA). |
| **Consumer Confidence Report (CCR)** | **Consumer Confidence Report Rule** | All detected regulated contaminants | N/A | CCR | CCR | CCR | CCR | CCR | Prepare and distribute CCR prior to July 1 each year. |

[1]An "Agreement in Principal" was recently signed (September, 2008) for a Revised Total Coliform Rule. The most significant potential revision that might impact Marysville includes elimination of the acute MCL for Total Coliform. Rather, systems that exceed 5% positive Total Coliform results in a given month will need to conduct a system assessment to identify and correct any deficiencies that may have contributed to the positive results. It is unlikely that a revised TCR will be promulgated prior to 2010. Marysville should continue to follow developments with the TCR process, as well as potential developments associated with distribution system water quality.
*Sources = Lake Goodwin Well, Edward Springs Well Nos. 1-3, Edwards Springs Shallow Collector, and Stillaguamish Ranney Well, unless otherwise indicated. Collect sample as near to source as possible, after treatment.

## Table 7-19 Regulatory Compliance Road Map – South Service Area

| | Regulation | Parameter | Required Sites | 2008 | 2009 | 2010 | 2011 | 2012 | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Chemicals** | **Phase II and V Rules** | Asbestos | Distribution Systems | No activity | No activity | No activity | No activity | No activity | Not required since <10% of distribution system piping is comprised of asbestos-cement pipe. |
| | **Lead & Copper Rule** | Lead & Copper | Customer taps | No activity | Follow Everett Regional Monitoring Plan | No activity | No activity | Follow Everett Regional Monitoring Plan | Marysville participates in Everett's regional monitoring program. Six locations in the South service area are included in the Regional Program. |
| | | Water Quality Parameters (pH, alkalinity, temperature) | Distribution system entry points | No activity | As above | No activity | No activity | As above | Marysville participates in Everett's regional monitoring program. |
| **Microbiological Contaminants** | **Total Coliform Rule (TCR)** | Total Coliforms | Distribution System TCR sites | Sample monthly | Sample monthly | Sample monthly | Sample monthly | Sample monthly | Marysville collects a total of 60 samples per month, system-wide. 32 samples are collected from the South service area each month. It is projected that Marysville will need to increase the system-wide sample pool to 70 sites per month in 2015, when the population exceeds 59,000. |
| | **Surface Water Treatment Rule (SWTR)** | Disinfectant residual | Distribution system entry point (Getchell Reservoir)<br><br>Distribution System TCR sites | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Monitor continuously<br><br>Sample monthly | Marysville must maintain a disinfectant residual ≥ 0.2 mg/L at entry points, and detectable residual (or HPC < 500 cfu/mL) at TCR sites, in 95% of monthly samples collected. |
| **Disinfectants and Disinfection Byproducts** | **Stage 1 D/DBPR** | Chlorine Residual MRDL | Not required for South Service Area | No activity | No activity | No activity | No activity | No activity | Marysville is not technically required to comply with the Stage 1 D/DBPR in the South Service Area. |
| | | Disinfection By-Products (TTHM, HAA5) | At voluntary DBP site (5900 block of 51st Avenue) | Continue voluntary quarterly sampling | Continue voluntary quarterly sampling | Continue voluntary quarterly sampling | Continue voluntary quarterly sampling | Refer to Stage 2 D/DBPR | Marysville conducts voluntary quarterly monitoring at one location in the South Service area. The Running Annual Average (RAA) is used to assess theoretical compliance. This should continue until the Stage 2 D/DBPR becomes effective in 2012. |
| | **Stage 2 D/DBPR** | Disinfection By-Products (TTHM, HAA5) | At eight monitoring locations identified through IDSE process (Initial Distribution System Evaluation) | Collect data per standard IDSE monitoring plan from 2007 | Submit System-Wide IDSE Report by January, 2009 | No activity – continue Stage 1 monitoring | No activity – continue Stage 1 monitoring | Sample quarterly | Eight samples per quarter (system-wide) must be taken at locations identified through the IDSE. The Locational Running Annual Average (LRAA) will be used for compliance instead of Running Annual Average (RAA). |
| **Consumer Confidence Report (CCR)** | **Consumer Confidence Report Rule** | All detected regulated contaminants | N/A | CCR | CCR | CCR | CCR | CCR | Prepare and distribute CCR prior to July 1 each year. |

# 8. Operations and Maintenance

## 8.1. Introduction

This section summarizes the operation and maintenance programs and procedures implemented by the City of Marysville (Marysville) to maximize performance and reliability of the potable water supply. The review and update of the Marysville's O&M programs and procedures is an on-going process. Concurrent with this WSP update, Marysville is conducting a detailed, formal review and documentation of all work instructions and standard operating procedures to be included into an electronic document library system. The result of that review will be a detailed, searchable, working document that captures the institutional O&M knowledge of the utility in one location. The document will be designed to be useful to both new and veteran operators.

## 8.2. Organization Structure and Responsibilities

Marysville's Public Works Department is responsible for water, sewer, drainage, construction, engineering, construction inspection, solid waste, fleet and facilities and street functions. Responsibilities for these functions are assigned to one of three managers identified by title as either City Engineer, Public Works Superintendent, or Fleet/Facility Manager. Each of these managerial positions reports directly to the Director of Public Works. Each manager has responsibility for more than one area. Emphasis in this plan is placed upon each position's responsibility as it applies to public water supply. Figure 8-1 shows the organizational structure for water operations.

### 8.2.1. Director of Public Works

The Director of Public Works directs all activities and programs within the Public Works Department including Marysville's services for potable water.

### 8.2.2. Deputy Director / City Engineer

The Deputy Director also acts as the City Engineer who plans, organizes, staffs and manages the Engineering Division. Responsibilities involve development of the six-year capital improvement program for the water utilities. The City Engineer is also responsible for annual capital projects including development of scopes-of-work and consultant selection.

### 8.2.3. Project Manager

The Project Manager, under the direction of the City Engineer, is responsible for overseeing assigned annual capital projects. Tasks include development of project schedules, scope-of-

work and consultant selection. The Project Manager also tracks progress through the development of plans, specification, and estimates. They also coordinate bidding and contract execution, and is tasked with submittal review and approval, progress reports, pay estimates, construction management/inspection and project close-out. The Project Manager maintains the water distribution model.

### 8.2.4. Public Works Superintendent

The Public Works Superintendent is responsible for planning, organizing, staffing and managing within the Operation and Maintenance Division. For the water supply system, responsibilities include repair and maintenance of Marysville's water system including transmission and distribution mains, source water facilities, storage facilities, and booster pump stations. The Superintendent oversees all annual maintenance programs including flushing, valve exercising, and source water well and reservoir inspections. The Superintendent is also tasked with budget development for the Operation and Maintenance Division. The Public Works Superintendent ensures that any required public notifications regarding the water system are made and may serve as the press contact.

### 8.2.5. Operations Maintenance Manager

Support to the Public Works Superintendent as assigned. This position is responsible for all operational activities associated with water supply, distribution, pumping and storage systems including distribution main flushing, valve exercising, and well monitoring. This position is also responsible for Preventive and Corrective Maintenance Program and other routine maintenance. The Operations Maintenance Manager also supervises new water service installation.

### 8.2.6. Utility Maintenance Lead

The Utility Maintenance Lead reports to the Operations Maintenance Manager and is responsible for all maintenance activities associated with water supply, distribution, pumping and storage systems including distribution main flushing, valve exercising, and well monitoring. Also performs Preventive Maintenance and checks calibration and proper monitoring of telemetry equipment.

### 8.2.7. Water Quality / Filtration Lead

The Water Quality / Filtration Lead is responsible for the operation and maintenance of the Stillaguamish Membrane Water Treatment Facility. This position ensures all water quality monthly reports are complete and submitted to the proper authorities. Responsibilities also include meter reading/repair, water quality monitoring and record keeping, and Water Conservation and Cross Connection Control programs.

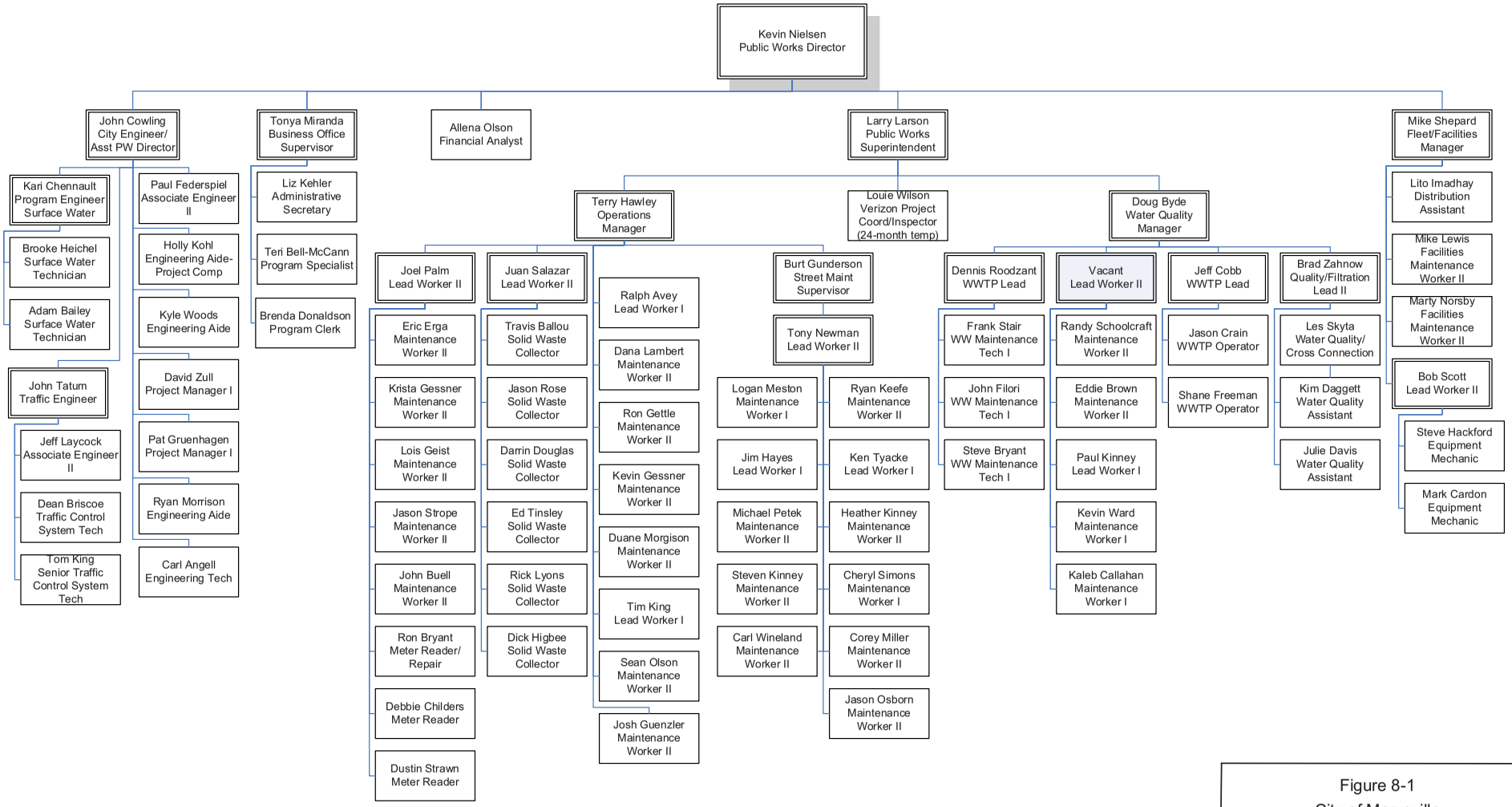



Figure 8-1
City of Marysville
Public Works Organization Chart
Water Comprehensive Plan

### 8.2.8. Construction Lead

The Construction Lead reports to the Operations Maintenance Manager and is responsible for construction activities throughout the distribution system including looping of dead-end lines, extension of water mains, valve installation and hydrant replacement/installation. The Construction Supervisor oversees emergency repairs of water main breaks and utility locates.

### 8.2.9. Program Specialist / Customer Relations Representative

The Customer Relations Representative manages customer inquiries related to dirty water, pressure extremes and taste and odor. This position tracks and coordinates all inquiries with the Operations and Water Quality Manager until the problem is resolved.

### 8.2.10. Fleet/Facility Manager

Organizes, staffs, and manages the Fleet/Facility Division. Responsibilities include preventative maintenance and repairs on all equipment, vehicles, and small tools and emergency generators used by Public Works. Also responsible for procurement including purchase of new equipment, vehicles and materials (pipe, meters, valves and fittings) used by the utility.

## 8.3. Operator Certification

Marysville is in full compliance with current laws and regulations regarding staff certification and training. Twenty Marysville Public Works employees possess Department of Health certifications. Table 8-1 at the end of this chapter is a summary of personnel certifications and experience in water system operations.

Public Works currently has one employee with a Water Treatment Plant Operator II certification and two employees with Water Treatment Plant Operator in Training (OIT) certification. Marysville is taking steps to have both individuals fully certified to operate the water treatment plant.

Marysville encourages and provides opportunity for all personnel to achieve the highest level of certification possible. Employees are supported and encouraged to meet continuing education (CEU) requirements by attending work related classes, refresher courses, safety training and regional conferences. Marysville conducts a continuing education program to assist employees in qualifying for higher levels of education. Certified employees working in positions requiring specific certifications are required to maintain that certification. To meet the staff educational needs, Marysville includes a budget line item in the annual O&M budget devoted to training.

## 8.4. System Operation and Control

The Marysville service area shares a common boundary with five adjacent purveyors. Growth, regionalization of water supply, and the Joint Operating Agreement No. 1 (JOA) requires coordination and cooperation among all of these purveyors.

Marysville operates separate sources of supply for the north and south service areas. In the south service area the primary source of supply is purchased water from the City of Everett; the secondary sources of supply are the Sunnyside Well #2 and Highway 9 Well. In the north service area the primary sources of supply are the Edward Springs (shallow collectors and three deep wells), the Stillaguamish Ranney Collector, and the Lake Goodwin Well.

