

Feasibility Report

Water System Evaluation Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins

**Prepared for
Washington State Department of Ecology**

**Prepared by
RH2 Engineering, Inc.**



January 2014

Feasibility Report

Water System Evaluation

Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins

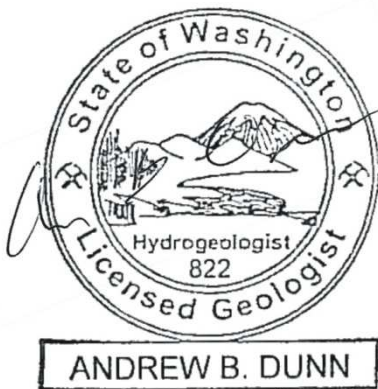
The information contained in this report was prepared by and under the direct supervision of the undersigned.



Randy L. Asplund, P.E.
Vice President



Daniel W. Burwell, P.E.
Project Engineer



Andrew B. Dunn, L.G., L.HG.
Project Hydrogeologist

A handwritten signature in blue ink that reads "Jim Bucknell".

Jim Bucknell, Senior Scientist
Project Manager

Feasibility Report Water System Evaluation Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins TABLE OF CONTENTS

| | |
|---|----------|
| Project Description | 1 |
| Overview of Public Water Systems in the Study Area | 3 |
| Tatoosh Water Company (DOH ID No. 87189) | 4 |
| Water Rights | 4 |
| Status of Water System Plan | 6 |
| Water Use | 8 |
| System Demand and Inchoate Water Rights..... | 9 |
| Willingness to Participate in a Regional Water Supply Solution..... | 10 |
| Wilderness Ridge Community Club (DOH ID No. 96876) | 10 |
| Water Rights | 10 |
| Status of Water System Plan | 12 |
| System Demand and Inchoate Water Rights..... | 14 |
| Willingness to Participate in a Regional Water Supply Solution..... | 15 |
| Rolf Bruun Water System (DOH ID No. 08915)..... | 16 |
| Water Rights | 16 |
| Status of Water System Plan | 16 |
| System Demand and Inchoate Water Rights..... | 17 |
| Willingness to Participate in a Regional Water Supply Solution..... | 17 |
| Camp Brotherhood (DOH ID No. 10824) | 17 |
| Water Rights | 17 |
| Status of Water System Plan | 18 |
| System Demand and Inchoate Water Use | 18 |
| Willingness to Participate in a Regional Water Supply Solution..... | 20 |
| Lake McMurray Recreational Resort (DOH ID No. 06604) | 20 |
| Water Rights | 20 |
| Status of Water System Plan | 20 |
| System Demand and Inchoate Water Rights..... | 21 |
| Willingness to Participate in a Regional Water Supply Solution..... | 21 |
| Leif Erikson Recreation Association (DOH ID No. 23735) aka Norway Park..... | 21 |
| Water Rights | 21 |
| Status of Water System Plan | 22 |

**Feasibility Report
Water System Evaluation
Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins
TABLE OF CONTENTS (CONTINUED)**

| | |
|--|-----------|
| System Demand and Inchoate Water Rights..... | 22 |
| Willingness to Participate in a Regional Water Supply Solution..... | 23 |
| McHaven, Inc. (DOH ID No. 44357) | 23 |
| Water Rights | 23 |
| Water System Plan Status | 24 |
| System Demand and Inchoate Rights | 24 |
| Willingness to Participate in a Regional Water Supply Solution..... | 25 |
| Big Lake Water Association (DOH ID No. 06700) | 25 |
| Water Rights | 25 |
| Water System Plan Status | 26 |
| System Demand and Inchoate Rights | 26 |
| Willingness to Participate in a Regional Water Supply Solution..... | 26 |
| Public Utility District No. 1 of Skagit County (DOH ID No. 79500) | 27 |
| Water Rights | 27 |
| Water System Plan Status | 30 |
| System Demand and Inchoate Water Rights..... | 30 |
| Willingness to Participate in a Regional Water Supply Solution..... | 30 |
| Summary of the Water Rights of the Public Water Systems in the Study Area | 30 |
| Issues and Potential Solutions | 31 |
| Demand Assumptions | 32 |
| Skagit Reservation | 33 |
| Water for Mitigation vs. Direct Service to Users..... | 34 |
| Spatial Nature of the Problem..... | 35 |
| Issues and Solutions No. 1: Lake McMurray and the Upper Nookachamps Subbasin | 39 |
| Proposed Solution | 41 |
| Operations and Maintenance Costs | 51 |
| Preliminary Implementation Steps..... | 52 |
| Conclusion of Issues and Solution No. 1 | 53 |
| Issue and Solution No. 2: Upper Reaches of the Fisher Sub-subbasin | 53 |
| Proposed Solution | 54 |
| Operations and Maintenance Costs | 60 |
| Preliminary Implementation Steps..... | 61 |

Feasibility Report Water System Evaluation Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins TABLE OF CONTENTS (CONTINUED)

| | |
|---|-----------|
| Conclusion of Issues and Solution No. 2 | 61 |
| Issue and Solution No. 3: Fisher Sub-subbasin..... | 61 |
| Operations and Maintenance Costs | 65 |
| Issue and Solution No. 3 Conclusion | 65 |
| Issue and Solution No. 4: Lower Fisher Creek Area in the Fisher Sub-subbasin..... | 65 |
| Overall Conclusion | 78 |
| References..... | 81 |

FIGURES

- Figure 1 – Study Area
- Figure 2 – Tatoosh Water Company Water System
- Figure 3 – Wilderness Ridge Community Club, Northwest Water System, and Rolf Bruun Water System
- Figure 4 – Water Systems near Lake McMurray
- Figure 5 – Existing Skagit PUD Water Mains
- Figure 6 – Potential New Home Demand by Section
- Figure 7 – Potential New Home Demand by Parcel
- Figure 8 – Subsurface Profile Showing Groundwater Divide
- Figure 9 – Upper Nookachamps Subbasin Options (Tatoosh Water Company)
- Figure 10 – Upper Fisher Creek Area Options (Tatoosh Water Company)
- Figure 11 – Fisher Sub-subbasin Tatoosh Water Company and Wilderness Ridge Community Club Intertie
- Figure 12 – Lower Fisher Creek Area Options (Wilderness Ridge Community Club)
- Figure 13 – Carpenter Creek Sub-subbasin Option

TABLES

- Table 1 – Tatoosh Water Company Water Rights
- Table 2 – Tatoosh Water Company Water Use
- Table 3 – Tatoosh Water Company Leakage
- Table 4 – Wilderness Ridge Community Club Water Rights
- Table 5 – Wilderness Ridge Community Club Water Use
- Table 6 – Northwest Water System Water Rights
- Table 7 – Northwest Water System Water Use
- Table 8 – Water Rights for the Rolf Bruun Water System
- Table 9 – Cascadian Center at Camp Brotherhood Water Rights
- Table 10 – Water Rights for Lake McMurray Recreational Resort
- Table 11 – Water Rights for the Leif Erikson Recreation Association
- Table 12 – Leif Erikson Recreation Association Water Use
- Table 13 – Water Rights for McHaven, Inc.

Feasibility Report
Water System Evaluation
Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins
TABLE OF CONTENTS (CONTINUED)

Table 14 – Water Rights for the Big Lake Water Association

Table 15 – Water Rights for the Skagit PUD’s Judy Reservoir System

Table 16 – Skagit PUD Water Use and Leakage

Table 17 – Summary of Existing Public Water System Water Rights and Inchoate Quantities

Table 18 – Skagit Reservation Report for Targeted and Adjacent Subbasin Management Units

Table 19 – Upper Nookachamps Subbasin Demand

Table 20A – Estimated Costs of Option 1a Tatoosh Water Company System Modifications and Upgrades for the Upper Nookachamps Subbasin

Table 20B – Estimated Costs of Option 1b Tatoosh Water Company System Modifications and Upgrades for the Upper Nookachamps Subbasin

Table 20C.1 – Tatoosh Water Company System Incentive 1

Table 20C.2 – Tatoosh Water Company System Incentive 2

Table 20C.3 – Tatoosh Water Company System Incentive 3

Table 20C.4 – Tatoosh Water Company System Incentive 4

Table 20C.5 – Tatoosh Water Company System Incentive 5

Table 20D – Estimated Power, Operations, and Maintenance Costs of Option 1a and 1b Tatoosh Water Company System Modifications and Upgrades for the Upper Nookachamps Subbasin

Table 21 – Fisher Creek Sub-subbasin Demand

Table 22A – Estimated Costs of Option 2a Tatoosh Water Company System Modifications and Upgrades for the Upper Fisher Creek Area

Table 22B – Estimated Costs of Option 2b Tatoosh Water Company System Modifications and Upgrades for the Upper Fisher Creek Area

Table 22C – Tatoosh Water Company System Incentive 6

Table 22D – Estimated Power, Operations and Maintenance Costs of Option 2a and 2b Tatoosh Water Company System Modifications and Upgrades for the Upper Fisher Creek Area

Table 23A – Estimated Costs, Tatoosh and Wilderness Ridge System Intertie Modifications and Upgrades, Fisher Sub-subbasin

Table 23B – Estimated Costs, Tatoosh and Wilderness Ridge System Intertie Wilderness Ridge System Modifications and Upgrades, Fisher Sub-subbasin

Table 23C – Estimated Power, Operations and Maintenance Costs of Option 3 Wilderness Ridge Community Club and Tatoosh Water Company System Intertie Modifications and Upgrades for Fisher Sub-subbasin

Table 24A – Estimated Costs of Option 4a Wilderness Ridge System Modifications and Upgrades, Lower Fisher Creek in the Fisher Sub-subbasin

Table 24B – Estimated Costs of Option 4b Wilderness Ridge System Modifications and Upgrades, Lower Fisher Creek in the Fisher Sub-subbasin

Table 24C – Estimated Costs of Option 4c Wilderness Ridge System Modifications and Upgrades, Lower Fisher Creek in the Fisher Sub-subbasin

Table 24D – Wilderness Ridge Water System Incentive 1

Table 24E – Wilderness Ridge Water System Incentive 2

Feasibility Report
Water System Evaluation
Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins
TABLE OF CONTENTS (CONTINUED)

Table 24F – Estimated Power, Operations, and Maintenance Costs of Options 4a, 4b and 4c
Wilderness Ridge Community Club System Modifications and Upgrades for Lower
Fisher Creek

Table 25 – Carpenter Sub-subbasin Demand

Table 26A – Estimated Costs of Option 5 Skagit PUD System Modifications and Upgrades for the
Carpenter Sub-subbasin

Table 26B – Estimated Power, Operations and Maintenance Costs of Options 5 Skagit PUD System
Modifications and Upgrades for the Carpenter Sub-subbasin

Table 27A – Summary of Option Planning-level Costs

Table 27B – Summary of Incentive Planning-level Costs

Water System Evaluation Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins Feasibility Report

PROJECT DESCRIPTION

RH2 Engineering, Inc., (RH2) was retained by the Washington State Department of Ecology (Ecology) to evaluate the advantages and potential issues of expanding and interconnecting the existing public water systems (PWS) to provide direct municipal water supply to property owners within the Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins within Water Resources Inventory Area (WRIA) 3. Ecology also requested that RH2 determine if there are opportunities for municipal water rights to be utilized as mitigation sources to offset new permit-exempt well development in those same subbasins. The study area is depicted in **Figure 1**.