## 8.4.1. South Service Area Source of Supply

### City of Everett Source of Supply

The primary source of supply for the south service area is purchased water from the City of Everett. Purchased water is conveyed to Marysville through the 30-inch Joint Operating Agreement (JOA) supply line. This water originates in Spada Lake and Chaplain Reservoirs. The water is treated at the City of Everett's direct filtration water treatment facility at Chaplain Reservoir. Total capacity of the Everett-Marysville pipeline is 20 MGD; under the JOA and subsequent agreement with Snohomish PUD, Marysville receives up to 13.15 MGD. The remaining 7.51 MGD is wheeled to the Tulalip Tribes and Snohomish County Public Utility District in accordance with the JOA. The JOA and related agreements which assign capacity rights to the JOA participants are described in greater detail in Section 3-x.

The treated water is conveyed to Marysville through JOA Supply Line #1 which connects to Everett's No. 2 and No. 3 Transmission Lines at Hewitt Avenue. Water is metered at the Hewitt Avenue connection and controlled with a flow rate valve. The 30-inch JOA supply line provides water to the Marysville service area with distribution system connections at 44$^{th}$ Street (to the Sunnyside Reservoir), SR 528, Cedarcrest Reservoir, and 84$^{th}$ Street. The JOA Supply Line #1 terminates at Getchell Reservoir located at 83$^{rd}$ Avenue and 100$^{th}$ Street. Pressure in the supply main is controlled with a pressure sustaining/altitude control valve at Getchell Reservoir. Maintenance crews conduct a drive-by or walking inspection of the four miles of supply main every other month. Blow-off valves are exercised annually and electrolysis checks conducted every four years.

### Sunnyside Well No. 2 and Hwy 9 Well

Sunnyside Well No. 2 serves as the back-up (secondary) source of supply in the event the Everett supply is out-of-service for maintenance or repair. When activated, this well would pump directly into the 360 Zone and also provide supply to the Sunnyside and Cedarcrest Reservoirs. The source is exercised on a quarterly basis and tested annually enabling Marysville to use it as necessary. The well was chlorinated when operated as a primary source; however all disinfection equipment was removed when the well was reclassified for secondary use only.

The Highway 9 Well is also available in the event the Cedarcrest Booster Pump Station is out of service. This well would supply the Hwy 9 Reservoir located in the 510 Zone. The well is only used to augment supply during emergency periods. The well is exercised on a quarterly basis to remain operable. The well was chlorinated when operated as a primary source; however all disinfection equipment was removed when the well was reclassified for secondary use only. Marysville is considering the installation of a sodium hypochlorite system in the future.

## North Service Area Source of Supply

The source of supply for Marysville's north service area includes Edward Springs comprised of shallow collectors and three deep wells, the Stillaguamish River Ranney Well, and Lake Goodwin Well.

## Edward Springs

The 24 shallow collectors provide gravity flow to the Edward Springs Reservoir. Three deep wells supplement the gravity flow. All wells pump to the screen house/chlorination facility and onto the Edward Springs Reservoir. The shallow collectors provide approximately 800 gpm continuous flow which is supplemented by 1 or 2 wells to meet north service area demand.

Water from the north service area supply is stored in the 6 MG Edward Springs Reservoir. Additional storage of 3 million gallons is located at Wade Road east of 67 th Avenue.

Washington State DOH classified the spring collection system as a Groundwater Under the Influence of Surface Water (GUI) source in March 2000. This classification has made the source subject to all rules and requirements of the Surface Water Treatment Rule (SWTR). In contrast to the Stillaguamish Ranney Well Collector source, Edward Springs has a controlled access watershed and water with consistently low turbidity. Marysville operates the Edward Springs source under the filtration avoidance clause of the SWTR through development of a Watershed Management Plan and other improvements which include fencing and signage at the watershed perimeter and disinfection and CT compliance improvements such as additional baffling at the Edward Springs Reservoir. In addition, Marysville thoroughly documents water quality history for the Edward Springs source as another requirement to continue avoiding filtration for this source.

## Stillaguamish River Ranney Well

The Ranney Well provides water to the Stillaguamish River Water Treatment Plant. Raw water is pumped by two 100 HP vertical turbine pumps from the Ranney Well Collector through an 18-inch diameter transmission line and passes first through a basket strainer prior to entry to the main plant. The flow then enters the membrane filtration tanks where it is treated. The primary treatment process for the Water Treatment Plant is a filtration process utilizing low-pressure, submerged membrane technology manufactured and supplied by Zenon Environmental, Inc. Filtered water is pumped by vacuum from the membrane tanks and is disinfected with sodium hypochlorite, followed by storage and disinfection contact in a 200,000-gallon, above-grade, steel clearwell before being pumped into Marysville's distribution system.

## Lake Goodwin Well

The Lake Goodwin Well is the source for the 327 pressure zone, which was put into service in 2008. The well also serves 25 homes along the supply line.

## 8.4.2. Service Area Isolation and Boundary Adjustment

The JOA stipulates that Everett supplied water is not to be mixed with the north service area sources other than under emergency situations. In an emergency event, valves along the boundary separation can be opened to supply water. The original boundary was located on an east/west line along 100th Street. Due to heavy growth and fire flow demands, the separation boundary was moved to an east/west line from 120th and State to 108th Street and 67th Avenue. This adjustment resulted in approximately 800 homes being added to the south service area. This adjustment was established in the summer of 2000.

Due to decreasing costs for using Marysville's treatment plant and rising costs for the Everett water, the north/south boundary may be moved further south in the future to maximize the area served with lower production costs.

## 8.4.3. Treatment

South service area water purchased from Everett is chlorinated at the Chaplain treatment facility. Marysville provides no additional chlorination once in the system. In the north service area, chlorine is added for disinfection and distribution system disinfectant residual at Edward Springs and Stillaguamish sources.

The Stillaguamish River Water Treatment Plant for the Stillaguamish River source was put into service in December 2006. This facility is capable of producing 3.15 MGD. Chlorination will continue to be provided for the Stillaguamish Ranney Collector source to provide a disinfectant residual in the distribution system. A water filtration plant O&M manual was submitted and approved by the DOH in December 2006. This manual provides a detailed discussion of the filtration process. Washington State Department of Health has categorized the Stillaguamish Water Treatment Plant at a Classification 2 level.

## 8.4.4. Booster Pump Stations

Marysville operates two booster pump stations located at Edward Springs and Cedarcrest Reservoir. To provide adequate fire flow in the absence of the additional storage, the booster pump station at Edward Springs was installed in 2001. These booster pumps are designed to activate when system pressure drops below a predetermined level during high demand periods.

The Edward Springs Reservoir Booster Station pumps have been retrofitted and are used to provide emergency backup to the 460 Zone and emergency supply for the 327 Reservoir in the event that Lake Goodwin is down. The area can be supplied from Edward Springs Booster Station as a secondary source if the Goodwin Well is out of service. A trailer-mounted generator can provide back-up power as required to Edward Springs Well 3. A permanently mounted 60 kW generator is installed at Edward Springs Booster Pump station with enough capacity to power one booster pump a full rated capacity.

**Cedarcrest Booster Pump Station**

The Cedarcrest Booster Pump Station is the primary source to the Hwy 9 Reservoir. Three 150 HP Byron Jackson pumps supply water from Cedarcrest Reservoir (170 Zone) to Hwy 9 Reservoir (510 Zone).

## 8.4.5. PRV, Intertie, and Line Valves

The Marysville system contains 52 PRVs. These PRVs are operated/maintained and adjusted by the Operations Division. See Table 1-7 in the System Description section for size, type and location.

The Marysville system includes 8 distribution system interties with four adjacent purveyors. Utility maintenance personnel are responsible for operation of the 8 interties. The interties vary in size from 4 to 8 inches. Intertie descriptions are provided in Chapter 2.

There are approximately 10,000 line valves in the Marysville distribution/transmission system. These valves vary in size from 4 to 30 inches and are manually operated to isolate sections of the distribution system during flushing activity, main brakes, flow redirection, or other maintenance issues as they arise. Valves are exercised annually with open/closed positions verified. Closed valves (pressure zone separation) have caps placed over the operating nut, assuring that the valves remain closed.

The utility maintenance programs for PRVs, interties and line valves are addressed later in the Section.

## 8.4.6. Telemetry, Instrumentation and Control

The telemetry system enables tracking and storing of system operating information. Table 8-2 at the end of this chapter is a summary of telemetry instrumentation and control for source, booster pumping, intertie, and selected storage facilities.

Integrated supply/transmission systems operations instrumentation and control for the JOA Supply Line No. 1 and distribution system is located at the Public Works headquarters. Instrumentation and control enables operators to monitor water levels in all reservoirs. Flow rates are controlled at the Hewitt connections and the inlet to Cedarcrest Reservoir. Additionally, the operators can continuously monitor flow meters at the Hewitt and Snohomish PUD connections and control water levels in the Cedarcrest and Getchell Reservoirs.

Programmable Logic Controllers (PLC's) monitor and control all operations of the Stillaguamish Water Treatment Plant. The PLC's perform all necessary control calculations required to safely operate the plant. The Human Machine Interface (HMI) workstations provide monitoring and control interface with the PLC's for operators. There are two workstations: one at Marysville's Public Works Department and one at the plant site.

# 8.5. Maintenance

Water quality and utility maintenance technicians conduct daily inspections and perform preventative/corrective maintenance on pump stations, reservoirs, PRV's and other distribution system components. Job standards have been developed for most maintenance tasks/activities performed by these technicians and are on file with Marysville. The following is a brief summary of system maintenance activity.

## 8.5.1. Maintenance Management

The Public Works Superintendent sets goals, establishes work priorities and makes plans to help achieve the organization's goals for the year. The Public Works Division Supervisors have the responsibility to plan, organize, direct and control the workforce to achieve department goals. The supervisors have the additional responsibility to develop Maintenance Work Standards that are used in the development of the annual work plan.

The annual work plan includes capital projects, system operations work, replacement work, routine corrective maintenance, equipment and distribution main service and project management. The annual plan is then divided into monthly schedules for project tracking purposes.

Marysville is in the process of implementing a CMMS software packages for tracking maintenance projects. Currently, projects are either tracked on paper or by using Excel spreadsheets.

## 8.5.2. Reservoir Maintenance

All reservoirs are inspected daily, quarterly, and on a five-year cycle employing an increasing degree of activity at each level. The objective of the daily visual inspections is evidence of vandalism, forced entry or damage and control functionality. On a quarterly basis a detailed inspection of access manholes, vents, overflow piping and valve exercising is conducted. Exterior maintenance is scheduled annually. Approximately every five years the reservoirs undergo a comprehensive engineering inspection and evaluation. In 2003, divers inspected the Getchel Reservoir. In 2004, divers inspected Cedarcrest and Edward Springs Reservoirs. In addition to this work, a tracer study was also conducted to ascertain turnover in the reservoirs. The results of these studies will be used for future Capital Improvement Projects. In 2008, an internal inspection was performed on the Wade Road and Edward Springs reservoirs. Future draining and cleaning work will be accomplished in conjunction with the program schedule.

## 8.5.3. Valve Maintenance

Marysville conducts a formalized, scheduled valve maintenance program so that system control is available to staff when needed. The Water Main Control Valve Maintenance and Flushing Program is available from Marysville and consists of locating and activating control valves in the distribution system. Valve exercising is scheduled over a two-year cycle, particularly for main line valves. The objective of the program is to detect malfunctioning valves and prevent valves from becoming inoperable due to freezing or build-up of rust or corrosion. The program also

ensures that valve locations are documented correctly and that valves are accessible. Malfunctioning valves are reported and maintenance work orders issued for repair or replacement.

### 8.5.4. PRV Maintenance

There are 52 PRVs at 31 locations throughout its service area. There are an additional five PRVs located at emergency intertie locations. Preventative maintenance is scheduled and conducted annually as part of the Public Works work plan. The testing and maintenance performed includes pressure checks and adjustments, cleaning of strainers, and replacement of parts as necessary.

### 8.5.5. Hydrant Maintenance

The primary function of fire hydrants is for supply of water for fire protection; however, hydrants are often used for other purposes. Marysville has a Hydrant Maintenance Program designed to maintain hydrants in proper working condition to provide available fire flow in the event of an emergency.

The maintenance program parallels the service area grid pattern used by the Marysville Fire Department. This grid system divides the service area into thirty-four distinct units. The maintenance procedure is to perform hydrant maintenance sequentially, one grid at a time. This sequential grid approach ensures every hydrant is checked and maintenance performed before moving to the next grid. Upon completion of a grid, notice is sent to the Fire Department for their records. Anytime a hydrant is off-line for any reason notification is provided to the Fire Department.

The hydrant maintenance checklist includes the following:

- Removal of all grass, weeds, etc. in hydrant area.
- Hydrants are tested in an approved manner for proper operation.
- Each hydrant is recorded.
- Caps are checked for cracks/operability.
- Threads and chain races are cleaned and lubricated.
- Hydrants are painted as necessary.
- The street shutoff valve is checked for accessibility and ease of identification from water main valves.

## 8.6. Meter Maintenance/Replacement

Marysville has two full time meter readers and one meter repair person on staff. The repair person has additional duties allowing approximately 1.5 weeks a month dedicated solely to meter repairs. Meter readers dedicate approximately seventy-five percent of the work time to meter reading and the remaining twenty-five percent to meter maintenance activities. In addition to the three meter employees, the Public Works Construction crew makes repairs whenever heavy equipment is required or repairs are needed on larger meters in the distribution system.

In 2007, Marysville deployed a Hexagram Star® Fixed Network Infrastructure that automatically reads water meters from a central location without the need for meter readers of vans. The automatic meter reading system installed throughout the city includes meter transmission units (MTU's), data collection units (DCU's) and a centrally located network control computer.

In 2007 Marysville had approximately 17,000 water meters that were read manually on a bi-monthly basis. During 2007 Marysville installed 3000 automatic read water meters with an aggressive installation schedule in the forthcoming years. With an anticipated growth rate of 1% annually the Automated Meter Reading system is tentatively scheduled for completion by 2012.

To identify meter maintenance projects in the field, meter readers code their handheld computer to a maintenance code whenever a malfunctioning meter is identified. A printed copy of the report is forwarded to the Operations Maintenance Manager. The Utility Maintenance Lead is responsible for planning and coordinating the repair activity.

A water meter testing facility has been established in the Public Works Maintenance Shop. At this time, field repairs and maintenance requirements have prevented the testing facility from being put into full use. Plans are in place for full utilization in the future. Currently the service area is 100% metered.

### 8.6.1. Flushing Program

Marysville conducts a combined uni-directional and grid zone flushing program designed to systematically flush the distribution system. This approach reduces flushing water demands, improves flushing efficiency, reduces water quality complaints resulting from flushing activity, and will possibly improve water quality. Utility personnel also practice regular scheduled flushing of distribution system dead-ends and in response to customer water quality complaints. Efforts are underway to complete full system flushes on a two-year frequency.

## 8.7. Emergency Response Operations

Marysville's objective is to provide and support effective planning, disaster management, and education services to enable citizens and employees of Marysville to prepare for, respond to, and recover from an emergency.

The Public Works Department has in place an "Emergency Action Plan" that outlines procedures to protect the water supply and the city's infrastructure. The Emergency Action Plan identifies potential threats or hazards that may jeopardize the city's water supply. The Emergency Action Plan is available from Marysville and addresses:

- Drought Response
- Water Quality Emergencies
- Earthquake Response
- Emergency Power Requirements
- Outside Agency Coordination
- Specific Emergency SOPs
- Floods

- Terrorism
- Volcanic Eruption

The plan also includes emergency notification procedures, alternate operations and interagency coordination procedures.

## 8.8. Safety

The Marysville Public Works Department prides itself on having a keen sensitivity to the needs and concerns of the community and their employees. To meet some of those needs, the Public Works Department works as a partner in the development of safety programs and awareness for all utility employees. This has been accomplished by the implementation of an "Accident Prevention Program" and can be obtained from Marysville.

Additionally, the Public Works Department maintains safety records for every employee and monitors renewal dates. New employees are issued proper safety equipment particular to the job assigned, and equipment is replaced with new as required. Each section of Public Works has an assigned safety representative to help manage the program. Department and individual divisions within the organization hold monthly safety meetings as well as on-site safety briefings before a major project is undertaken. Particular emphasis is placed on the following topics:

- Confined Space Entry
- Trenching and Shoring
- Chlorine Safety
- Heavy Equipment Operation
- Use of Personal Protection Gear
- Flagging
- First Aid/CPR
- MSDS Tracking

Marysville has an assigned Safety Manager to oversee the actions of the Public Works Department and to monitor new state or federal requirements.

## 8.9. Design and Construction Standards and Specifications

Marysville Public Works conducts all construction of water mains and appurtenances in accordance with city standards (Appendix 8-1), applicable American Water Works Association (AWWA) standards and Section 7-11 of the WASDOT/APWA Standard Specifications. In addition, the North Snohomish County Coordinated Water System Plan contains minimum design and construction standards for the participating utilities. As a participant in the adoption of the North Snohomish County Coordinated Water System Plan, Marysville can reference the minimum design and construction standards as part of the developer extension requirements.

These standards and specifications are intended to meet or exceed the design and construction standards referenced in WAC 246-290. This material is intended to meet the requirements of the DOH submittal exception process for distribution mains construction. By qualifying for this

process and following the approved procedures and standards, Marysville is provided a waiver from the requirement of DOH approval for individual projects.

## 8.10. Water Quality Operations

Marysville takes an aggressive approach to protect its water resources. Constant monitoring and testing of the source of supply and the distribution system is designed to protect water quality from source to tap. See section 7.0 for more details.

## 8.11. Backflow Prevention and Cross Connection Control

Marysville's Cross-Connection Control Program (CCP) was reviewed as part of this Water System Plan Update, and is provided in Appendix 8-2. Under WAC 246-290-490, Marysville has the responsibility to protect the public water system from ill effects associated with contamination due to cross-connections and backflow events. The CCP has been developed to meet DOH requirements contained in WAC 246-290-490 and includes the following key elements:

**Establishment of Local Authority.** Marysville's legal authority to implement and enforce a cross-connection control program is established by Marysville Municipal Code Chapter 14.10, Water Supply Cross-Connections.

**Procedures for Evaluation of Service Connections Hazards.** Procedures and schedules for determining the degree of hazard posed by new and existing service connections are provided in the CCP. For new services, Marysville performs an initial cross-connection review prior to construction. For existing services, evaluations are performed on a schedule, with those posing the greatest potential hazard designated as having the highest priority. Evaluations of existing connections consist of meeting customers, reviewing facility drawings, and a physical survey of all exposed piping (if allowed by the customer). After the evaluation, the customer is notified if installation of a backflow prevention assembly is required. If, after 90 days, the customer has not installed a proper assembly, Marysville may install an assembly at the service connection. Marysville also reserves the right to disconnect the customer's service, in the event that immediate corrective action is required and is not taken by the customer.

**Procedures for Eliminating or Controlling Cross-Connections.** Marysville requires that cross-connections be eliminated if possible. If they cannot be eliminated, cross-connections are to be controlled and prevented by backflow prevention assemblies appropriate for the given situation.

**Utilize Qualified Cross-Connection Specialists.** Marysville's program is implemented by certified Cross-Connection Control Specialists (CCS). As of January 2008 Marysville has 7 employees holding state certifications as CCS, as well as employing 2 certified Backflow Assembly Testers (BATs). Marysville assigns one certified CCS (Water Quality Supervisor) as the CCP administrator. Other personnel holding CSS certification routinely assist the CCP Administrator in implementing the program.

**Assembly Testing and Inspection Procedures.** Marysville has procedures to ensure that backflow prevention assemblies are installed properly and tested annually. This process includes notification and correspondence by Marysville to customers who own such assemblies.

**Quality Insurance Program for Testing.** Marysville's program requires that all backflow prevention assembly test reports submitted to Marysville document that the tester is on Marysville's annually developed list of certified testers and that the test kit used is in proper calibration.

**Incident Response Procedures.** Select city personnel are trained to respond to reported backflow incidents. Procedures for such responses and notification of the Snohomish Health District and DOH are contained within the CCP.

**Consumer Education.** The CCP incorporates information on cross-connection control into Marysville's existing consumer education program. Marysville provides all new water customers with a Customer Information Kit, which includes guidelines on installation, inspection, and testing procedures to ensure compliance with cross-connection control regulations.

**Maintenance of Program Records.** Marysville utilizes a Tokay database for storing, organizing, and tracking CCP records, including an inventory of known backflow prevention assemblies. In 2007, Marysville's database contained information on 1340 backflow prevention assemblies at 742 different sites throughout the service area.

# 8.12. Supplies and Equipment

## 8.12.1. Water Treatment Chemicals

Marysville adds chlorine in the form of 12.5% concentration of sodium hypochlorite to all Edward Springs sources for disinfection purposes. The chlorination facilities at this site consist of a separate, alarmed chlorination building housing one bulk storage tank and chemical metering pumps. The metering pumps are operated in a lead / lag configuration where upon the failure of the lead pump the lag pump will deliver the required dosage and a notification alarm will sound. Maintenance crews, on a weekly basis, monitor bulk sodium hypochlorite usage and schedule deliveries as needed.

The Stillaguamish River Water Treatment Plant uses Citric Acid and Sodium Hypochlorite for cleaning the membrane modules. Sodium hypochlorite is also used for disinfection of the membrane plants filtrate prior to entering the clearwell. Sodium Bisulfite is used to neutralize the Clean In Place oxidants prior to disposal. Sodium Hydroxide is used for pH adjustment of the disposed cleaning residual. The following chemicals are used at the Plant;

| CHEMICAL | STORAGE LOCATION | STORAGE QUANTITY |
|---|---|---|
| Sodium Bisulfite (NaSO3) | Chemical Storage Room | 16 gallons |
| Sodium Hydroxide (NaOH) | Chemical Storage Room | 27 gallons |
| Sodium Hypochlorite (NaOCL) | Hypochlorite Storage Room | 1000 gallons |
| Citric Acid | Membrane Room | 53 gallons |

Water purchased from Everett is treated with chlorine and fluoridated by Everett, no additional chemicals or treatment is provided by Marysville.

### 8.12.2. Emergency Power Generators

A 60 KW trailer-mounted diesel generator is positioned at the Public Works Department yard and available for emergency use at various sites in the service area. A second 60 KW trailer mounted diesel generator is positioned at the Public Works Department and is dedicated for headquarters use during emergencies.

Edward Springs Well #3 is equipped with an adapter plug for support of a backup emergency generator. The Edward Springs Booster Pump Station is equipped with permanently mounted 90 KW emergency generator adequate to power one booster pump at full rated capacity. The new generator can also support other equipment such as lighting and chemical metering as necessary.

### 8.12.3. Spare Parts

The Public Works Department keeps an inventory of commonly needed parts as well as emergency supplies at the Public Works yard and stockroom. Marysville's supply department tracks the inventory and orders additional supplies as required. Marysville expects critical spare equipment kept in stock include meters, meter boxes, various valves of all necessary sizes, pipe fittings, pipe, emergency clamps of various sizes etc. Large non-emergency items are purchased on an as needed basis.

### 8.12.4. Tools and Equipment

Smaller commonly used tools and equipment are carried in the employee's trucks or are readily available from the stockroom. Tools and equipment such as pumps, small compressors, portable generators, pressure washers, and power tools are available from the stockroom. Larger infrequently used items are rented from various equipment rental companies located in Marysville.

### 8.12.5. Heavy Equipment

The Public Works Department owns heavy equipment such as dump trucks, graders, rollers, forklifts, backhoes and bulldozers. If necessary, larger equipment is leased or rented on an as needed basis from local suppliers. Marysville's maintenance and construction crews have personnel trained and experienced in heavy equipment operation.

## 8.13. Recordkeeping and Reporting

Marysville utilizes an Information and Records Management system. By computer network tracking, Marysville's Public Works Department has developed a filing system that breaks down the well sites, reservoirs, distribution system, water meters and other necessary components that make up a service area. Marysville also involves department heads and supervisors to maintain and track their areas of responsibility. On an annual basis maintenance records are reviewed for the annual report. The Operations Maintenance Manager is responsible for submitting all state required monthly forms to the appropriate agencies.

Records include, but are not limited to the following:

- Water quality
- MCL violations
- Water quality complaints
- Backflow prevention
- Maintenance and construction
- O&M manuals
- Personal records
- Flushing and distribution system
- Well operation monitoring
- SWTR Disinfection Monthly Report
- Water Treatment Plant Monthly Report
- Treatment Plant Pressure Decay Test and Particle Count Monthly Report

## 8.14. O&M Improvements (2009 – 2012)

Below is a list of O&M improvements which have been identified by Marysville staff.

- Continue implementation of the new maintenance management software.
- Continue installation of Automatic Meter Reading equipment.
- Install sampling stations throughout the new 327 Zone.
- Enhance flushing and valve exercising programs to meet goal of completing entire system every two years.
- Tie dead end mains, where possible, to close loops and increase fire flow.
- Pave around Edwards Springs to increase ease of maintenance.
- Evaluate de-chlorination alternatives for use during distribution system flushing.
- Complete job standards for every task/activity performed by the Utility Maintenance Division.
- Upgrade the distribution system instrumentation and control system to effectively operate the transmission system.
- Lake Goodwin Well Improvements to include new sodium hypochlorite disinfection system
- Install new sodium hypochlorite disinfection system at Sunnyside reservoir for emergency events.
- Video, inspect and rehabilitate Sunnyside Well 2 if necessary.

## Table 8-1 City of Marysville Operator Certifications

| Employee | Position Title | Certifications | Years of Experience |
|---|---|---|---|
| Ralph Avey | Equipment Operator | WDS I, WDS, CCS | 19 years |
| John Buell | Utility Maintenance Worker II | WDM II, WDS, WTPO IT | 19 years |
| Doug Byde | Water Quality Manager | WDM IT, WTPO IT | 1 year |
| Kimarie Daggett | Water Quality Assistant | WDM II, CCS, WDS, WTPO I | 10 years |
| Julie Davis | Water Quality Assistant | WDM I | 4 years |
| Eric Erga | Maintenance Worker II | WDM I, WDS | 12 years |
| Kevin Gessner | Maintenance Worker II | WDM 1 | 6 years |
| Krista Gessner | Maintenance Worker II | WDM I | 6 years |
| Lois Geist | Maintenance Worker II | WDM I | 4 years |
| Ron Gettle | Maintenance Worker II | WDM I | 6 years |
| Terry Hawley | Operations Manager | WDM 4, CCC Specialist, WTPO II | 15 years |
| Tim King | Equipment Operator | WDM II | 10 years |
| Dana Lambert | Maintenance Worker II | WDS, WDM I | 27 years |
| Larry Larson | Public Works Superintendent | WDM 4, CCC Specialist, WTPO IT | 15 years |
| Duane Morgison | Utility Locator | WDM II | 20 years |
| Sean Olson | Maintenance Worker II | WDM I | 1 year |
| Joel Palm | Utility Maintenance Specialist/Lead II | WDM III, CCC Spec, WDS | 27 years |
| Les Skyta | Water Quality/CCC Spec. | WDM II, CCS | 27 years |
| Louie Wilson | Construction Coordinator/Lead II | WDM III | 29 years |
| Brad Zahnow | Quality/Filtration Lead II | WDM II, WTPOIT, CCS, BAT | 7 years |