RH2 performed the following tasks and subtasks to complete this report.

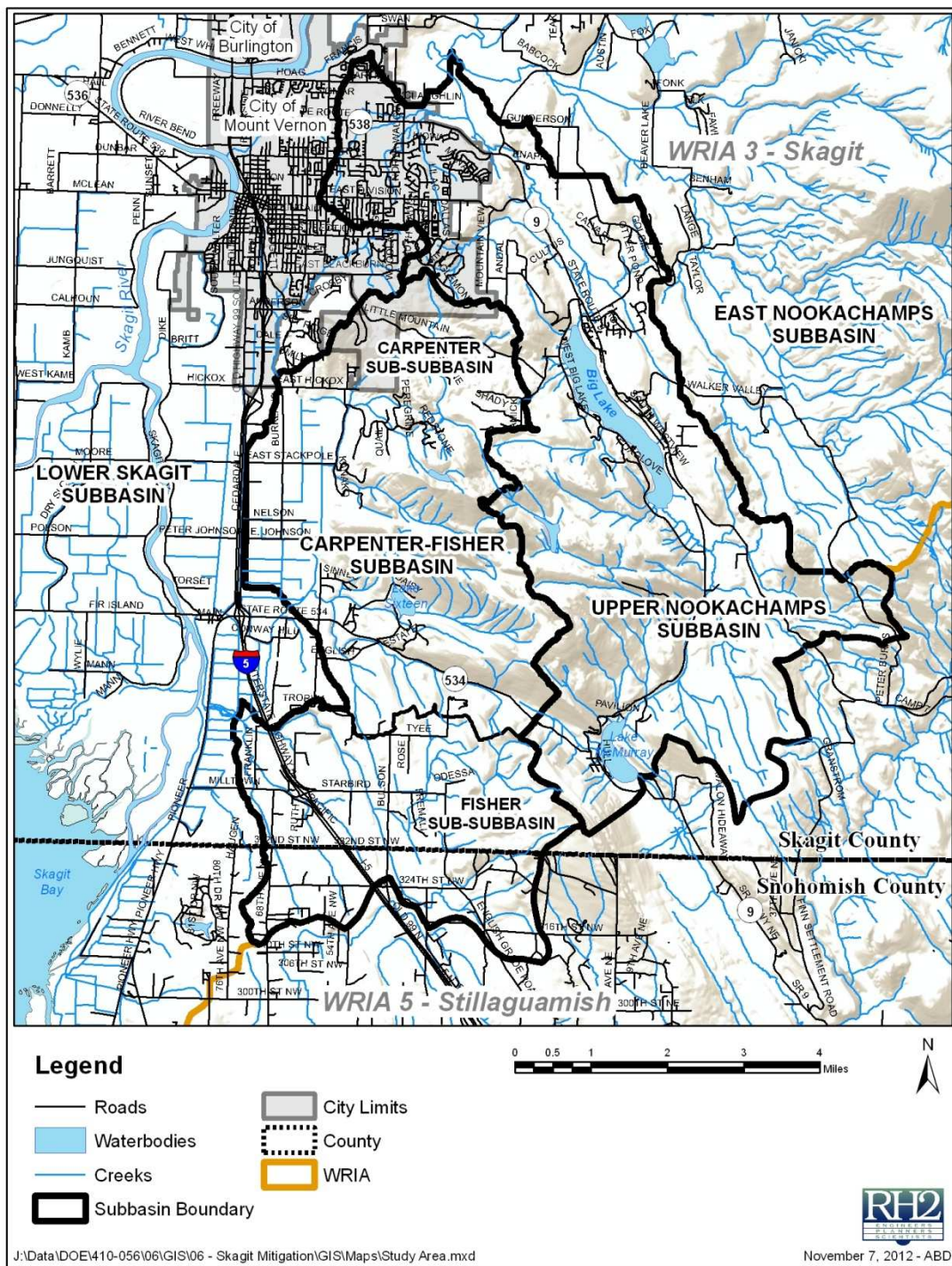
Task 1 – Water System Expansion Evaluation

- 1.1 Identify and review water system plans and other engineering documents for all municipal water suppliers in close proximity to the subbasins while focusing on those systems nearest the Carpenter-Fisher, Upper Nookachamps, and East Nookachamps subbasins.
- 1.2 Identify water rights associated with the systems and conduct a “water right self-assessment” of those rights in terms of their existing use and the potential availability of water for future uses.
- 1.3 Determine the potential for expanding service to existing groundwater users with individual or small group systems and undeveloped parcels that would have historically used individual or small group systems to access groundwater.
- 1.4 Identify physical, legal, financial, or cultural barriers that would hinder or prevent any municipal water supplier from extending their service even though their water right is adequate to serve the new connections.
- 1.5 Determine the feasibility of the municipal water suppliers, including at least Tatoosh Water Company (DOH PWS ID 87189), Wilderness Ridge Community Club (DOH PWS ID 96876), and Skagit Public Utility District No. 1 of Skagit County (Skagit PUD) (DOH PWS ID 79500), and extending service to meet new demand or to replace current small or individual uses with a municipal water supply, including direct service expansion and the creation of a satellite system or systems.

Task 2 – Water Right Mitigation Opportunities Using Public Water Systems

- 2.1 Identify opportunities to use existing municipal water rights for mitigation for groundwater use associated with individual and small group wells within the subbasins.
- 2.2 Assess physical, legal, financial or cultural barriers associated with the mitigation opportunities.

Figure 1 – Study Area



OVERVIEW OF PUBLIC WATER SYSTEMS IN THE STUDY AREA

There are several public water systems in the study area, including Tatoosh Water Company, Wilderness Ridge Community Club, Rolf Bruun Water System, Northwest Water System, Camp Brotherhood, McHaven Inc., Leif Erikson Recreation Association, Lake McMurray Recreation Resort, Big Lake Water Association, and Public Utility District No. 1 of Skagit County. These systems either currently serve water to portions of the study area, or are in close proximity to the study area and could possibly serve water within the study area. In order for any of these systems to expand their service area, each water system will need to either complete a comprehensive water system plan, or update an existing water system plan. Under the municipal water law, the water system planning process allows water systems to identify changes to its service area and, once the plan is approved, the service area defines the place of use of its water rights, even if it is a different area than that originally described on the system's water right(s). Also, the municipal water law defines when a water right is for municipal water supply purposes. The Revised Code of Washington (RCW) 90.03.015(4) states:

(4) "Municipal water supply purposes" means a beneficial use of water: (a) For residential purposes through fifteen or more residential service connections or for providing residential use of water for a nonresidential population that is, on average, at least twenty-five people for at least sixty days a year; (b) for governmental or governmental proprietary purposes by a city, town, public utility district, county, sewer district, or water district; or (c) indirectly for the purposes in (a) or (b) of this subsection through the delivery of treated or raw water to a public water system for such use. If water is beneficially used under a water right for the purposes listed in (a), (b), or (c) of this subsection, any other beneficial use of water under the right generally associated with the use of water within a municipality is also for "municipal water supply purposes," including, but not limited to, beneficial use for commercial, industrial, irrigation of parks and open spaces, institutional, landscaping, fire flow, water system maintenance and repair, or related purposes. If a governmental entity holds a water right that is for the purposes listed in (a), (b), or (c) of this subsection, its use of water or its delivery of water for any other beneficial use generally associated with the use of water within a municipality is also for "municipal water supply purposes," including, but not limited to, beneficial use for commercial, industrial, irrigation of parks and open spaces, institutional, landscaping, fire flow, water system maintenance and repair, or related purposes.

RCW 90.03.330 (3) further states that the inchoate (un-perfected) portion of a municipal purpose water right is a right in good standing. Ecology Water Resources Program Policy 2030, 2003 Municipal Water Law Interpretive and Policy Statement, interprets the statute as requiring "active compliance" with the definitions of beneficial use in RCW 90.03.015(4). The policy states the following:

- a. Conformance with the definition occurs where a water right holder uses water for one or more of the categories of beneficial use included in the definition of a water right for municipal water supply purposes.
- b. If the water right holder is a public water system participating in the water system planning process, then conformance with the definition occurs when the water right is identified as being held for existing customers, future growth or supply needs, standby/reserve, backup or emergency, other reasonable future use in a water system plan (WAC 246-290-100), project report (WAC 246-290-110), construction document (WAC 246-290-120), source approval (WAC 246-290-130), existing system as-built approval (WAC 246-290-140), or coordinated

water system plan (WAC 246-293) as approved by the Department of Health, or a small water system management program (WAC 246-290-105) as required by the Department of Health.