## Table 8-2 Marysville Telemetry System Capabilities

| | Facility | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Edward Springs System | Smokey Point Pressure Station | Edward Springs Booster Pump Station | Stillaguamish System Filter Plant | Highwa y 9 System | Snohomish County PUD | Getchell Reservoir | Tulalip Intertie 88th Street | Cedarcrest Reservoir System & Pump | Ranney Well Site | Wade Reservoir | Sunnyside Reservoir |
| High/Low Level Alarm | • | | | • | • | | • | | | | • | • |
| Reservoir Outlet Flow Recorder | • | | | • | | | | | | | | |
| Level Recorder | • | | | • | • | | • | | • | • | • | • |
| Reservoir Outlet Flow Alarm | | | | | | | | | | | • | • |
| Hi/Low Pressure | | • | • | • | | | | | | High | | |
| Flow Recorder | Outlet | | | • | | Pump Gravity | | • | Inlet/Outlet Pump | • | In/out | In/out |
| Hi/Low Pressure Alarm | | • | • | • | | | | | | | | |
| Hi/Low Flow | • | | | • | | • | | • | • | | | |
| Pump Failure | • | | • | • | | | | | • | • | • | • |
| Low Suction Pressure | | | • | • | | | | | | | | |
| Power Failure | • | | • | • | • | • | • | • | • | | | |

| | Facility | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Edward Springs System | Smokey Point Pressure Station | Edward Springs Booster Pump Station | Stillaguamish System Filter Plant | Highwa y 9 System | Snohomish County PUD | Getchell Reservoir | Tulalip Intertie 88th Street | Cedarcrest Reservoir System & Pump | Ranney Well Site | Wade Reservoir | Sunnyside Reservoir |
| Valve Failure | • | | • | • | | | | | • | | | |
| Temperature | | | • | • | | | | | | | | |
| Communication Failure | • | • | • | • | • | • | • | • | • | • | • | • |
| Low Level Well Alarm | | | • | | | | | | | • | | |
| Smoke Alarm | | | | • | | | | | | | | |
| Chlorine Alarm | • | | | flood | | | | | | | | |
| Water Spill Alarm | | | | • | | | | | | | | |
| Surge Control Valve Failure Alarm | | | • | compressor | | | | | | | | |
| Power Failure Alarm | • | | • | • | • | • | • | • | • | | | |
| Police Alarm | | | | • | | | | | | • | • | • |
| Flow Totalizer | • | | | • | | • | | • | | • | | |
| Pressure Indicator | | • | E.S. Reservoir | • | | | | | | | | |
| Pump Control | | | • | • | | | | | • | | | |
| Turbidimeter | • | | | • | | | | | | | | |

| | Facility | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Edward Springs System | Smokey Point Pressure Station | Edward Springs Booster Pump Station | Stillaguamish System Filter Plant | Highwa y 9 System | Snohomish County PUD | Getchell Reservoir | Tulalip Intertie 88th Street | Cedarcrest Reservoir System & Pump | Ranney Well Site | Wade Reservoir | Sunnyside Reservoir |
| Altitude Valve Control | | | | | | | • | | | • | | |
| Communication Failure | • | • | • | • | • | • | • | • | • | | | |
| Intrusion Alarm | • | | generator | • | • | • | • | • | • | • | • | • |

# 9. Capital Improvement Program

This chapter describes the methodology used in developing the City of Marysville's (Marysville) water system Capital Improvement Program (CIP), and presents the costs and schedules for projects planned for implementation in 2009-2028.

## 9.1. Development of CIP

The CIP described herein was developed from a combination of the following elements: projects previously identified and included in the Marysville 2007/2008 Capital Improvement Program; projects identified through conversations with Marysville staff; and projects identified during the system analysis of Marysville source, storage, distribution, transmission and water quality, as documented in earlier chapters of this WCP. In addition, recurring or annual capital projects related to system maintenance (e.g., spring collector improvements and water main replacement programs) have also been included in the list of improvements.

A 20-year implementation schedule of the projects was then developed. Generally, projects of higher priority (i.e., those that address current system needs) were scheduled for implementation within the six-year planning horizon (2009-2014). Projects that serve anticipated future needs associated with system growth, or are less critical to system operation, were scheduled for implementation between 2015 and 2028. Detailed scheduling of the higher priority projects was based primarily upon Marysville's existing forecast of project implementation timelines. Where applicable, the timing of water system projects has been coordinated with sewer and street improvements planned for the same locations.

Planning-level (AACE[1] Class 4) cost estimates have been developed for each capital project included in the 2009-2028 CIP. Generally, each project cost includes the following components:

- **Base construction cost.** Includes all labor and material costs needed to construct a project. For pipeline and valving projects, construction costs were estimated based upon unit construction costs derived from bid tabulations for recent Marysville projects and similar water distribution projects for other utilities in Snohomish and King Counties.
- **Sales tax.** Calculated as 8.5 percent (the 2008 local tax rate) of the base construction cost.
- **Construction contingency.** Takes into account the uncertainties associated with estimating project costs at this planning level. Calculated as 20 percent of the total of base construction plus sales tax.
- **Design engineering/permitting/construction administration.** Includes Marysville and consultant design costs, and other related cost items, such as permitting and construction administration. For most projects, this is calculated as 25 percent of the base construction cost.

[1] Association for the Advancement of Cost Engineering.

These elements are summed to determine the total project-level cost estimate for a project, as expressed in 2008 dollars.

To account for inflation and the increase of construction costs over time, the base project-level costs have been escalated to their anticipated year of construction. It is impossible to predict accurately the rate at which construction costs will increase over the 2009-2028 period; however, a conventional method to estimate such increases is to examine cost index trends of past years.

The most comprehensive set of historical construction cost data in the United States is reflected in the RS Means Historical Cost Indexes. The Everett, Washington indexes indicate that construction costs have increased at an average rate of 5.6 percent per year over the past four years (2005-2008). This historic value is used to escalate construction project costs from base year (2008) dollars to costs in the anticipated year of construction, except for those projects where Marysville already established costs in approved budget documents.

Where applicable, design costs are scheduled one year in advance of construction costs, to reflect the phasing typically used for larger projects.

## 9.2. Planned Projects

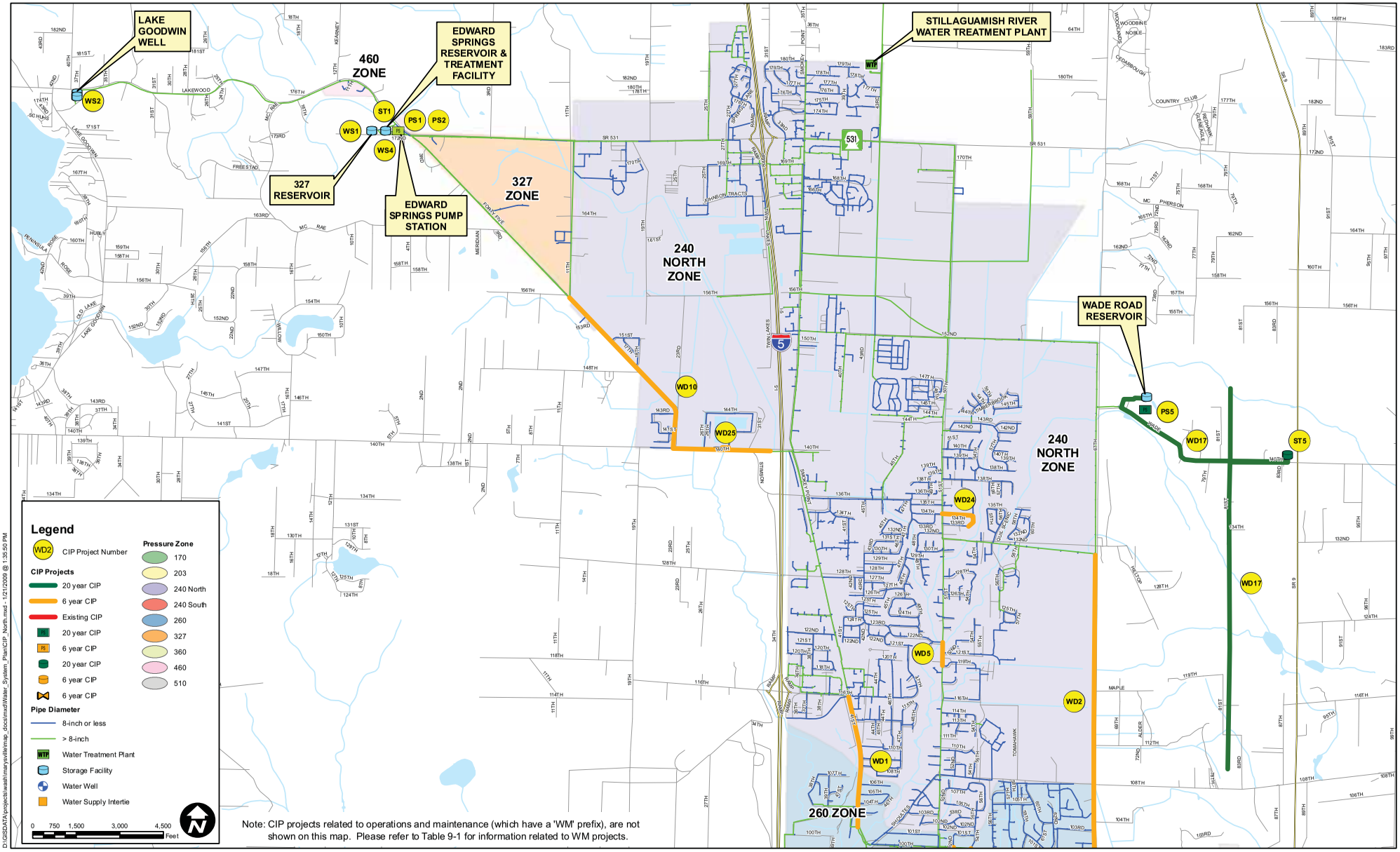
Table 9-1 presents Marysville's schedule of CIP projects planned for implementation between 2009 and 2028. Figures 9-1 and 9-2 provide the locations for the major planned improvements. Descriptions of each project follow.

In total, Marysville's six-year CIP (for years 2009-2014) includes approximately $37.6 million in improvements (in inflation-adjusted dollars). The long-term CIP (2015-2028) includes approximately $40.5 million in improvements.

## Table 9-1 Capital Improvement Program (2009-2028)

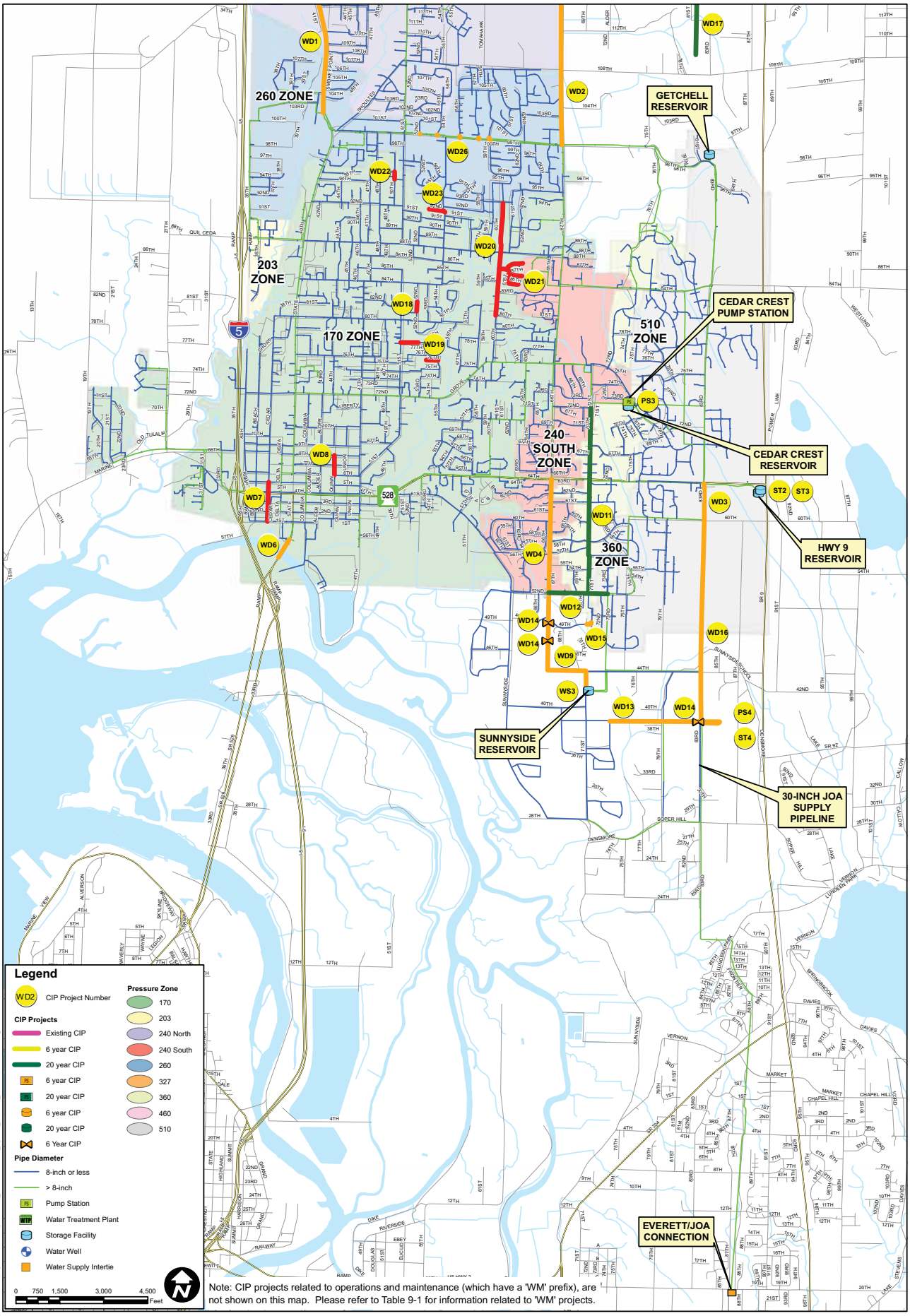
| Project No. | Budget Project Code [2] | Description | Justification | Base Project Cost [3] (2008 Dollars) | Schedule and Cost of Improvements (in thousands of dollars) [1] 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 6-yr CIP TOTAL | 2015-2028 [4] | 20-yr CIP TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Water Supply and Treatment*** | | | | | | | | | | | | | |
| WS-1 | W0604* | Additional Spring Collector Improvements [5] | Supply | 52 | 50 | 52 | 52 | 52 | 52 | 52 | 310 | | 310 |
| WS-2 | W0605* | Lake Goodwin Well Development | Treatment | 20 | 20 | | | | | | 20 | | 20 |
| WS-3 | W0705* | Sunnyside Well #1 Relocate & #2 Rehab | Supply | 300 | 300 | | | | | | 300 | | 300 |
| WS-4 | W1001* | Ultraviolet Treatment | Treatment | 780 | | 780 | | | | | 780 | | 780 |
| ***Water Storage*** | | | | | | | | | | | | | |
| ST-1 | W0602* | Edward Springs Baffles | Water Quality | 200 | 200 | | | | | | 200 | | 200 |
| ST-2 | W0014* | Hwy 9 Reservoir Demolition | Substandard | 10 | 10 | | | | | | 10 | | 10 |
| ST-3 | W0903* | Hwy 9 Reservoir | Additional Storage | 2,250 | | | | 250 | 2,000 | | 2,250 | | 2,250 |
| ST-4 | W0901 | Soper Hill (Whiskey Ridge) Property & Reservoir (1 MG) | Acquisition/Future Service Area | 3,630 | 1,300 | | | | 3,060 | | 4,360 | | 4,360 |
| ST-5 | NA | North 510 Zone Reservoir (1 MG) | New Pressure Zone | 3,330 | | | | | | | 0 | 5,180 (2015-17) | 5,180 |
| ***Water Booster Pump Stations*** | | | | | | | | | | | | | |
| PS-1 | W0808* | Edward Springs Pump Modification | Fire flow | 100 | 100 | | | | | | 100 | | 100 |
| PS-2 | W0902* | Edward Springs Booster Pump Building | Other - to protect new equipment | 200 | 200 | | | | | | 200 | | 200 |
| PS-3 | W1002* | Cedarcrest Pump Station Rehab (Motor Control/Valve Replacement) | Operations | 150 | | 150 | | | | | 150 | | 150 |
| PS-4 | NA | Soper Hill (Whiskey Ridge) Pump Station (Design Point=700 gpm @ 130'; 35 hp) | Acquisition/Future Service Area | 810 | | | | | 1,060 | | 1,060 | | 1,060 |
| PS-5 | NA | North 510 Zone Pump Station (Design Point=300 gpm @ 300'; 40 hp) | New Pressure Zone | 930 | | | | | | | 0 | 1,360 (2015) | 1,360 |
| ***Water Transmission and Distribution System*** | | | | | | | | | | | | | |
| WD-1 | W0401 | State Ave (102nd to 116th; 4,578', replace 12" AC with 18" DI) | Replace and Upsize | 2,030 | | | | | | | 0 | 2,970 (2015) | 2,970 |
| WD-2 | W0402 | 67th Ave (100th to 132nd; 10,469', new 18") and PRV | Emergency Intertie | 3,310 | 60 | 1,810 | 1,910 | | | | 3,780 | | 3,780 |
| WD-3 | W0801 | 83rd Ave NE (60th to 64th; 1,301', upsize 12" to 16") | Replace and Upsize | 560 | | | | 700 | | | 700 | | 700 |
| WD-4 | W0702 | 67th Ave NE (52nd to 64th; 3,943', upsize 10" to 16") | Replace and Upsize | 1,680 | | | | | | 40 | 40 | 2,416 (2015) | 2,456 |
| WD-5 | W0803* | 51st Avenue (119th Pl NE to 122nd Pl NE; 820', replace 12" CI with 12" DI) | Replacement | 200 | 200 | | | | | | 200 | | 200 |
| WD-6 | W0804* | Ebey Slough Bridge (717', new 12") | Transportation Project | 10 | 10 | | | | | | 10 | | 10 |
| WD-7 | NA | Cedar Avenue 1st - 5th (1,407', new 8") | Fire flow | 440 | | | 520 | | | | 520 | | 520 |
| WD-8 | NA | Quinn Avenue 6th - 8th (972', new 8") | Fire flow | 300 | | | | 370 | | | 370 | | 370 |
| WD-9 | NA | 67th Ave NE (44th to 52nd); 44th St NE (67th to 71st); 71st Ave NE (to Sunnyside Res) (4,697', new 18") | Replace and Upsize | 2,070 | | | | 2,570 | | | 2,570 | | 2,570 |
| WD-10 | NA | 140th Pl NE (23rd to I-5); north on 23rd Ave NE, then northwest on 45 Road (144th to 156th) (10,053', replace 12" AC with 18" DI) | Replace and Upsize | 3,570 | | | | 2,220 | 2,340 | | 4,560 | | 4,560 |
| WD-11 | NA | 71st Ave NE (52nd to 72nd; 6,559', 12") | Replace and Upsize | 2,290 | | | | | | | 0 | 4,060 (2018-19) | 4,060 |
| WD-12 | NA | 52nd St NE (67th to 73rd; 2,023', replace 10" with 12") | Replace and Upsize | 700 | | | | | | | 0 | 1,270 (2019) | 1,270 |
| WD-13 | NA | Soper Hill (Whiskey Ridge) Reservoir waterline (4,378', new 12") | Acquisition/Future Service Area | 1,530 | | | | | 2,010 | | 2,010 | | 2,010 |
| WD-14 | NA | Soper Hill (Whiskey Ridge) PRVs (3) | Acquisition/Future Service Area | 170 | | | | | 220 | | 220 | | 220 |
| WD-15 | NA | Connection of Soper Hill to 360 Zone on 49th St NE (200', new 8") | Acquisition/Future Service Area | 60 | | | | | 80 | | 80 | | 80 |
| WD-16 | NA | 83rd Ave NE (Soper Hill Res to 60th St; 6,859', new 16") | Future Transmission | 2,930 | | | | | | 4,060 | 4,060 | | 4,060 |
| WD-17 | NA | North 510 Zone Reservoir waterline (22,838', new 12") | New Pressure Zone | 7,970 | | | | | | | 0 | 16,200 (2015-17) | 16,200 |
| WD-18 | NA | 52nd Dr NE (north from 81st Pl NE to existing 6" CI; 340', new 8") | Fire flow | 110 | | 120 | | | | | 120 | | 120 |
| WD-19 | NA | 77th Pl NE (600', replace 6" with 8"); 76th St NE (410', replace 6" with 8") | Fire flow | 310 | | 350 | | | | | 350 | | 350 |
| WD-20 | NA | 60th Dr NE (3,842', upsize from 6" to 8") | Fire flow | 1,190 | | | 1,400 | | | | 1,400 | | 1,400 |
| WD-21 | NA | 61st Dr NE and 84th Pl NE (758', upsize from 6" to 8") | Fire flow | 240 | | | | 300 | | | 300 | | 300 |
| WD-21 | NA | 87th St NE (621', upsize from 6" to 8") | Fire flow | 190 | | | | 240 | | | 240 | | 240 |
| WD-21 | NA | 86th St NE (855', upsize from 6" to 8") | Fire flow | 260 | | | | 320 | | | 320 | | 320 |
| WD-22 | NA | 50th Ave NE (250', upsize from 6" to 8") | Fire flow | 80 | | | | | | 110 | 110 | | 110 |
| WD-23 | NA | 92nd St NE (561', upsize from 6" to 8") | Fire flow | 180 | | | | | | 250 | 250 | | 250 |
| WD-24 | NA | 134th Pl NE and 54th Dr NE (1,502', upsize from 6" to 8" and some new 8") | Fire flow | 470 | | 520 | | | | | 520 | | 520 |
| WD-25 | NA | 140th Pl NE (305', upsize from 4" to 8") | Fire flow | 100 | | | 120 | | | | 120 | | 120 |
| WD-26 | NA | Pipes and valves to adjust North/South boundary (5 segments, 25' ea, 8") | Other | 40 | | | 50 | | | | 50 | | 50 |
| ***Water Maintenance and Operations*** | | | | | | | | | | | | | |
| WM-1 | W R&R* | Watermain R&R [5] | Replacement | 468 | 900 | 468 | 468 | 468 | 468 | 468 | 3,240 | 6,580 | 9,820 |
| WM-2 | W0000* | Watermain Oversizing [5] | Subsidized Development Cost | 31 | 30 | 31 | 31 | 31 | 31 | 31 | 185 | 434 | 619 |
| WM-3 | W0603* | PRV Rate of Flow | Operations | 21 | 20 | 21 | 21 | | | | 62 | | 62 |
| WM-4 | W0807* | Stillaguamish Fiber Optics | Operations | 35 | 35 | | | | | | 35 | | 35 |
| WM-5 | W0607* | Water Meter AMR | Operations | 1,000 | 1,000 | | | | | | 1,000 | | 1,000 |
| WM-6 | NA | Water System Plan Update | Planning | 300 | | | | | | 416 | 416 | | 416 |
| **Total Water System Improvements** | | | | **47,607** | **4,435** | **4,302** | **4,572** | **7,521** | **11,321** | **5,427** | **37,578** | **40,470** | **78,048** |

Notes:
(1) Costs are escalated from Base Project Cost (2008 dollars) to stated year of construction, assuming a 5.6% annual increase in costs, except for those projects with an asterick (*) next to the Budget Project Code. Costs for those projects are included in City-approved budget documents. See Section 9.1 for more details regarding the cost escalation methodology.
(2) City project code in budget documents. NA = Not Applicable (I.e., project not previously budgeted for).
(3) Base Project Cost includes: construction costs (materials and labor), sales tax (8.5% of construction), construction contingency (20% of construction + sales tax), and design engineering (25% of construction). One exception to this is Project WD-10 (since the project is already designed and permitted), for which the Base Project Cost is comprised of construction costs, sales tax, and contingencies/construction administration at 15% of construction + sales tax.
(4) Total costs associated with projects implemented in 2015 through 2028. Specific years of project implementation are noted where applicable.
(5) Project includes annually budgeted amount to cover unspecified project costs. Budgeted annual amounts (in 2008 dollars) are listed below by project.
WS-1: $52,000
WM-1: $468,000 (except for $900,000 in 2009)
WM-2: $31,000




**Capital Improvement Projects**
**North System**
*Figure 9-1*

City of Marysville | Water Comprehensive Plan




## Capital Improvement Projects South System

*Figure 9-2*

### 9.2.1. Water Supply and Treatment

The following are supply and treatment-related capital projects.

- **WS-1: Additional Spring Collector Improvements**
  Various improvements to the Stillaguamish Ranney Well collectors, including routine maintenance/upgrades, as well as installation of new components as necessary.
- **WS-2: Lake Goodwin Well Development**
  Installation of a disinfection system (most likely sodium hypochlorite) on the waterline leading from the Lake Goodwin Well to the 327 Zone Reservoir. This project was substantially completed in 2008. Project close-out costs remain on the CIP for 2009.
- **WS-3: Sunnyside Well #1 Relocation and Well #2 Rehabilitation**
  Installation of a replacement well for the abandoned Sunnyside Well No.1. In addition, rehabilitation of Sunnyside Well No.2.
- **WS-4: Ultraviolet Treatment System**
  Installation of an ultraviolet disinfection system at the Edward Springs Treatment Facility. The system is expected to be on-line by 2011.

### 9.2.2. Water Storage

The following are storage-related capital projects, including those identified in Chapter 5.

- **ST-1: Edward Springs Baffles**
  Installation of curtain baffles in the Edwards Springs Reservoir, with the objective of creating a flow pattern that maximizes water detention time and reduces short-circuiting.
- **ST-2: Highway 9 Reservoir Demolition**
  Demolition of an old, small reservoir that has an overflow elevation at a different hydraulic grade than the primary 1.7 MG Highway 9 Reservoir.
- **ST-3: Highway 9 Reservoir**
  Construction of a second Highway 9 Reservoir (1.8 MG) to meet increasing storage volume requirements and provide redundancy in the South 510 Zone.
- **ST-4: Soper Hill (Whiskey Ridge) Reservoir**
  Property acquisition in 2009, and design/construction in later years, for a new reservoir east of 83rd Avenue. This reservoir, currently planned to be 1 MG in size, will provide storage to an area previously served by Snohomish PUD.
- **ST-5: North 510 Zone Reservoir**
  Installation of a new 1 MG reservoir to provide storage to the future North 510 Zone.

### 9.2.3. Water Booster Pump Stations

The following are pump station-related capital projects, including those identified in Chapter 5.

- **PS-1: Edward Springs Pump Modification**
  Implementation of various improvements to the Edward Springs Booster Pump Station. Improvements completed in 2008 include pump replacement (to increase head so that pumps can provide fire flow for the 460 Zone) and telemetry system improvements. Additional costs associated with piping modifications at the pump station remain on the CIP for 2009.
- **PS-2: Edward Springs Booster Pump Building**
  Improvements to the structure that houses the Edward Springs Booster Pump Station.
- **PS-3: Cedarcrest Pump Station Rehabilitation**
  Improvements to the Cedarcrest Pump Station, including motor control and valve replacements.
- **PS-4: Soper Hill (Whiskey Ridge) Pump Station**
  Installation of a new pump station to provide source capacity to the area to be served by the new Soper Hill Reservoir. In addition, this pump station will replace the existing Cedarcrest Pump Station (which sits at an elevation of approximately 150 feet), which is currently used to fill the Highway 9 Reservoir and serve customers in the South 510 Zone. Installation of this pump station will allow Marysville to pump from the JOA Transmission line (approximately 400 feet elevation) to the South 510 Zone, which will save Marysville money in pumping costs. For planning purposes, this pump station was sized to provide 700 gpm at a head of 130 feet (approximately 35 horsepower). Marysville would need to further refine the capacity of this pump station during the design phase.
- **PS-5: North 510 Zone Pump Station**
  Installation of a new pump station to provide source capacity to the future North 510 Zone. For planning purposes, the proposed pump station was sized to provide 300 gpm at a head of 300 feet (approximately 40 horsepower). Marysville would need to further refine the capacity of this pump station during the design phase.

### 9.2.4. Water Transmission and Distribution Systems

The following are transmission and distribution-related capital projects, including those identified from the system analysis which is described in Chapter 5.

In general, Projects WD-1 through WD-12 are projects that replace aging infrastructure (older cast iron and asbestos cement pipe) and have been previously identified in previous Marysville Capital Improvements Programs. The exceptions to this include the following: Project WD-4 includes installation of new pipe which will serve as transmission piping for future development along 67$^{th}$ Ave NE; Project WD-6 consists of new pipe being installed as part of a Washington Department of Transportation project; and Projects WD-7 and WD-8 both include installation of new pipe to eliminate dead ends and improve available fire flow for the local area.

Projects WD-13 through WD-17 consist of new piping required to connect the following proposed facilities: Soper Hill Reservoir (Project ST-4), Soper Hill Pump Station (Project PS-4), North 510 Zone Reservoir (Project ST-5) and North 510 Zone Pump Station (Project PS-5).