The policy also addresses changes or transfers of inchoate water rights and says that inchoate portions of municipal purpose water rights found to be in good standing are eligible for change or transfer and that this may allow the inchoate portions of such water rights to be transferred to another municipal water supplier or integrated into a regional water system.

Tatoosh Water Company (DOH ID No. 87189)

The Tatoosh Water Company operates a water system that includes land in both Snohomish and Skagit Counties, and is located south of Lake McMurray and east of Interstate 5 (I-5). The system was originally planned to serve a major, high density residential/recreational development with as many as 1,200 customers. The Tatoosh system infrastructure, which is oversized for the current number of connections served, includes a 1.05-million-gallon (MG) reservoir, two wells with a combined pumping capacity of 1,800 gallons per minute (gpm) (Well 1 is 925 gpm and Well 2 is 875 gpm; although they do not operate at the same time), a booster pump station (BPS) with three pumps and a capacity of 1,750 gpm that pumps water from the well site toward the distribution system, and an extra bay in the pump station that could be fitted with an additional pump. In the Final Report - Instream Flow Assessment Pilot Project from Northwest Hydraulic Consultants (NHC) 2005, NHC stated the system served 223 people with 103 connections. NHC concluded, from reviewing other reports, that groundwater withdrawals by Tatoosh Water Company could reduce stream flows in streams tributary to Pilchuck Creek (NHC 2005), which is located within the Stillaguamish watershed (WRIA 5). (Snohomish County Surface Water Management, 2007.) Note: on December 28, 2012, Mr. Steve Aslanian, Manager at the Tatoosh Water Company, reported that the NHC report was in error with respect to the water rights of the Tatoosh Water Company. Mr. Aslanian indicated that the report incorrectly doubled the groundwater withdrawals that were available to the Tatoosh Water Company and, as a result, NHC's conclusions regarding water availability and the potential impacts on stream flows were incorrect. These errors were confirmed in the errata sheet prepared by Mr. Steve Hirschey of Ecology's Water Resources Program who confirmed that Ecology had provided the wrong data to NHC.

Water Rights

Table 1 includes information on the water rights for the Tatoosh Water Company.

Table 1 – Tatoosh Water Company Water Rights

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|---|-----------------------|------------------|---------------|--|--|--------------|--------------|---|
| G1-00114C | Tatoosh Company | Certificate | 5/20/1971 | Municipal Supply and Irrigation of 300 acres | Yes | 750 | 844 | Assume total annual volume not to exceed 1,135 afy. |
| G1-00115C | Tatoosh Water Company | Certificate | 5/20/1971 | Municipal Supply and Irrigation of 338 acres | Yes | 800 | 1,135 | |
| S1-070681CL | Tatoosh Company | Short Form Claim | Not Provided | Domestic | Unknown | Not Provided | Not Provided | Uncertain if they represent a vested right. Will not be included in the total as part of this work. |
| S1-070682CL | Tatoosh Company | Short Form Claim | Not Provided | Domestic | Unknown | Not Provided | Not Provided | |
| G1-070683CL | Tatoosh Company | Short Form Claim | Not Provided | Domestic and Stockwatering | Unknown | Not Provided | Not Provided | |
| G1-070684CL | Tatoosh Company | Short Form Claim | Not Provided | Domestic and Stockwatering | Unknown | Not Provided | Not Provided | |
| G1-070685CL | Tatoosh Company | Short Form Claim | Not Provided | Domestic | Unknown | Not Provided | Not Provided | |
| G1-070686CL | Tatoosh Company | Short Form Claim | Not Provided | Domestic and Stockwatering | Unknown | Not Provided | Not Provided | |
| G1-070687CL | Tatoosh Company | Short Form Claim | Not Provided | Domestic | Unknown | Not Provided | Not Provided | |
| Certificated Water Rights Total | | | | | | 1550 | 1135 | |
| Existing Use | | | | | | 925 | 112.1 | |
| Existing Inchoate Right | | | | | | 600 | 1022.9 | |
| Estimated Additional Future System Needs | | | | | | 0 | 280 | 2.5 times existing use |
| Estimated Inchoate Right after Satisfying Anticipated Future Internal System Demand | | | | | | 625 | 742.9 | |
| | | | | | | | | |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| None | | | | | | | | |

The seven claims on record with Ecology for the Tatoosh Water Company are all recorded on the short claim form and, as a result, provide virtually no detail about the water use and what is being claimed. For the purposes of this study, any vested water rights that might be expressed by these water right claims will not be considered as a potential source of supply to serve others.

Tatoosh Water Company has two water right certificates, G1-00114C and G1-00115C. The place of use for G1-00114C is the “Area served by Tatoosh Company (formerly Foothills Investment Company) within Skagit and Snohomish Counties.” The place of use for G1-00115C is the “Area served by Tatoosh Water Company within Sections 1, 11, 12, 13, and 14 of T. 32 N., R. 4 E. of W.M. and Section 7, T. 32 N., R. 5 E. of W.M. Situate within Skagit and Snohomish Counties.” Additional variations on the existing service area are shown in **Figure 2**. Originally, there were five water right permits issued to serve the Tatoosh development (G1-00112P, G1-00114P, G1-00115P, G1-00116P, and G1-00117P). On each of these permits, the annual volume that was determined by Ecology investigators to be needed for the entire development, as planned, was 1,284 acre-feet per year (afy). Three of the permits, G1-00112P, G1-00116P, and G1-00117P appear to have been voluntarily cancelled by Tatoosh since they did not need to use the wells that were identified as the point of withdrawal under those rights at the time. The certificates for G1-00114 and G1-00115 issued for lower instantaneous rates than their associated permits. It is presumed that the certificated quantities were based on the Proof of Appropriation forms that were submitted. Permit G1-00114P was issued for 1,000 gpm and 1,200 afy, but the certificate was issued for 750 gpm and 844 afy. It should also be noted that while the certificate for G1-00114C identifies the annual volume on the face of the

certificate as 844 afy, the breakdown of annual volume by purpose of use on the face of the document identifies a total of 1,284 acre-feet split between municipal (784 acre-feet) and irrigation (500 acre-feet) uses. Permit G1-00115P was issued for 1,000 gpm and 1,200 afy, but the certificate was issued for 800 gpm and 1,135 afy. The certificate for G1-00115C did not list any provisions.

In the original reports of examination (ROE) and permits for both of these water rights, the Provisions section states: “Issued as a supplemental supply to *[the other Tatoosh water rights]*. Total withdrawal under this permit is not to exceed 1,200 afy less any quantity over 84 afy withdrawn under *[the other Tatoosh water rights]*.”

Similar language to the noted statement in the Provisions section occurs on certificate G1-00114C. However, the 1,200 afy has been replaced with the annual volume that appears on the face of the document. The insertion of the new annual volume limit and maintenance of the, “less any quantity over 84 acre-feet per year” creates a situation where the provision seems to suggest that the total of all of the Tatoosh water rights is 928 afy. However, two years after the G1-00114C certificate issued, the certificate for G1-00115C issued and the annual volume allowed on the face of that certificate is 1,135 afy, which is greater than the earlier identified maximum annual volume.

RH2 interprets the record to indicate that the Tatoosh Water Company is thus entitled to withdraw a maximum instantaneous quantity of 1,550 gpm and a maximum annual quantity of 1,135 afy under the authority of certificates G1-00114C and G1-00115C.