Projects WD-18 through WD-25 were developed to improve the level of available fire flow in large areas of the system that were shown to be inadequate during the system analysis, as described in Chapter 5. The projects include upgrade of small diameter pipe to 8-inch pipe or a new section of 8-inch pipe to loop the existing system.

Project WD-26 comprises five short sections of 8-inch pipe (or new connections) which are required to transfer areas of the system that are currently served from the 18-inch pipeline in 100th Street NE to the 10-inch pipeline that lies in the same right-of-way. Marysville staff proposes to move the boundary between the north and south service areas even further south in the future to maximize the area served with water from the Stillaguamish WTP.

Each of the transmission and distribution-related capital projects are described in further detail below.

- **WD-1: State Avenue (102nd to 116th)**

  Replacement of a 12-inch asbestos concrete (AC) distribution pipe with 4,578 feet of 18-inch ductile iron pipe along State Avenue from the right-of-way for 102nd to 116th Street NE.

- **WD-2: 67th Avenue NE (100th to 132nd)**

  New installation of 10,469 feet of 18-inch diameter ductile iron pipe along 67th Avenue NE between 100th Street NE and 132nd Street NE. Includes installation of a pressure reducing valve (PRV) station and property/easement acquisition for pipeline. This pipeline will provide a connection between the north and south service areas.

- **WD-3: 83rd Avenue NE (60th to 64th)**

  Replacement of a 12-inch distribution pipe with 1,301 feet of 16-inch ductile iron pipe along 83rd Avenue NE between 60th Street NE and 64th Street NE.

- **WD-4: 67th Avenue NE (52nd to 64th)**

  Replacement of a 10-inch distribution pipe with 3,943 feet of 16-inch ductile iron pipe along 67th Avenue NE between 52nd Street NE and 64th Street NE.

- **WD-5: 51st Avenue NE (119th Place NE to 122nd Place NE)**

  Replacement of a 12-inch cast iron (CI) distribution pipe with 820 feet of 12-inch ductile iron pipe in 51st Avenue NE between 119th Place NE and 122nd Place NE. This section of pipeline is being installed in conjunction with a transportation project where the road elevation is being raised two feet.

- **WD-6: Ebey Slough Bridge Pipe**

  New installation of 717 feet of 12-inch distribution pipe, on the Ebey Slough Bridge. Marysville will provide a limited amount of design for this project, which will be implemented by the Washington State Department of Transportation.

- **WD-7: Cedar Avenue (1st to 5th)**

  New installation of 1,407 feet of 8-inch diameter ductile iron pipe along Cedar Avenue between 1st Street and 5th Street. New pipe will complete looping in this area and allow for more available fire flow in this area.

- **WD-8: Quinn Avenue (6th to 8th)**

  New installation of 972 feet of 8-inch diameter ductile iron pipe along Quinn Avenue between 6th Street and 8th Street. New pipe will complete looping in the immediate area and allow for more available fire flow.

- **WD-9: 67th Avenue NE (44th to 52nd), 44th Street NE (67th to 71st), and 71st Avenue NE (to Sunnyside Reservoir)**

  New installation of 4,697 feet of 18-inch diameter ductile iron pipe. This pipe is located in the right-of-way and will replace the existing 10-inch pipe (which crosses private property) that carries water from the Sunnyside Reservoir into the distribution system. This pipeline starts at the Sunnyside Reservoir, heads west and then turns north on 71st Avenue NE. The pipe continues west along 44th Street NE, then turns north 67th Avenue NE and continues north to the intersection of 67th Avenue NE and 52nd Street NE.

- **WD-10: 140th Place NE (23rd to I-5), North on 23rd Avenue NE, Northwest on 45 Road**

  Replacement of a 12-inch AC distribution pipe with 10,053 feet of 18-inch ductile iron pipe. The pipe starts on 140th Place NE (beginning 300 feet west of Interstate 5) and goes west to where it turns north on 23rd Avenue NE. The pipe continues north along 23rd Avenue NE and then turns northwest and follows 45 Road to the intersection of 45 Road and 11th Avenue NE.

- **WD-11: 71st Avenue NE (52nd to 72nd)**

  Replacement of 10-inch AC distribution pipe with 6,559 feet of 12-inch diameter ductile iron pipe along 71st Avenue NE between 52nd Street NE and 72nd Street NE.

- **WD-12: 52nd Street NE (67th to 73rd)**

  Replacement of a 10-inch distribution pipe with 2,023 feet of 12-inch ductile iron pipe along 52nd Street NE between 67th Avenue NE and 73rd Avenue NE.

- **WD-13: Soper Hill (Whiskey Ridge) Reservoir Waterline**

  New installation of 4,378 feet of 12-inch diameter ductile iron pipe. This pipeline will carry water from the proposed Soper Hill Reservoir (Project ST-4) and Soper Hill Pump Station (Project PS-4) into the existing Soper Hill area distribution system.

- **WD-14: Soper Hill (Whiskey Ridge) PRVs**

  New installation of three PRVs. The location of these PRVs are approximate and may change when Marysville designs the infrastructure required to serve the portion of the existing Soper Hill/Snohomish PUD system proposed for annexation.

- **WD-15: Connection of Soper Hill to 360 Zone, on 49th Street NE**

  New installation of 200 feet of 8-inch diameter ductile iron pipe. This pipe will connect existing 8-inch pipe in 49th Street NE (currently owned by Snohomish PUD) to Marysville pipe in the 360 Zone.

- **WD-16: 83rd Avenue NE (Soper Hill Reservoir to 60th)**

  New installation of 6,859 feet of 16-inch diameter ductile iron pipe. This pipe will carry water pumped from the proposed Soper Hill Pump Station (Project PS-4) into the South 510 Zone. The pipe is located along 83rd Ave NE between the approximate 38th Street right-of-way and 60th Street NE.

- **WD-17: North 510 Zone Reservoir Waterline**

  New installation of 22,838 feet of 12-inch diameter ductile iron pipe. This project comprises the proposed transmission lines for the area to be developed east of the existing North 240 Zone. The north/south line is located within the 81st Avenue NE right-of-way from just south of where the right-of-way crosses the Middle Fork of Quilceda Creek to just north of where the right-of-way crosses 108th Street NE. The east/west line runs from the North 510 Zone Pump Station (Project PS-5) located at the Wade Road Reservoir site, continues east along Wade Road, and ends just west of the intersection of Wade Road and State Route 9.

- **WD-18: 52nd Drive NE (North from 81st Place NE to Existing 6-inch CI)**

  New installation of 340 feet of 8-inch diameter ductile iron pipe. This project will improve available fire flow along 52nd Drive NE. This project is located in 52nd Drive NE; and it completes a loop between dead-end pipe ending just north of 81st Place NE and connecting to existing 6-inch which extends south from 84th Street NE.

- **WD-19: 77th Place NE and 76th Street NE**

  Replacement of a 6-inch distribution pipe with 600 feet of 8-inch ductile iron pipe in 77th Place NE, extending east from intersection of 77th Place NE and 51st Avenue NE. Replacement of a 6-inch distribution pipe with 410 feet of 8-inch ductile iron pipe in 76th Street NE, extending west from 55th Avenue NE. This project will improve available fire flow in the area local to 77th Place NE and 76th Street NE.

- **WD-20: 60th Drive NE**

  Replacement of a 6-inch distribution pipe with 3,842 feet of 8-inch ductile iron pipe in 60th Drive NE located between 80th Place NE and 93rd Place NE. This project will improve available fire flow in the local area along 60th Drive NE.

- **WD-21: 61st Drive NE and 84th Place NE**

  Replacement of a 6-inch distribution pipe with 758 feet of 8-inch ductile iron pipe. This project will help improve available fire flow in the local area along 61st Drive NE and 84th Place NE. This portion of Project WD-21 extends south along 61st Drive NE (starting at the intersection with 86th Street NE), turns east and continues along the road to the end of 84th Place NE.

- **WD-21: 87th Street NE**

  Replacement of a 6-inch distribution pipe with 621 feet of 8-inch ductile iron pipe. This portion of Project WD-21 starts at the intersection of 86th Street NE and

continues east to the end of 87th Street NE. This project will help improve available fire flow in the local area along 87th Street NE.

- **WD-21: 86th Street NE**

  Replacement of a 6-inch distribution pipe with 855 feet of 8-inch ductile iron pipe. This portion of Project WD-21 is located in 86th Street NE; it starts at the intersection with 60th Drive NE and continues east to the end of 86th Street NE. This project will help improve available fire flow in the local area along 86th Street NE.

- **WD-22: 50th Avenue NE**

  Replacement of a 6-inch distribution pipe with 250 feet of 8-inch ductile iron pipe. This pipe is located in 50th Avenue NE, starting at the intersection of 50th Avenue NE and the 95th Street NE right-of-way and extends 250 feet to the south. This project will help improve available fire flow in the local area along 50th Avenue NE.

- **WD-23: 92nd Street NE**

  Replacement of a 6-inch distribution pipe with 561 feet of 8-inch ductile iron pipe in 92nd Street NE. This pipe starts at the intersection of 92nd Street NE and 55th Avenue NE and continues west to the end of the road. This project will help improve available fire flow in the local area along 92nd Street NE.

- **WD-24: 134th Place NE and 54th Drive NE**

  Replacement of a 6-inch distribution pipe with 1,502 feet of 8-inch ductile iron pipe along 134th Place NE between 51st Ave NE and 54th Drive NE. Includes some new 8-inch pipe (to complete loop along 54th Drive NE which connects pipe in 134th Place NE to pipe in 133rd Place NE). This project will help improve available fire flow in the local area along 134th Place NE and 54th Drive NE.

- **WD-25: 140th Place NE**

  Replacement of a 4-inch distribution pipe with 305 feet of 8-inch ductile iron pipe in 140th Place NE. This project starts at the intersection of 140th Place NE and 29th Avenue NE and extends west to the hydrant. This project will help improve available fire flow in the local area along 140th Place NE.

- **WD-26: Pipes and Valves along North/South Boundary**

  New installation of five segments of 8-inch ductile iron pipe, each 25 feet in length. These new connections transfer existing connections to the 18-inch line in 100th Street NE to the 10-inch pipeline that also lies in the right-of-way. These new connections will extend the boundary of the north service area further south; the 18-inch main will continue to wheel water from the Getchell Reservoir to the Tulalip Tribe meter located on the western edge of the Marysville service area.

## 9.2.5. Water Maintenance and Operations

The following are maintenance and operations-related capital projects.

- **WM-1: Watermain Rehabilitation and Replacement**

  Routine annual replacement of undersized or aging pipelines, primarily aimed at the replacement of AC and CI pipe. An annual amount of $468,000 is budgeted to

address these projects. The amount is greater ($900,000) in 2009, to reflect carryover from unfinished 2008 projects.

- **WM-2: Watermain Oversizing**

  In some cases, Marysville requires that developers install pipes larger than necessary to serve solely their developments, in order to account for future growth in system demands. This CIP line-item reflects an annual budget amount that covers the additional costs incurred on such projects.

- **WM-3: PRV Rate of Flow**

  Installation of additional and/or replacement PRVs as required to maintain pressure zone boundaries.

- **WM-4: Stillaguamish Fiber Optics**

  A new telemetry system was installed in the system in 2008. This CIP line-item reflects close-out costs associated with this project.

- **WM-5: Water Meter AMR**

  Installation of a mobile radio read system for Marysville's water service meters, to be completed in 2009.

- **WM-6: Water System Plan Update**

  Routine update to the WCP, as required every six years.

# 10. Financial Plan

## 10.1. Introduction

The effective implementation of a Water System Plan (WSP) is dependent upon accurately developing a plan that can be financially supported by the utility; will meet State and local regulatory requirements; and provides the flexibility to deal with unforeseen changes.

This chapter presents a financial plan that reviews the revenues and expenses for the City of Marysville's (Marysville) water system. The financial plan includes projected operating and capital costs of the system for the six-year time horizon of 2009 to 2014. The revenues and expenses used in the financial plan were obtained from Marysville's 2007 budget. Revenues and expenses were updated to reflect the 2009 budget. Marysville is in the process of completing a comprehensive rate study. The capital costs contained within the financial plan utilize the Capital Improvement Plan (CIP) in Chapter 9 of this Water Comprehensive plan. The results of the financial plan outline the annual operating and capital needs of the water system and determine if the current water utility revenues are sufficient to cover operating and capital costs. This analysis is not intended to initially provide a detailed review of cost of service or various alternative rate designs.

## 10.2. Past Financial History

The past two years of financial information for the water utility were evaluated to gain an understanding of the past performance of the utility, and at the same time, gain perspective of the current financial status of the water utility.

Table 10-1 is a summary of a two-year financial history (2006 - 2007) for Marysville's water utility, as reported in Marysville's annual audited financial statements for 2006 and city records for 2007.

**Table 10-1**
**Water System Financial History ($000s)**

| | 2006 | 2007 |
|---|---|---|
| **Total Revenue** | $17,397,086 | $11,967,242 |
| | | |
| **Expenses** | | |
| O&M | 8,713,883 | 8,701,455 |
| Debt Service | 2,536,577 | 2,193,981 |
| **Total** | $11,250,460 | $10,895,436 |
| | | |
| **Balance in Capital Funding** | $6,146,626 | $1,071,805 |

Overall, the utility has adequate revenue for operations and capital. In 2006, bond proceeds from a separate fund were used for capital; the balance was applied to the capital reserve for

additional capital projects. The remaining balance is used for capital improvements and/or reserved for future capital needs. Some capital improvements are also funded through low-interest loans and revenue bonds, resulting in debt service payments. Target levels for funding capital improvements for future years are discussed later in this section. Historically Marysville has managed its financial resources in a prudent manner in order to meet the operating, capital, and regulatory needs of the utility.

# 10.3. Development of the Financial Plan

A financial projection was developed to determine the utility's ability to meet its capital improvement and operating needs over the six-year time period being reviewed. Fund balance and reserve levels were also analyzed in developing the financial projection. The financial plan was developed to review the projected revenues and expenses of the water system for 2009 to 2014. This time period is consistent with the six-year planning period contained within the other planning chapters. Marysville's adopted 2009 budget was used as a base. Future years were escalated by applying factors for inflation and growth, which are described below.