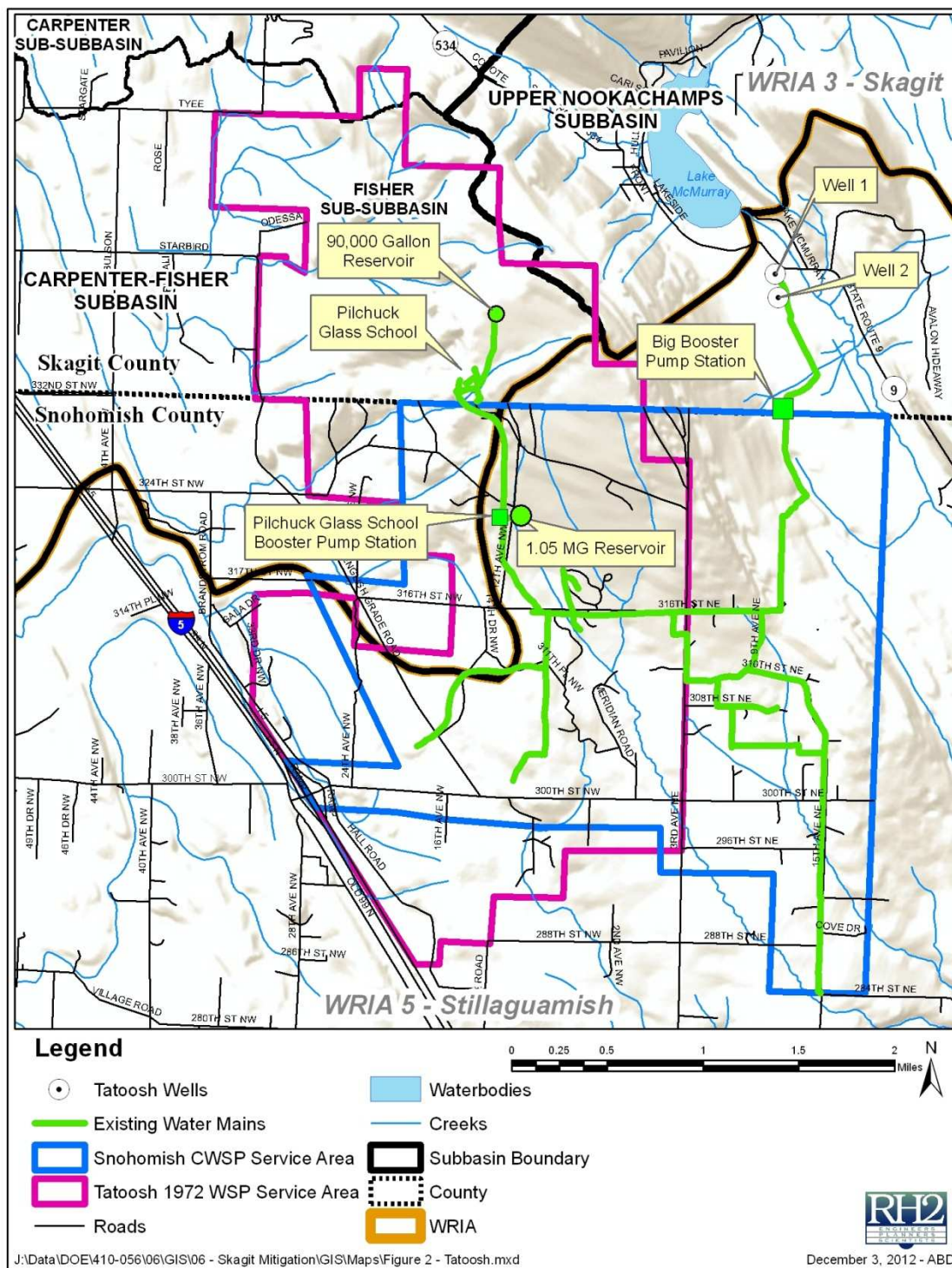
Status of Water System Plan

Tatoosh Water Company currently has a blue operating permit from Washington State Department of Health (DOH). This means that this system is considered adequate for existing uses but is not considered adequate for adding new service connections. Tatoosh’s water system plan was last updated in 1972.

According to DOH, Tatoosh is currently approved for 116 connections, of which 111 are for full-time residences and 5 are seasonal connections for the months of May through August. The Tatoosh Water Company’s water rights meet the criteria to be considered municipal purpose water rights.

Two places of use, or service areas, for Tatoosh are shown on **Figure 2**. One of the boundaries was from the original 1972 water system plan (Hugh Goldsmith & Associates, 1972). This boundary lies within both Skagit and Snohomish Counties and includes area within the Carpenter-Fisher Subbasin, Upper Nookachamps Subbasin, and the Stillaguamish watershed. The second service area is from the North Snohomish County Coordinated Water System Plan, which was originally adopted in February 1992 (Economic and Engineering Services, 1992). The version of the Tatoosh Water Company service area shown on **Figure 2** was obtained from a map that was last revised in November 2007. This boundary only covers the Tatoosh service area in Snohomish County, which excludes the Pilchuck Glass School property located in Skagit County and which is presently served water by Tatoosh.

Figure 2 – Tatoosh Water Company Water System



If the Tatoosh Water Company desires to expand its service area or add additional connections, Tatoosh would be required to complete an update of its Comprehensive Water System Plan since the system would become an expanding PWS. This plan should identify the service area in which Tatoosh intends to serve water. Once the plan is approved by Ecology and DOH, the place of use on its water rights would automatically change to match the water system plan service area.

Water Use

Water use data for the Tatoosh Water Company for the period of 2000 to 2011 is shown in **Table 2**.

Table 2 – Tatoosh Water Company Water Use

| Year | Annual Withdrawal | | Average Day Demand |
|----------|-------------------|-----------|--------------------|
| | Gallons | Acre-feet | Gallons |
| 2000 | 20,667,987 | 63.4 | 56,625 |
| 2001 | 17,712,106 | 54.4 | 48,526 |
| 2002 | 19,360,249 | 59.4 | 53,042 |
| 2003 | 22,662,599 | 69.5 | 62,089 |
| 2004 | 26,019,114 | 79.8 | 71,285 |
| 2005 | 29,925,459 | 91.8 | 81,988 |
| 2006 | 33,248,803 | 102.0 | 91,093 |
| 2007 | 36,535,358 | 112.1 | 100,097 |
| 2008 | 33,615,248 | 103.2 | 92,097 |
| 2009 | 33,382,664 | 102.4 | 91,459 |
| 2010* | 26,970,154 | 82.8 | 73,891 |
| 2011 | 26,659,246 | 81.8 | 73,039 |
| Averages | 25,507,583 | 78.3 | 69,884 |

*Mr. Steve Aslanian, Tatoosh Water Company, reported the 2010 data was from prop meters and the other data was from paddle meters.

The Tatoosh Water Company submitted Water Use Efficiency Annual Performance Reports to DOH for 2010 and 2011. In those reports, Tatoosh reported that 43.7 percent and 50.9 percent of its water was lost through distribution system leakage in 2010 and 2011, respectively. **Table 3** illustrates the magnitude of this problem.

Table 3 – Tatoosh Water Company Leakage

| Year | Total Water Produced and Purchased (gallons per year & afy) | Distribution System Leakage – Annual Volume (gallons per year & afy) | Percentage of Total Water Produced and Purchased Lost as Leakage |
|------|--|---|--|
| 2010 | 24,974,000 gallons 76.6 afy | 10,925,431 gallons 33.5 afy | 43.7% |
| 2011 | 26,659,000 81.8 afy | 13,569,000 gallons 41.9 afy | 50.9% |

Source: DOH, Water Use Efficiency Annual Performance Reports, Tatoosh Water Company, 2010 & 2011.

Mr. Aslanian, Manager of the Tatoosh Water Company, reported that Tatoosh has a disproportionately large ratio of pipe in the ground for a relatively small customer base. It also has 3-inch to 14-inch transmission mains and a 2-mile long 14-inch transmission main, much of which traverses a remote right-of-way and has been identified as a likely source of leaks based on pressure

losses in that portion of the system. The system also has long sections of small diameter “spaghetti lines” which are suspected to be a source of leaks. During the summer months, the system has a relatively high demand for water for irrigation, which reduces the ratio of unaccounted-for water

Washington Administrative Code (WAC) 246-290-820 established standards for distribution system leakage as part of the Water Use Efficiency Program under Part 8 of that rule. This section of the rule describes the requirements for municipal water suppliers and requires such suppliers to “develop and implement a water use efficiency program which includes sufficient cost-effective water use efficiency measures to meet the water use efficiency goals developed under WAC 246-290-830.” These goals are to be established by the elected governing board or governing body of the public water system and “must be designed to enhance the efficient use of water by the water system’s consumers” (WAC 246-290-830 (1) and (2).

WAC 246-290-820 includes the following standards:

- (b) Municipal water suppliers will be considered in compliance with this section if any of the following conditions are satisfied:
 - (i) Distribution system leakage calculated in accordance with subsection (2) of this section is ten percent or less for the last three-year average;
 - (ii) Distribution system leakage calculated under subsection (3) of this section meets the numerical standards for the approved alternative methodology for the last three-year average;
 - (iii) For systems serving less than five hundred total connections, distribution system leakage calculated in accordance with subsection (2) of this section is twenty percent or less for the last three-year average and the steps outlined in subsection (5) of this section are completed; or
 - (iv) A water loss control action plan has been developed and implemented under subsection (4) of this section and the system is meeting the implementation schedule.

System Demand and Inchoate Water Rights

Tatoosh Water Company’s water rights allow for the maximum annual withdrawal of 1,135 acre-feet of water. The maximum annual water withdrawal over the past 12 years occurred in 2007 and was 112.1 acre-feet. Therefore, based on the municipal water law determination that inchoate municipal water rights are rights in good standing, the inchoate portion of the Tatoosh water right is 1,022.9 acre-feet of water. Tatoosh also appears to satisfy Ecology’s active compliance policy requirements in that the system provides water for several of the beneficial use categories in the definition of municipal water supply purposes.

During a site visit on November 7, 2012, Mr. Aslanian said it is difficult to predict future water needs for the undeveloped parcels in the Tatoosh service area because of the variety of water uses in its service area. For example, he said he has a customer with 2 acres of grapes and another that has 5 acres of landscaping. They also have a school in the service area and what he described as “huge infrastructure” with only about 111 connections at the present time.

Willingness to Participate in a Regional Water Supply Solution

Mr. Aslanian explained that Tatoosh is owned by the Pacific Denkmann Company (PDC) and that the decision of whether to participate in any recommended solutions rests with the PDC Board of Directors. As of November 7, 2012, Mr. Aslanian has not discussed this project with the PDC Board; however, Mr. Aslanian said he believes PDC would be most interested in projects that would provide potable water to customers as opposed to projects that are simply providing streamflow augmentation. For example, he believes the PDC Board would more likely favor moving water north to the Lake McMurray area if the water was used for streamflow augmentation, potable supply, and to provide fire hydrants for Fire District 15, which is located on the west side of Lake McMurray. Mr. Aslanian's comments indicated that the PDC Board has not ruled out Tatoosh's participation and it is recommended that Ecology continue to work with PDC and Tatoosh to pursue its involvement in the proposed solutions presented later in this report.

Wilderness Ridge Community Club (DOH ID No. 96876)

The Wilderness Ridge Community Club Water System is located in northern Snohomish County, west of I-5, near Lake Ketchum. The 1995 water system plan (Trepanier Engineering, 1995) for Wilderness Ridge states that:

In May of 1977, it was approved to service 150 connections and allowed to draw water at a maximum rate of 250 gpm (129.7 ac-ft per yr.). In March of 1992, an application was made to increase the water rights to service 300 connections and to withdraw water at a maximum rate of 365 gpm (150 ac-ft per year). That application has been recently approved (permit G1-25596P).

This system receives its water from two wells that are located in the Lower Skagit Subbasin.

Water Rights

Table 4 includes information on the water rights utilized by the Wilderness Ridge Community Club.