## 10.3.1. Revenue

The first component of the financial plan is a review of the sources of revenue of the water system. The different revenues received from operations are:

- Rate revenues – water sales to customer accounts;
- Other revenues – interest income, water connections, treated water, and other miscellaneous sources

Projections for future year rate revenues were developed by applying a projected growth rate to the 2009 budgeted rate revenue. The 2009 budget showed a reduction in overall rate revenue from 2007 and 2008 due to recent annexations and the loss of the 50% surcharge on rates from outside city customers. Due to the assumed increase in service area, a four percent growth in the number of customers and demands on the system may be realized, but with a *loss* of revenue due to the reduction of outside city surcharge with annexations, the *revenue* growth rate is half the demand forecast growth. In addition, with the slowing economy, growth was reduced an additional one percent, resulting in growth projections of one percent for 2009 and 2010, two percent for 2011 and 2012. For 2013 and 2014 the four percent of the demand forecast was used, assuming the economy may improve by that time, and less growth will be the result of annexations.

Other miscellaneous revenues, including investment interest, water connections, and other sources, are also projected to increase by an average of 2 3/4 percent per year through 2014.

Rate revenues are projected to be approximately $6.5 million in 2009. The rate revenues of the utility come from water sales to the residential, commercial, and irrigation customers, as well as schools. The rate revenue is estimated to increase to $7.4 million by 2014, using above mentioned growth applied each year.

Other revenues for 2009 total approximately $679,000; a majority of the revenue stems from miscellaneous service revenue. The total amount of other revenue increases over the six years, reaching approximately $947,000 by 2014.

The total revenue available to offset the operating and capital requirements of the water system totals $7.2 million in 2009 and is projected to increase to $8.3 million by 2014.

**Table 10-2**
**Projected Six-year Revenue (000s)**

| Sources of Funds | Budget | Projected | | | | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Rate Revenue | $6,500 | $6,565 | $6,696 | $6,830 | $7,103 | $7,388 |
| Miscellaneous Revenue | 679 | 927 | 1,036 | 1,036 | 1,015 | 949 |
| **Total** | $7,179 | $7,492 | $7,732 | $7,866 | $8,119 | $8,337 |

## 10.3.2. Expenses

The second part of the financial plan is a review of the applications of funds, or expenses. The projection of future operating expenses is based on the 2009 budget levels. These expenses are projected for future years by applying the escalation factors pertinent to the type of expense being reviewed. The escalation factors range from 1% to 15% (purchased water). Four main cost components were reviewed in developing the financial forecast:

- Operations and Maintenance (O&M)
- Taxes Expenses
- Debt Service
- Capital Improvements Funded From Rates

### *Operation and Maintenance Expenses*

Using the 2009 budget as a starting point, expenses were escalated by factors representing assumed inflationary rates to obtain projected costs. Escalation factors include labor (escalated by four percent per year), benefits (six percent), materials and supplies (three percent), and miscellaneous (three percent). Purchased water was escalated by nine percent in 2009-2011, and by 15% in 2011. This is tied to the expected increases in wholesale water rates from the City of Everett.

Some O&M expenses are shared by both Marysville's water and sewer utilities. The costs were prorated by 50% in these cases to represent only the water utility's share of the expense.

Some program cost increases and decreases were seen in the 2009 budget. These were noted and reviewed with Marysville staff to determine the appropriate cost level to escalate into future years. O&M expenses are projected to be from $6.6 million in 2009 and increase to $8.7 million in 2014. These costs include the utility's taxes and transfer expenses.

### *Debt Service*

According to city financial records, there is a 2005 Water/Sewer Revenue bond and a Drinking Water Revolving Fund loan that relate to the water utility. The Drinking Water Revolving Fund loan is specifically for Stillaguamish water system improvements. There are also two refunding issues, a 1998 and a 2004 which reflect a 1993 bond issue. The combined debt service on the existing debt averages approximately $2.1 million for the 2009 to 2012 time period. The 2004 and 1998 refunding issue payments end in 2012. At that time, the payments on the 2005 issue double, with the total cost of existing debt approximately $1.7 million through 2014.

The financial plan assumes two new debt issues, a low-interest loan in 2012 for waterline replacements and one revenue bond for the larger water line replacements and the Soper Hill reservoir project planned for 2013.

Meeting debt service coverage (DSC) requirements is an important financial indicator for well managed utilities. Debt service coverage is a financial measurement of an entity's ability to repay debt. A debt service coverage ratio is a comparison of net income before debt service payments to the total debt service on revenue bonds, or on all outstanding debt service. A debt service coverage ratio of 1.25 or 1.30 is generally considered the legally acceptable minimum for revenue bonds. A DSC ratio of 1.5 is considered a financially stronger target to strive for. Bond rating agencies look at a utility's DSC ratio in determining the utility's rating, which affects interest rates for future bond issues. The higher the DSC ratio, the better the rating and the lower future interest rates and debt payments. Marysville is projected not to meet the DSC ratio requirement in the years 2012 to 2014 without some adjustments to rates, or reductions in costs, due to assumed new financing of capital improvement projects in those years. Marysville will need to be watchful of this planning requirement during its financial evaluations in order to maintain an adequate DSC ratio. Before any rate adjustments, Marysville has a DSC of 1.16 in 2009 and 0.0 in 2014 as current revenues are not projected to fully fund projected operating costs.

### *Taxes and Transfer Payments*

The water utility pays the State public utility tax (5.29%), for which Marysville is eligible for reductions and exemptions for irrigation and wheeling revenue. There is also a local excise tax of 6%, and an additional "in lieu of tax" based on $3.375 per thousand dollars of plant value. The taxes are contained in the overall Utility Administration section budget, which also applied to wastewater. Therefore, 50% was allocated to each utility. Taxes total $1.04 million in 2009 and increase to $1.2 million by 2014.

### *Capital Improvements Funded from Rates*

Capital improvements are related to the infrastructure of a utility. The modeling of this plan identified a number of projects for infrastructure improvements. The CIP also contains a number of renewal and replacement and growth-related projects. Renewal and replacements are, as the name suggests, the replacement of existing and worn out (depreciated) facilities. Some of the renewal and replacement projects are also major maintenance projects, such water main replacements. Some projects are also due to

regulatory requirements (e.g., safe drinking water act). Growth-related facilities, on the other hand, are those related to system expansion and new customers. Many of the utility capital projects have all three elements contained. That is, they address a regulatory issue, they will replace and existing facility, and they will be designed and built to provide service for growth. Funding sources are determined, in part, by what type of improvements the project provides.

Marysville capitalizes some staff time and benefits for those staff working on capital projects. The financial analysis conducted for this plan has incorporated the capital projects outlined in Chapter 9 of this Plan. These projects have been assigned in the year they are expected to be completed along with any known or anticipated funding sources. Identified capital improvement project totals range from approximately $4.3 million to $10.9 million per year from 2009 to 2014, and total approximately $38 million over the projected 6-year review period. Table 10-3 presents a summary of the capital improvement projects and funding sources of the utility.

**Table 10-3**
**Projected Capital Improvement Needs (000s)**

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Water Supply Improvements** | | | | | | |
| Water Supply and Treatment | $370 | $832 | $52 | $52 | $52 | $52 |
| Water Storage | 1,510 | 0 | 0 | 250 | 5,060 | 0 |
| Water Booster Pump Stations | 300 | 150 | 0 | 0 | 1,060 | 0 |
| Water Transmission and Distribution System | 270 | 2,800 | 4,000 | 6,720 | 4,650 | 4,460 |
| Water Maintenance and Operations | 1,985 | 520 | 520 | 499 | 499 | 915 |
| **Total** | $4,435 | $4,302 | $4,572 | $7,521 | $11,321 | $5,427 |
| | | | | | | |
| **Outside Funding Sources** | | | | | | |
| Capital Improvement Charges | $2,000 | $2,000 | $2,040 | $2,081 | $2,164 | $2,251 |
| New Rev. Bond Proceeds | 0 | 0 | 0 | 0 | 3,500 | 0 |
| New Low Interest Loans | 0 | 0 | 0 | 1,700 | 0 | 0 |
| Use of Operating Reserve | 0 | 0 | 0 | 0 | 0 | 0 |
| Use of Capital Reserve | 1,400 | 900 | 700 | 1,500 | 3,057 | 176 |
| **Total** | $3,400 | $2,900 | $2,740 | $5,281 | $8,721 | $2,427 |
| | | | | | | |
| **Net CIP Funded From Rates** | $1,035 | $1,402 | $1,832 | $2,240 | $2,600 | $3,000 |

It is anticipated that Marysville will use a large amount of reserve funding to cover its capital improvements. This is due to the bond proceeds from the 2005 bond issue which are available for many of the identified capital projects. Reserve funds are discussed in more detail later in this section.

As a practical matter, and prudent practice, a utility should fund a portion of its capital improvements from rates on an on-going basis. The balancing of funding projects

between existing and future customers is prudent as the improvements benefit both. The funding of capital from rates, shown at the bottom of Table 10-3, is targeted toward funding at a minimum level of annual depreciation expense. In 2006 that expense was $1.4 million, which is water's portion (50%) of the total 2006 depreciation. Given the level of projected capital improvements, the annual depreciation expense will increase substantially over the next 6-years. The target, therefore, was 1.5 times the annual depreciation expense, or $2.0 million. In 2009, the level of funding is $1.0 million increasing to $3.0 million by 2014. The increase in CIP funding from rates is implemented gradually to balance the impacts to rates with the goal of funding a minimum of annual depreciation expense. It is recommended that whenever Marysville is able to increase this level of funding for capital, it should. This funding source enables Marysville to maintain a strong debt service coverage ratio, which is important to maintaining lower interest rates on future revenue bonds.

The capital analysis assumes that any additional funding beyond what is necessary to meet the annual capital requirements will be placed into the capital reserve for future capital needs.

## 10.3.3. External Sources of Funds for Capital Projects

Marysville has the ability to apply for grant and loan funds available to public entities for water system projects. Table 10-4 provides a summary of the contacts for various funding agencies. These sources rarely provide full funding of a construction project. Marysville would need to supplement any of these funds with matching funds to meet eligibility criteria and to ensure that implementation of the recommended capital improvement projects can occur.

**Table 10-4**
**Funding Agency Contacts**

| Program | Address | Phone | Fax | Internet |
|---|---|---|---|---|
| Centennial Clean Water Fund | Department of Ecology<br>P.O. Box 47600<br>Olympia, WA 98504-7600 | (360) 407-6566 | (360) 407-6426 | www.ecy.wa.gov |
| Drinking Water State Revolving Fund | Department of Health<br>DWSRF<br>PO Box 47822<br>Olympia, WA 98504-7822 | (360) 236-3095 | (360) 236-2253 | www.doh.wa.gov |
| Public Works Trust Fund | Public Works Board<br>P.O. Box 48319<br>Olympia, WA 98504-8319 | (360) 586-7186 | (360) 664-3029 | www.pwb.wa.gov |
| Infrastructure Database (over 200 funding programs) | Infrastructure Assistance Coordinating Council (IACC) | (360) 725-5002 | | http://www.infrafunding.wa.gov |

A brief description of these funding sources is provided below.

**Centennial Clean Water Fund (CCWF) –** Managed by the Department of Ecology (Ecology) – The CCWF is available to local governments and tribes for measures to

prevent and control water pollution. Both grants and loans are available on a yearly funding cycle.

CCWF is the largest State Grant Program for water projects. It provides grants for planning, design, and construction of facilities and other activities related to water quality. The primary focus of the program is pollution prevention and funding projects with a quantifiable water quality benefit. The CCWF funding cycle requires that applications be submitted by mid-February.

Funds are available to protect a source of water supply, as well as funding of water conservation or water reuse projects, if they can be shown to be the cost-effective alternative to solve a water quality problem. Funding from this program is not available to provide excess capacity, but must be used to meet existing customer needs. Funding can also not be used to provide a source of supply. Grants and loans from this program are also available for the wellhead protection activities.

Each public body is limited to a maximum of five funded projects per year, with a maximum of $2.5 million available for each of two projects, and a limit of $250,000 per project for the remaining three projects. Grant funding of 50 to 75 percent of a project's cost is available depending on the type of project.

**Drinking Water State Revolving Fund (DWSRF)** - The Washington Department of Health (DOH) manages these funds. In August 1996 Congress reauthorized the Safe Drinking Water Act (SDWA) and appropriated funding for states to develop their Drinking Water State Revolving Fund (DWSRF) loan programs. Each state receives annual allocations in the form of a Capitalization Grant. In Washington State, the DWSRF is jointly managed by the Department of Health (DOH), Division of Drinking Water and the Public Works Trust Fund Board (Board), along with its partner, the Department of Community, Trade and Economic Development.

DWSRF loans are available to all community public water systems, and non-profit, non-community public water systems, except federally owned systems. The loans may be used to address SDWA health standard violations, replace infrastructure for SDWA compliance, or consolidate supplies and acquire property if needed for SDWA compliance.

The terms of the loan are generally one percent less on interest than municipal utility revenue bonds, and life of the loan can extend for the life of the facility up to a 20-year maximum. A ten percent local match is required on all projects. In addition, eligible systems must demonstrate "adequate operational, technical, and financial capability to maintain compliance," have an approved water system plan (WSP) to ensure the applicant project is included in the WSP Capital Improvement Program, and meet other eligibility criteria.

**Public Works Trust Fund -** The Public Works Trust Fund (PWTF) loan program is a loan set up by the Legislature to assist cities, towns, counties, or special districts with funding for different types of public works projects. The projects can include streets, roads, bridges, drainage systems, water systems, and sanitary sewer systems. The emphasis of allocating funds is for replacement and/or repair of existing systems. No

funds are allocated to install a new system. Rather, loans are provided to rehabilitate or replace an existing system serving an existing population.

The loans are issued at up to one percent interest rate for a maximum term of 20 years for applications requesting 95 percent funding of the project. The interest rate decreases to 0.5 percent when the local government provides 15 percent of the project funding. A debt service coverage requirement is not imposed on the PWTF loan.

**Infrastructure Assistance Coordinating Council –** One key resource in identifying other funding programs is the Infrastructure Assistance Coordinating Council (Council). The Council is comprised of state and local organizations whose function is to provide funding for infrastructure repair and development. The purpose of the Council is to assist local governments in coordinating funding efforts for infrastructure improvements. This is an important resource as the Council will be aware of any new funding opportunities that may arise.