Table 4 – Wilderness Ridge Community Club Water Rights

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|---|---------------------------------|--------------------|---------------|---------------------------|--|---|--|---|
| G1-115428CL | Wilderness Ridge Community Club | Long Form Claim | 7/1969 | Domestic | NA | 150 | 5.3 | Documenting water use under GWC 6709. Not a vested right. |
| GWC 6709 | Harry Davidson, Inc. | Certificate | 2/3/1969 | Community Domestic Supply | Yes | 150 | 5.3 | Possibly the developer's name |
| G1-22415C | Wilderness Ridge Community Club | Certificate | 1/24/1975 | Community Domestic Supply | Yes | 250 (100 additive, 150 non-additive) | 129.7 | Total of GWC 6709 and G1-22415C is 250 gpm and 135 afy |
| G1-25596P | Wilderness Ridge Community Club | Superseding Permit | 1/11/1990 | Multiple Domestic Supply | Yes | 365 | 150 (15 additive, 135 non-additive) | Total of GWC 6709, G1-22415C, and G1-25596P is 150 afy |
| Water Rights Permit and Certificate Total | | | | | | 615 | 150 | 150 lots, 200 gallons per day per lot |
| Existing Use | | | | | | 600 | 47.8 | |
| Existing Inchoate Right | | | | | | 15 | 102.2 | |
| Estimated Additional Future System Needs | | | | | | 0 | 34 | |
| Estimated Inchoate Right After Satisfying Anticipated Future Internal System Demand | | | | | | 15 | 68.2 | |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| G1-27572 | Wilderness Ridge Community Club | Application | 1/6/1995 | Community Domestic Supply | Yes | 365 | Undecided | |

The Wilderness Ridge Community Club has a water right claim, a certificate, a superseding permit, and a new application. The water right claim G1-115428CL is the long form, and states that water use began in 1969. With the exception of the so-called exempt wells, groundwater uses initiated after 1945 required a water right issued by the state. Assuming that the date of first putting water to beneficial use is correct, this claim probably does not represent a valid vested water right for Wilderness Ridge. For the purposes of this study, any vested water rights that might be expressed by these water right claims will not be considered as a potential source of supply to serve others.

Certificate GWC 6709 was issued in the name of Harry Davidson, Inc., which might have been the original developer for the Lake Ketchum Recreation Tracts, for 150 gpm and 5.3 afy for community domestic supply for the Lake Ketchum Recreation Tracts.

Certificate G1-22415C authorizes the use of 250 gpm and 129.7 afy and specified, “total withdrawal from Ground Water Certificate (GWC) No. 6709 and G1-22415C shall not exceed 250.0 gpm with an annual withdrawal of 135.0 afy for community domestic supply.”

Superseding Permit G1-25596PP authorizes the use of 365 gpm and a total of 150 afy. It further states, “total annual quantity from water right certificate 6709C and Certificate G1-22415C and Permit G1-25596P shall not exceed 150 AF/Y.”

The water rights for Wilderness Ridge Community Club appear to satisfy the definition of municipal water supply purpose water rights.

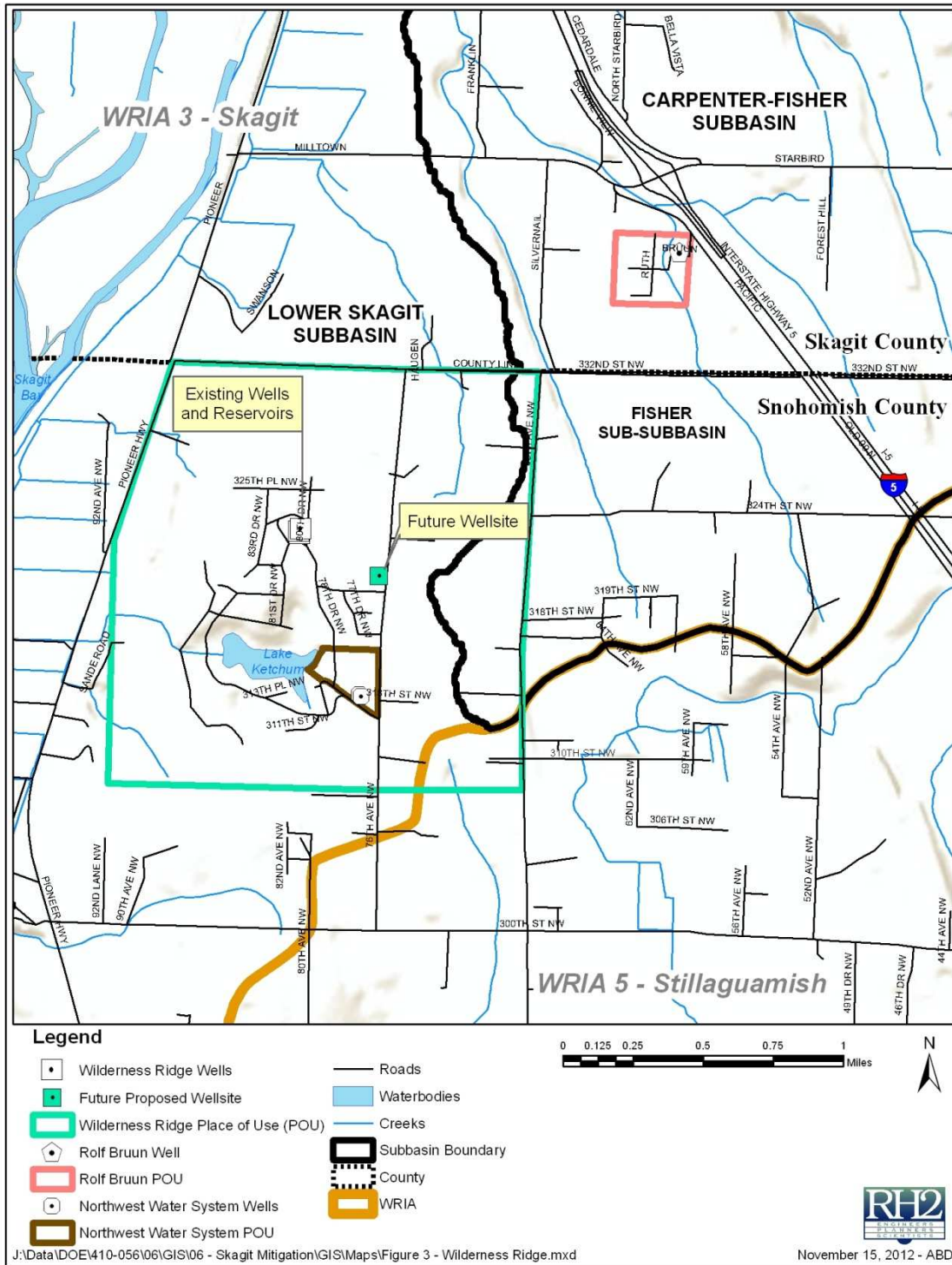
Wilderness Ridge Community Club has a pending groundwater application (G1-27572) on file with Ecology for 365 gpm. During a site visit on November 7, 2012, Ms. Phyllis Ketzenberg, Secretary of the Wilderness Ridge Community Club, confirmed that Wilderness Ridge is still interested in pursuing this water right application and, in fact, has access rights to a 1-acre parcel adjacent to its system for a potential well site. This access includes a 10-foot-wide easement which would allow access to the site and a right-of-way for future water mains. The proposed future well location is shown on **Figure 3**.

Status of Water System Plan

The Wilderness Ridge Community Club's water system plan was last approved by DOH in 1995 under the condition that the system not exceed 272 connections until the 100,000-gallon storage reservoir was completed. At the November 7, 2012, site visit, the existence of the 100,000-gallon reservoir was confirmed.

Wilderness Ridge Community Club has a green operating permit from DOH. This means that this system is considered adequate for existing uses and adding new service connections up to the number of approved service connections, which is 600 connections for this system. The Wilderness Ridge water right place of use and service area is shown in **Figure 3**.

Figure 3 – Wilderness Ridge Community Club, Northwest Water System, and Rolf Bruun Water System



System Demand and Inchoate Water Rights

According to the DOH database, the Wilderness Ridge Community Club has 284 total connections. **Table 5** shows water use data for 2010 and 2011.

Table 5 – Wilderness Ridge Community Club Water Use

| Year | Total Water Produced and Purchased (gallons per year & afy) | Distribution System Leakage – Annual Volume (gallons per year & afy) | Distribution System Leakage – Percentage |
|------|--|---|--|
| 2010 | 15,583,024 gallons 47.8 afy | 22,455 gallons 0.07 afy | 0.1% |
| 2011 | 15,590,968 gallons 47.8 afy | 7,123 gallons 0.02 afy | 0.0% |

Source: DOH Water Use Efficiency Annual Performance Report – 2010 & 2011, Wilderness Ridge Community Club, Water System ID No. 96876.

Each of the 284 connections is calculated to use approximately 54,898 gallons of water per year or an average of 150 gallons per connection per day. At the November 7, 2012, site visit, Ms. Ketzenberg confirmed that the Wilderness Ridge Community Club's system average use per connection per day is 150.4 gallons as of the end of 2011. Wilderness Ridge Community Club has water rights which authorize the annual withdrawal of 615 gpm and 150 afy. It appears that Wilderness Ridge Community Club currently has an inchoate water right of approximately 102.2 acre-feet of water. According to Ms. Ketzenberg, this system includes about 150 parcels that will need water in the future. Assuming a conservative rate of 200 gallons per day (gpd) for the new parcels and assuming one connection per parcel, the system would require an additional 30,000 gpd or about 34 afy. This would result in a total water use of 81.8 afy (the current 47.8 afy plus 34 afy that will be needed), leaving an inchoate right of 68.2 afy.

Ms. Ketzenberg also said that Wilderness Ridge Community Club intends to absorb Northwest Water System, (DOH No. 02287) which falls inside of its existing service area, at some point in the future. Northwest Water System, Inc., has a water right certificate (G1-23536C) under the name of Thomas Williams for 72 gpm and 24 afy for community domestic supply (**Table 6**). The priority date of this right is December 26, 1979. This system receives its water from two wells located in the Lower Skagit Subbasin. Based on the description of the system and number of connections, RH2 believes that this water right would be recognized as being for municipal water supply purposes.