**Revenue Bonds -** Revenue bonds are an external source of funding for capital projects. The sale of revenue bonds is the most common source of funds for construction of major utility improvements. Water rate and charges are the main source of funds for debt service (principal and interest) payments. A key benefit of revenue bonds is the exemption of interest paid on them from federal income taxes. A determination of the utility's ability to repay debt is an important consideration. A debt service coverage ratio (total revenue, less O&M and tax expenses, divided by debt requiring a coverage ratio) is calculated and the utility's finances are reviewed in order to verify payments are feasible. Coverage ratios of 1.25 (25 percent more than the debt payment) are typical, but coverage of 1.5 is a more prudent financial target.

Similar to revenue bonds, other bond financing approaches include utility local improvement districts (ULIDs), special assessment districts (SADs) and other funding for projects that serve and benefit a limited service area within Marysville's total service area. Then the costs of those improvements are shared only by those customers benefiting from those improvements.

**Utility Local Improvement Districts (ULID) -** Projects benefiting a specific area of adjacent properties can be funded through utility local improvement districts (ULID). After a ULID is formed, the cost of the project can be assessed against the benefited properties in proportion to their share of the total benefits. The amount of the assessment cannot exceed the increase in the value of the property resulting from the project.

A ULID combines property assessments and revenue funding from water rates. The additional security of the bonds tends to bring lower interest rates. There is also added flexibility and equity as Marysville can accommodate the cost of special construction problems or of upsizing the distribution system.

While the above list of possible grant, loan and other funding opportunities for Marysville is not exhaustive, it does however, highlight the most probable outside funding sources available to the District for its capital improvements.

**Developer Extensions –** Developer extensions are one way to mange growth of the system to meet new customer needs. Under a developer extension, the owner of a development requests water service. Filing fees usually cover administration costs only. The developer pays all costs of the extension and turns the facility over to Marysville for operation and maintenance.

### 10.3.4. Internal Sources of Funding for Capital Projects

Internal funding sources available to offset capital costs include contributions received from new water customers for their capacity impact on the system. Marysville charges Capital Improvement Charges to new development in order to help fund capital improvements related to growth. These fees are important to bring equity between new and existing customers. Funding from these charges is projected to be $2 million in 2009, down from actual revenue in 2007 of over $3 million. This revenue source has declined with the economy in recent years. It is anticipated to remain lower through 2011, and assumed to begin to increase in the latter three years assuming the economy begins to recover. The 2008 charge for a 5/8"x3/4" meter (connection) is $4,750. The charges are based on the customer classification (residential, commercial etc.). These charges should be adjusted annually to keep up with the construction cost index. A commonly used measure for these annual updates is the *Engineering News Record.* Marysville should also conduct a comprehensive update of these fees every 3 to 5 years, or as new major capacity-related projects are undertaken. As of the writing of this report, Marysville is in the process of updating this fee.

As noted earlier, Marysville also uses available reserves for capital projects, as available.

## 10.4. Summary of the Financial Projections

A summary of the financial plan and resulting financial status of the water system is provided in Table 10-5. This is an abbreviated summary of the detailed financial plan and analysis, which is provided in Appendix 10-1.

**Table 10-5**
**Projected Six-year Financial Plan (000s)**

| | Budget | Projected | | | | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| **Sources of Funds** | | | | | | |
| Water Sales | $6,500 | $6,565 | $6,696 | $6,830 | $7,103 | $7,388 |
| Other Sources | 679 | 927 | 1,036 | 1,036 | 1,016 | 949 |
| **Total** | $7,179 | $7,492 | $7,732 | $7,866 | $8,119 | $8,337 |
| **Applications of Funds** | | | | | | |
| O&M and Taxes | $6,646 | $6,732 | $7,044 | $7,775 | $8,231 | $8,729 |
| CIP Funded From Rates | 1,035 | 1,402 | 1,832 | 2,240 | 2,600 | 3,000 |
| Debt Service (P+I) | 2,193 | 2,189 | 2,191 | 2,257 | 2,170 | 2,167 |
| **Total** | $9,874 | $10,323 | $11,067 | $12,272 | $13,001 | $13,896 |
| **Balance/Deficiency of Funds** | ($2,695) | ($2,831) | ($3,335) | ($4,406) | ($4,882) | ($5,559) |
| Plus: Additional Taxes | (136) | (142) | (168) | (222) | (246) | (280) |
| **Total Bal/(Def) of Funds** | ($2,831) | ($2,973) | ($3,503) | ($4,627) | ($5,128) | ($5,839) |
| **Bal./Def as a % of Rates** | 43.5% | 45.3% | 52.3% | 67.7% | 72.2% | 79.0% |

When interpreting the results of Table 10-5 it is important to understand that the "Bal/Def as a % of Rates" is cumulative. That is, any rate adjustments made in previous years would reduce the required adjustment in the following years. If no adjustments were made prior to 2014, a 79.0% adjustment would be required. It is also important to keep in mind that the model assumes expenses are completely expended within each year. Typically, utilities receive additional revenue and often actual expenditures do not total 100 percent of budget appropriations. Therefore, Marysville has a number of options for deferring the adjustment until the latter part of the test period. Those options would include adjusting capital improvement timing, use more reserves for capital improvements, reducing some other operating expenses, and closely monitoring additional revenue or increased growth beyond the assumed growth rate.

The results of Table 10-5 show that existing rates are not sufficient throughout the time period under review.

It is important to note that the financial plan presented in this section is predicated upon an assumed level of growth on the system, and assumptions related to inflation. Should this growth increase, slow down, or not occur, the level of rate adjustment required will be affected. Likewise, if costs escalate faster or slower than indicated in this plan, the projected rate adjustments shown in Table 10-5 would also be affected.

## 10.5. Reserve Levels

Another key indicator of a utility's financial health and viability is its reserve levels. Because a portion of the utility's revenue is consumption based, and therefore dependent upon weather conditions and usage patterns, maintaining adequate reserve levels is important for stable fiscal management of the utility. A discussion of the utility's reserves is provided below.

Industry standards (American Water Works Association – AWWA) recommend that utilities maintain working capital reserves at a level adequate to handle unexpected occurrences, including unexpected cash flow fluctuations. A minimal balance for an O&M reserve, or operating reserve, is recommended to be a minimum of 45 days (12 percent of annual) of operations and tax expenses. This is more typical for monthly billing cycles. Some utilities with bi-monthly billing cycles will use 60 or 90 days as their minimum target to maintain. Minimum balance of 45 days for the utility would equate to approximately $830,000 in the first half of the review period, increasing to $1 million by 2014. Marysville begins the test period in 2007 with a balance of $2.1 million in operating reserves at year end. This level is maintained through the review period.

The utility also has a balance in the capital reserve fund. In 2009, this reserve ends the year with $9.3 million and ends the review period with a balance of $3.0 million by 2014. Sound financial policies indicate that a capital fund balance equal to an average year's worth of capital projects is a prudent reserve amount. When averaging the 2009 to 2014 projected capital improvements the result appears high due to some large projects in 2012-2014. For the utility, this minimum capital fund target would be $5.0 million. During the test period, the reserve level drops to $3.0 million when funds are used for capital projects. Dropping below the target balance is reasonable for a year or two. Whenever possible, the fund should be replenished. Marysville should continue to watch this reserve level in future years and build to the target level whenever revenue exceeds the capital expenditures of a given year. Between the capital fund balance and the operating reserve, the utility's reserve levels appear adequate.

## 10.6. Review of the Existing Water Rates

There are various "generally accepted" water rate structures that can be used to establish rates. The initial starting point in considering a rate structure is the relationship between fixed costs and variable costs. Fixed costs are generally collected as a fixed charge on a monthly basis (e.g. $5.00 per month/meter). This charge may be called by various names (e.g. customer charge, meter charge, base charge, etc.) but in all cases, it is intended to collect those fixed costs that the utility incurs.

Currently, Marysville has both a meter charge for service and a commodity charge (overage rate) based on usage. This charge is related to the variable costs of producing and providing water service. For a residential customer inside the city, the meter charge for a 5/8" meter includes an allowance of 6,000 gallons of usage. Beyond that level of usage, the overage rate applied is $2.60 per 1,000 gallons. There are different rate schedules for customers in different parts of the utility service area. Those include inside the city, the Coordinated Water Study Plan Area (CWSP) which has a 50% surcharge above the Inside City rate, and outside the CWSP, which is twice the Inside City rate. For purposes of this overview, the rates in effect as of 2009 are presented in Table 10-6.

**Table 10-6**
**2009 Bi-Monthly Retail Water Rates**

| Meter Size | Allowance (in gallons) | Inside City | CWSP[1] | Outside CWSP |
|---|---|---|---|---|
| 5/8″ x 3/4" | 6,000 | $24.17 | $36.31 | $48.25 |
| 3/4" x 3/4" | 9,000 | 31.82 | 47.74 | 63.65 |
| 1″ | 15,000 | 47.23 | 70.79 | 97.41 |
| 1-1/2″ | 30,000 | 85.68 | 128.52 | 171.26 |
| 2″ | 48,000 | 132.19 | 198.39 | 264.38 |
| 3″ | 75,000 | 201.65 | 302.43 | 402.80 |
| 4″ | 150,000 | 393.21 | 589.56 | 785.81 |
| 6″ | 360,000 | 930.65 | 1,396.58 | 1,861.91 |
| 8″ | 450,000 | 1,161.78 | 1,742.47 | 2,323.05 |
| 10″ | 600,000 | 1,546.12 | 2,318.77 | 3,092.44 |
| 12″ | 840,000 | 2,160.67 | 3,240.95 | 4,321.23 |
| | | | | |
| Overage Rate | per 1,000 gals | $2.60 | $3.98 | $5.20 |
| Summer Surcharge | per 40,000 gals | $3.16 | $4.79 | $6.22 |

1) Coordinated Water Study Plan Area (CWSP)

The utility has separate bi-monthly charges for customers with private fire protection including annual hydrant charges of $37.33 per year. Customers with automatic sprinkler systems are charged an additional bi-monthly rate. These charges range from $40.60 every two months for a 2-inch meter to $146.68 every two months for a 12-inch meter.

There are also separate rate schedules for low-income senior and disabled customers that differ slightly from the rate schedules above. These customers receive a 30 percent discount from the rates of their service area. The utility also has a summer surcharge for residential customers using more than 40,000 gallons of water in a bi-monthly period. These customers pay a 20% surcharge on the overage rate in the months of May through September for usage over 20,000 gallons a month.

Marysville bills on a bi-monthly basis. However, monthly costs are usually evaluated when reviewing the affordability of a utility service cost for the average household. A monthly bill for an average city customer, using 10,000 gallons of water a month, would be $30.29.

The utility's meter charge is based on the size of the customer's meter. This approach is typically used to recognize that larger meter sizes place greater demands and capacity requirements on the system. It is common to base the meter charge rate differential on the American Water Works Association (AWWA) safe operating capacity of the meter. The meter capacity approach is summarized in Table 10-7.

**Table 10-7**
**Example of the Development of Fixed Meter Charges Based Upon Meter Capacity**

| Meter Size | Capacity Meter Weight Factors | Meter Charges at Capacity Weightings |
|---|---|---|
| 5/8x3/4" | 1.00 | $4.05/month |
| 1" | 2.50 | 10.13 |
| 1-1/2" | 5.00 | 20.25 |
| 2" | 8.00 | 32.40 |
| 3" | 15.00 | 60.75 |
| 4" | 25.00 | 101.25 |
| 6" | 50.00 | 202.50 |
| 8" | 80.00 | 324.00 |
| 10" | 115.00 | 465.75 |
| 12" | 168.75 | 683.44 |

Meter capacity is an important concept in that a customer that has a 2" meter is regarded, from a capacity perspective, as the equivalent of eight 5/8 x 3/4" customers. Another way of saying this is the customer with a 2" meter is, from a capacity perspective, the equivalent of eight (8.00) single-family homes with 5/8 x 3/4" meters. Since a large portion of costs are generally related to meeting capacity requirements, one can see the importance of taking into account capacity in establishing rates for customers. When reviewing the meter charges and the allowance given for each meter size, the charges do not actually increase by meter size. Therefore, in the future Marysville may wish to consider adjusting the meter charges for larger size meters to reflect the larger impact these customers have on the system.

The conceptual rate review undertaken indicates that Marysville's water rates attempt to capture the cost differential to serve customers with varying facility requirements. The utility also surcharges based on location and usage, and appropriate discounts for impaired customers.

## 10.7. Overview of Future Water Rates

Based upon the results of the financial analysis, Marysville will require adjustments in rates in future years to meet the on-going operational and capital needs of the water utility system, as identified within this document. Table 10-8 shows the level of rate adjustment needed for the six-year projected period to meet operating and capital costs as identified within this plan.

**Table 10-8**
**Projected Rate Adjustments Needed 2009 through 2014**

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Rate Adjustment | 43% | 45% | 52% | 68% | 72% | 79% |

It is important to remember that these rate adjustments are cumulative. Any increases made in the earlier years reduce the increases needed in the latter years. It appears the utility will need substantial rate adjustments in the early part of the planning period in order to adequately fund

all operating and capital costs planned within Marysville's budget, the capital needs identified within this comprehensive plan, and to maintain adequate debt service coverage ratios. Other options include reducing operating or capital costs, or deferring or delaying capital projects. Given the projected costs contained within the financial plan developed herein, in the latter years of the 6-year review period (2012 o 2014) the utility will need cost of living increases in order to meet projected inflationary and project costs, which out strip projected growth in revenues.

Marysville is in the process of completing a comprehensive water rate study. The study will likely address any recommended changes to the level of rates in order to generate adequate revenue for all operations and capital needs, and address any rate structure changes Marysville may be considering.

## 10.8. Summary

The financial plan results presented in this section indicate that water rates for the six-year projected time horizon of 2009 to 2014 will require adjustments to fund the projected O&M, capital, and debt service requirements. Marysville has demonstrated its commitment to responsible management of the utility by past rate adjustments, its on-going utility rate study, and by funding adequate levels of operations, capital and reserves. Continued prudent fiscal management will enable the water utility to continue to operate on a financially sound basis.