According to DOH, the Northwest Water System serves a population of 99 and is approved for 39 connections and has 35 existing connections. Northwest Water System has two wells (Ecology Unique ID AGB776 and AGB777). According to the Water Use Efficiency Annual Reports for 2010 and 2011, the Northwest Water System produced 2,604,700 and 2,031,230 gallons of water per year, respectively with a distribution system leakage of approximately 5,000 gallons or 0.2 percent (**Table 7**).

According to Mr. William Beckman, Operator of the Northwest Water System, its average consumption per connection per day in 2010 was 204 gpd and, in 2011, it was 159 gpd. Mr. Beckman indicated a willingness to have Wilderness Ridge Community Club assume the ownership and operation of the Northwest Water System.

Table 6 – Northwest Water System Water Rights

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|---|---------------------|---------------|---------------|---------------------------|--|--|----------|--|
| G1-23536C | Thomas Williams | Certificate | 12/26/1979 | Community Domestic Supply | No | 72 | 24 | |
| | | | | | | Water Right Total | 72 | 24 |
| | | | | | | Existing Use | Unknown | 8 |
| | | | | | | Existing Inchoate Right | Unknown | 16 |
| | | | | | | Estimated Additional Future System Needs | 0 | 5.7 |
| Estimated Inchoate Right after Satisfying Anticipated Future Internal System Demand | | | | | | 0 | 10.3 | Assuming eventual demand could be up to 350 gpd per connection for the 35 connections. |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| None | | | | | | | | |

Table 7 – Northwest Water System Water Use

| Year | Total Water Produced and Purchased (gallons per year & afy) | Distribution System Leakage – Annual Volume (gallons per year & afy) | Distribution System Leakage – Percentage |
|------|---|--|--|
| 2010 | 2,604,700 gallons 8.0 afy | 5,000 gallons | 0.2% |
| 2011 | 2,031,230 gallons 6.2 afy | 5,000 gallons | 0.2% |

Source: DOH Water Use Efficiency Annual Performance Report – 2010 & 2011, Northwest Water System, Water System ID No. 02287.

If it is assumed that the Wilderness Ridge Community Club will eventually provide water to the current customers of the Northwest Water System, then there must be sufficient water retained to serve the existing customers, including any increase in demand due to changing use patterns over time. If it is conservatively assumed that each of the 35 connections will use 350 gpd the total use under G1-23536C would be 13.7 afy. This level of use would leave 10.3 afy under that water right that could be used in the Carpenter-Fisher subbasin.

Willingness to Participate in a Regional Water Supply Solution

The Wilderness Ridge Community Club's Board of Directors were briefed on this study by Mr. Jim Bucknell of RH2 on October 12, 2012. Subsequent to that meeting, the Wilderness Ridge Board expressed a willingness to continue to participate in discussions of potential recommendations as they may relate to Wilderness Ridge and agreed to a site visit by Mr. Bucknell and RH2 engineer Mr. Dan Burwell, on November 7, 2012. The purpose of this site visit was to evaluate the existing Wilderness Ridge water system and determine the capacity of the existing infrastructure, evaluate what system changes might be needed if options involving Wilderness Ridge are selected, and to begin the preparation of planning-level cost estimates for any identified system modifications. This is discussed in more detail under Issues and Potential Solutions section of this report.

Rolf Bruun Water System (DOH ID No. 08915)

The Rolf Bruun Water System is a relatively small Group A public water system located in the Fisher Creek Sub-subbasin to the west of I-5 and south of Starbird Road in Skagit County. This system receives its water from a well that is located in the Fisher Sub-subbasin.

Water Rights

The water rights for the Rolf Bruun Water System are shown in **Table 8**.

Table 8 – Water Rights for the Rolf Bruun Water System

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|---|---|-----------------|---------------|-----------------------|--|----------|----------|---|
| G1-00348C | Roger Tjeerdsma & Douglas Ploeg dba Tjeerdsma & Ploeg Company | Certificate | 11/4/1971 | Group Domestic Supply | No | 20 | 4.5 | |
| G1-006406CL | Rolf Bruun | Long Form Claim | 9/1/1971 | Group Domestic | No | 50 | 30 | Likely not a vested right due to priority date listed on document |
| Water Right Total | | | | | | 20 | 4.5 | Estimated annual use based on 13 connections at 350 gpd/connection |
| Existing Use | | | | | | 20 | 5 | |
| Existing Inchoate Right | | | | | | 0 | -0.5 | |
| Estimated Additional Future System Needs | | | | | | 0 | 0 | |
| Estimated Inchoate Right after Satisfying Anticipated Future Internal System Demand | | | | | | 0 | 0 | No inchoate since not municipal water supply water rights and right likely fully used |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| None | | | | | | | | |

The Rolf Bruun Water System has a long form claim, number G1-006406CL. This claim likely does not represent a valid vested water right because it states that the date of first putting water to beneficial use was 1971.

Ecology's water rights database includes a water right certificate (G1-00348C) for 20 gpm and 4.5 afy for group domestic supply. The water right application was submitted by Mr. Rolf Bruun but was subsequently assigned to Mr. Roger Tjeerdsma and Mr. Douglas Ploeg, doing business as Tjeerdsma and Ploeg Company.

Mr. Bucknell of RH2 spoke with the Rolf Bruun Water System owner, Mr. Ploeg, in a telephone conversation on October 16, 2012. This system's water use does not satisfy the definition of a municipal purpose water right.

Status of Water System Plan

The Rolf Bruun Water system does not meet the DOH criteria for requiring an approved water system plan. If the system intends to expand or make system improvements in the future, DOH would require the preparation of a planning document supported by an engineering system capacity analysis for review and approval by DOH staff.

The Rolf Bruun Water System has a green operating permit from DOH. This means that this system is considered adequate for existing uses and adding new service connections up to the number of

approved service connections, which is 14 connections for this system. The water right place of use and service area for this system is shown in **Figure 3**.

System Demand and Inchoate Water Rights

The Rolf Bruun Water System is calculated by DOH to have 13 connections and is authorized by DOH to have 14. If each home is assumed to use 350 gpd (0.39 afy), the existing annual use would be approximately 5 acre-feet, which is more than the water right annual limit of 4.5 acre-feet. Therefore, we assume that there is no additional water available under this water right certificate to serve other parcels within the subbasin.

Willingness to Participate in a Regional Water Supply Solution

When asked if he would support creation of a regional public water system to serve water to the Rolf Bruun service area, Mr. Ploeg indicated he would likely support such a system but could not speak for the other users of the system.

Camp Brotherhood (DOH ID No. 10824)

Camp Brotherhood, Inc., is now called the Cascadian Center at Camp Brotherhood (Camp). According to DOH, it is a transient, non-community water system located just south of Lake McMurray. This system receives its water from a flowing artesian well that is located within the Stillaguamish watershed (WRIA 5).

Water Rights

Table 9 includes information on the water rights for the Camp Water System.

Table 9 – Cascadian Center at Camp Brotherhood Water Rights

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|---|--|---------------|---------------|---------------------------|--|----------|----------|---|
| G1-00113C | Foothills Investment Company (now known as Tatoosh Company) for Camp Brotherhood, Inc. | Certificate | 5/20/1971 | Community Domestic Supply | Uncertain | 300 | 84 | Original developer's name |
| Certificated Water Rights Total | | | | | | 300 | 84 | System has indicated they are not interested in expanding service to others |
| Existing Use | | | | | | 60 | Unknown | |
| Existing Inchoate Right | | | | | | 240 | Unknown | |
| Estimated Additional Future System Needs | | | | | | Unknown | Unknown | |
| Estimated Inchoate Right after Satisfying Anticipated Future Internal System Demand | | | | | | 0 | 0 | |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| None | | | | | | | | |

The Camp has water right G1-00113C for 300 gpm and 84 afy. The water right application was submitted by the Foothills Development Company for the community of Tatoosh. The Foothills

Development Company later became the Tatoosh Company. The ROE estimated the ultimate population of 1,500, with a daily requirement of 50 gpd per capita for a total annual quantity of 84 afy.

Status of Water System Plan

The Camp Water System does not meet the DOH criteria for requiring an approved water system plan. If the system intends to expand or make system improvements in the future, DOH would require the preparation of a planning document supported by an engineering system capacity analysis for review and approval by DOH staff.

The Camp has a green operating permit from DOH. This means that this system is considered adequate for existing uses and adding new service connections up to the number of approved service connections, which is 25 for this system. The place of use for the Camp water right is shown in **Figure 4**.

DOH has classified this as a transient, non-community water system. It has a total of 25 approved connections with a residential population of 13 and a non-residential population of 50 people. DOH has calculated 14 connections based on the Camp's existing water use.

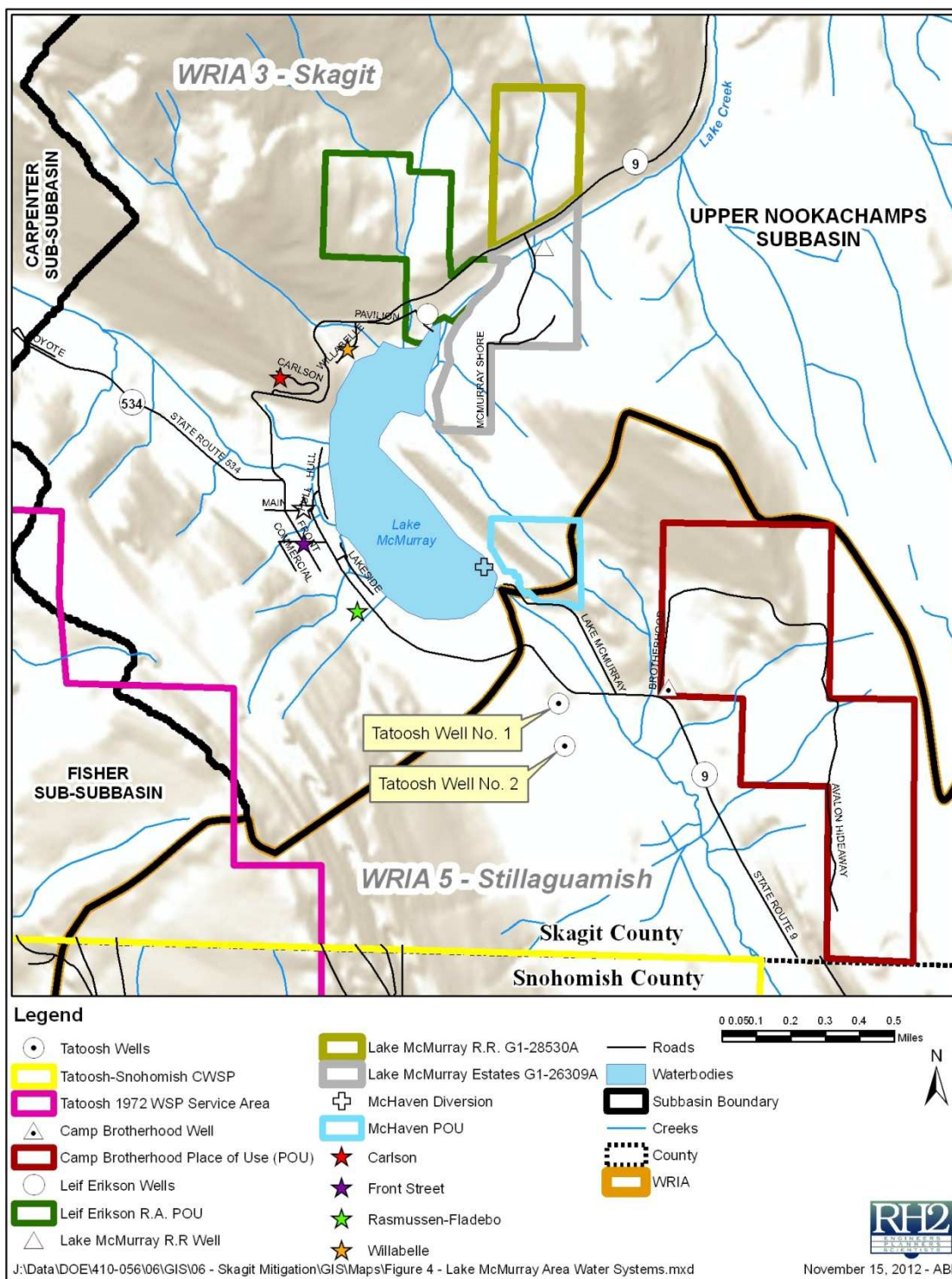
System Demand and Inchoate Water Use

The Camp uses an artesian well located in WRIA 5 and Mr. Phil Corey, primary contract for the Camp Brotherhood Water System, in a telephone conversation on October 23, 2012, reported that it currently withdraws about 60 gpm and that its demand fluctuates throughout the year as attendance at the retreat site fluctuates. A 1994 report by Kegel and Associates, Inc., cited a 1983 report by Hart Crowser and Associates entitled *Groundwater Development Feasibility Study* in which Hart Crowser and Associates concluded that the aquifer in the area is more than adequate to provide water to the Camp. Mr. Corey thinks the water right likely qualifies as a municipal purpose water right because he believes its use would satisfy the provisions related to part-time residents.

The Camp has a 79,000-gallon bladder reservoir and a 5,000-gallon stainless steel tank that provides storage and fire flow for the Camp Water System.

The place of use for the Camp's water right is shown in **Figure 4**.

Figure 4 – Water Systems near Lake McMurray



Willingness to Participate in a Regional Water Supply Solution

Because of the reliability of the Camp's flowing artesian well and the high quality of the water, Mr. Corey has little interest in connecting to a regional water system because the system's water does not have to be treated and its existing operation is working well.

Therefore, it is recommended that the Camp be eliminated from future consideration as a potential source of water that could be used to meet future demand in the Upper Nookachamps Subbasin.

Lake McMurray Recreational Resort (DOH ID No. 06604)

The Lake McMurray Recreational Resort (Resort) is a campground resort located northeast of Lake McMurray. In addition to the campground resort, which is also referred to as the Lake Associates Recreation Club (LARC), the applications held by the Resort also propose to cover water service for the Lake McMurray Estates, which consists of 16 lots located south of State Highway 9 and on the northeast shore of Lake McMurray. The Resort Water System receives its water from a well that is located in the Upper Nookachamps Subbasin near Lake Creek.

Water Rights

Table 10 includes information on the water rights for the Resort Water System.

Table 10 – Water Rights for Lake McMurray Recreational Resort

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|---|-----------------------------------|---------------|---------------|----------------------------------|--|----------|-----------|--|
| None | | | | | | | | |
| Water Rights Total | | | | | | 0 | 0 | No water rights identified |
| Existing Use | | | | | | Unknown | Unknown | |
| Existing Inchoate Right | | | | | | 0 | 0 | |
| Estimated Additional Future System Needs | | | | | | Unknown | Unknown | |
| Estimated Inchoate Right After Satisfying Anticipated Future Internal System Demand | | | | | | 0 | 0 | |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| G1-26309 | Lake McMurray Recreational Resort | Application | 8/16/1991 | Group Domestic Supply | Yes | 46 | Undecided | Place of use is the Lake McMurray Estates (16 lots), south of HWY9 |
| G1-28530 | Lake McMurray Recreational Resort | Application | 1/2/2008 | Multiple Domestic and Recreation | Uncertain | 8.73 | Undecided | For use on the resort property |

The Resort has two pending water right applications for a total of 54.73 gpm (G1-26309 and G1-28530). It does not have water rights sufficient to authorize its existing water use beyond that allowed by the groundwater permit exemption.

Status of Water System Plan

DOH provided water system planning documents from 1995 for the Resort Water System, but does not have an existing water system plan on file (DOH, 2012). This system does not meet the DOH criteria for requiring an approved water system plan. If the system intends to expand or make system improvements in the future, DOH would require the preparation of a planning document supported by an engineering system capacity analysis for review and approval by DOH staff.

The Resort currently has a blue operating permit from DOH. This means that this system is considered adequate for existing uses but is not considered adequate for adding new service connections.

The proposed place of use for the Resort as identified in the two water right applications is shown in **Figure 4**.

Mr. Mike King is the Resort Water System owner and operator. In a telephone conversation on October 16, 2012, Mr. King stated that the system has a 67,000-gallon fire tank and a 16,000-gallon tank (reservoir) for its domestic supply. According to Mr. King, this system is on commercial-grade septic systems so the bulk of its water is recharged back into the aquifer from which it is withdrawn. Mr. King also stated that chum salmon are the only salmon that utilize the stream on the system's property, which is a tributary to Lake Creek, and that the salmon are not present until November or December each year after the low-flow period has ended.

System Demand and Inchoate Water Rights

DOH has classified the system as a transient non-community water system with a residential population of 12 (5 current connections) and a non-residential population of 156. DOH has calculated 47 connections but has only approved 27 connections based on system capacity.

Since RH2 could not locate water right documents for the Resort Water System, other than the two pending applications for this system, there is no inchoate portion available to serve others within the Upper Nookachamps Subbasin.

Willingness to Participate in a Regional Water Supply Solution

Mr. King is the sole owner of the Resort and its water system. He stated that he prefers to maintain his independence and is not interested in connecting to a regional water supply system should such a source become available in the future.

Therefore, it is recommended that the Resort be eliminated from future consideration as a potential source of water that could be used to meet future demand in the Upper Nookachamps Subbasin. However, since this system has no water rights and there is not sufficient water left under the reservation to allow for issuance of a water right permit to cover this use, its use either needs to be offset by mitigation or it will need to hook up to a regional system.

Leif Erikson Recreation Association (DOH ID No. 23735) aka Norway Park

According to the Leif Erikson Recreation Association (LERA) water system plan, the development consists of approximately 220 residential sites on 93 acres of land, located at the north end of Lake McMurray in Skagit County. However, only 168 out of the 220 lots will be developed in conformance with the Special Use Permit (No. SP 90 045.ORD) issued by Skagit County. This system receives its water from two wells located in the Upper Nookachamps Subbasin near Lake McMurray.

Water Rights

Water rights for the LERA Water System are shown in **Table 11**. The LERA has one water right certificate (G1-08034C) which authorizes the withdrawal of 65 gpm and 100 afy, and two pending water right applications. RH2 believes that this water right certificate qualifies as being for municipal water supply purposes.

Table 11 – Water Rights for the Leif Erikson Recreation Association

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|--|-------------------------------------|---------------|---------------|---------------------------|--|-------------------------|----------|--------------------------|
| GWC 5504 | Leif Erikson Recreation Association | Certificate | 4/11/1966 | Community Domestic Supply | Yes | 65 | 100 | |
| Estimated Additional Future System Needs | | | | | | Water Rights Total | 65 | 100 |
| | | | | | | Existing Use | 65 | 16.5 |
| | | | | | | Existing Inchoate Right | 0 | 83.5 |
| | | | | | | | 0 | 37 |
| Estimated Inchoate Right After Satisfying Anticipated Future Internal System Demand | | | | | | | 0 | 46.5 |
| Additional annual demand estimated as 27 afy based on 20 year forecast from water system plan, plus 10 additional afy. | | | | | | | | |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| G1-26939 | Leif Erikson Recreation Association | Application | 2/17/1993 | Community Domestic Supply | Yes | 180 | 100 | For 400 additional homes |
| G1-26940 | Leif Erikson Recreation Association | Application | 2/17/1993 | Community Domestic Supply | Yes | 115 | 0 | |

Status of Water System Plan

The water system plan for the LERA was approved by DOH in 2004 for 194 equivalent residential units (ERUs) service connections based on the limited physical availability of water (RH2, 2004). The LERA Water System has a green operating permit from DOH. This means that this system is considered adequate for existing uses and adding new service connections up to 194 connections. The service area for the LERA is shown in **Figure 4**. Since water system plan updates are due every 6 years, LERA is currently out of compliance with its water system plan requirement.

According to the DOH database, while approved for 194 connections, it currently has 137 calculated connections. This system is classified as a Group A community water system with a residential population of 190 and a non-residential population of 80.

System Demand and Inchoate Water Rights

Table 12 shows water use data for 2010 and 2011. The LERA Water System use appears to meet the criteria for municipal purpose water rights.

Table 12 – Leif Erikson Recreation Association Water Use

| Year | Total Water Produced and Purchased (gallons per year & afy) | Distribution System Leakage – Annual Volume (gallons per year & afy) | Distribution System Leakage – Percentage |
|-------------|--|---|---|
| 2010 | 5,387,502 gallons 16.5 afy | No data | N/A |
| 2011 | 4,981,313 gallons 15.3 afy | No data | N/A |

Source: DOH Water Use Efficiency Annual Performance Report – 2010 & 2011, Leif Erikson Recreation Association, Water System ID No. 23735.

The 137 connections each use approximately 108 gallons per connection per day. It appears that the LERA currently has an inchoate water right in the amount of approximately 83.5 afy. The water system plan for LERA was last updated in 2004 and predicted a water right excess of 0 gpm instantaneous and 56.5 acre-feet in annual quantity in 20 years (2024) (RH2, 2004). Mr. Larry Solheim, RH2's contact for the LERA, said in a telephone conversation on October 16, 2012, that the projection for 20 years would probably not represent full build-out and the system would still likely require some additional water. However, it appears that the LERA will continue to have a significant inchoate water right, a portion of which could conceivably be made available to assist in alleviating water supply issues in the Upper Nookachamps Subbasin.

Willingness to Participate in a Regional Water Supply Solution

DOH's limitation of approved connections due to the water right instantaneous limit results in a recommendation that this system not be considered for expansion into a regional water supply solution. However, if LERA were to hook-up to a regional water system, its water rights could be placed in the Trust Water Rights Program to mitigate potential users downstream.

McHaven, Inc. (DOH ID No. 44357)

McHaven Inc. (McHaven) is a small public water system near the south end of Lake McMurray in Skagit County. It is primarily a recreational use system with a number of trailer sites. This system receives its water from a surface water diversion from Lake McMurray in the Upper Nookachamps Subbasin.

Water Rights

Water rights for the McHaven Water System are shown in **Table 13**.

Table 13 – Water Rights for McHaven, Inc.

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (cfs) | Qa (afy) | Comments |
|---|--|---------------|---------------|---------------------------|--|---------------|----------|-------------------------------|
| S1-22259C | Glen W. Kensmoe (Lake McMurray Resort) | Certificate | 12/3/1974 | Single Domestic Supply | No | 0.02 (9 gpm) | 1 | Lake McMurray is the source |
| S1-22262C | Glen W. Kensmoe (Lake McMurray Resort) | Certificate | 12/3/1974 | Community Domestic Supply | Yes* | 0.04 (18 gpm) | 5.5 | Lake McMurray is the source |
| Water Right Total | | | | | | 0.06 | 6.5 | |
| Existing Use | | | | | | 0.01 | 6.5 | Estimated annual use |
| Existing Inchoate Right | | | | | | 0.05 | 0 | |
| Estimated Additional Future System Needs | | | | | | 0 | 0 | |
| Estimated Inchoate Right after Satisfying Anticipated Future Internal System Demand | | | | | | 0.05 | 0 | Municipal Purpose water right |
| * Per e-mail from Tom Mortimer 8/14/2013 | | | | | | | | |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| None | | | | | | | | |

*McHaven holds two water rights, S1-22262C and S1-22259C, originally issued to Glenn W. Kensmoe (Lake McMurray Resort). Both water rights, as well as the Lake McMurray Resort, were conveyed to McHaven in 1990. This information was provided by Mr. Tom Mortimer, representing McHaven, on August 14, 2013. Certificate S1-22262C is issued for 0.04 cfs (approximately 18 gpm) and 5.5 afy. Certificate S2-22259C is issued for 0.02 cfs (approximately 9 gpm) and 1.0 afy. According to DOH's Water Facilities Inventory Form for McHaven, the system has 6 permanent connections serving a full-time residential population of 12 people. The resort has transient users throughout the year, ranging from a low of 180 in November to a high of 620 in July and August. Absent specific daily population counts, it appears that this water right likely satisfies the municipal purpose water right requirement of providing residential use of water for a non-residential population that is, on average, at least 25 people for at least 60 days per year.

Water System Plan Status

The McHaven water system does not meet the DOH criteria for requiring an approved water system plan. If the system intends to expand or make system improvements in the future, DOH would require the preparation of a planning document supported by an engineering system capacity analysis for review and approval by DOH staff.

McHaven has a green operating permit from DOH. This means that this system is considered adequate for existing uses and adding new service connections up to the number of approved service connections, which is 36 for this system. The water right place of use and service area for McHaven is shown in **Figure 4**.

System Demand and Inchoate Rights

According to Mr. Terry Doiron, the primary contact for the McHaven Water System at the time of this investigation, McHaven currently diverts surface water from Lake McMurray and the rate of diversion is about 3 to 4 gpm and is limited by the capacity of the system's sand filters. DOH has categorized this system as a transient non-community system with a residential population of 12 and a non-residential population of 20. DOH has calculated 35 connections and the system is approved for 36. Based on McHaven's Water Facilities Inventory on file with DOH, an average of 353 temporary or transient users have access to the water system throughout the year. As a result, it appears that McHaven's water rights constitute municipal purpose water rights as defined in RCW 90.03.015(4).

Willingness to Participate in a Regional Water Supply Solution

In a telephone conversation with Mr. Doiron on October 17, 2012, Mr. Doiron said McHaven approached the Tatoosh Water Company several years ago about connecting to the Tatoosh system but were turned down. McHaven has also looked into the possibility of purchasing neighboring property with water rights or drilling a new well in an attempt to obtain additional water. Mr. Doiron is very interested in connecting to a new public water system if a new system were to be created in this area. Because the McHaven Water System uses surface water, the Environmental Protection Agency (EPA) considers the system to be a system in distress. This is worthy of investigation to determine whether any financial assistance may be available once decisions are made regarding water supplies for this area.

Big Lake Water Association (DOH ID No. 06700)

The Big Lake Water Company (Big Lake) is a Group A public water system on the northwest shore of Big Lake in Skagit County. According to its sanitary survey dated March 4, 2008, the system is a:

Group A with 65 connections and a population of 118. System has 4 sources, 1 & 5 are pumped and 3 & 4 are artesian. There are two pressure zones in this system. This system has continuous chlorination from 2 points. Water from all sources flow into a 22,000 gallon reservoir and has two booster pumps that send water to distribution.

Big Lake has several water rights which are shown in **Table 14**. The Big Lake Water System is being dissolved and customers are transitioning to receive water from the Skagit PUD, which has a redundant water system in the area.

Water Rights

The water rights for Big Lake are shown in **Table 14**.

Table 14 – Water Rights for the Big Lake Water Association

| Permit, Certificate, or Claim Number | Name on Water Right | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
|---|-------------------------------------|---------------|---------------|---------------------------|--|----------------|----------------|--|
| SWC 3161 | Big Lake Water Company Incorporated | Certificate | 3/20/1948 | Community water system | Yes | 157 (0.35 cfs) | None Listed | |
| G1-22387 | Big Lake Water Company | Certificate | 1/13/1975 | Community Domestic Supply | Yes | 13 | 21 | |
| G1-22388 | Big Lake Water Company | Certificate | 1/13/1975 | Community Domestic Supply | Yes | 14 | 23 | |
| G1-22389 | Big Lake Water Company | Certificate | 27407 | Community Domestic Supply | Yes | 16 | 26 | |
| Groundwater Rights Total | | | | | | 43 | 70 | |
| Existing Use | | | | | | Unknown | Unknown | |
| Existing Inchoate Right | | | | | | Unknown | Unknown | |
| Estimated Additional Future System Needs | | | | | | 0 | 0 | |
| Estimated Inchoate Right after Satisfying Anticipated Future Internal System Demand | | | | | | Not Applicable | Not Applicable | Customers are being hooked up to Skagit PUD. Big Lake is working with Ecology on transfer of rights to Trust Water Rights Program. |
| Application Number | Name on Application | Document Type | Priority Date | Purpose of Use | Municipal Purpose as Defined in RCW 90.03.015? | Qi (gpm) | Qa (afy) | Comments |
| None | | | | | | | | |

The Big Lake Water System has the following water rights in the name of the Big Lake Water Company.

- SWC 3161: 0.35 cubic feet per second (cfs)
- G1-22387C: 13 gpm, 21 afy (supplemental to G1-22388 and G1-22389), maximum annual withdrawal is 70.0 afy.
- G1-22388C: 14 gpm, 23 afy (supplemental to G1-22387 and G1-22389)
- G1-22389C: 16 gpm, 26 afy

The three groundwater certificates grant the Big Lake Water System the right to withdraw a maximum quantity of 70 afy. None of these rights appear to be supplemental to the surface water right, which does not have an annual quantity limitation specified. Therefore, the total amount available to Big Lake appears to be 70 afy, plus the reasonable annual quantity for the surface water right. The lack of an annual quantity limit was common in surface water rights issued in the middle of the last century.

Water System Plan Status

The Big Lake Water System has a green operating permit from DOH. This means that this system is considered adequate for existing uses and adding new service connections up to the number of approved service connections, which is 70 connections for this system.

Big Lake is classified by DOH as a Group A community water system. It has a residential population of 188 and no non-residential connections. DOH has calculated that the system has 45 connections but is approved for a total of 70 connections. This use appears to satisfy the criteria for municipal purpose water rights.

Skagit PUD has extended its system through and beyond the area served by Big Lake. In a telephone conversation on October 16, 2012, Mr. Steve Harmon, Big Lake Water Association representative, said that Skagit PUD and Big Lake have a parallel system in place and that, as Big Lake is dissolved, users will shift over to the Skagit PUD Water System. Ecology is working with Big Lake with the intent of acquiring the water rights for this system and using that water for mitigation for out of stream uses in the lower part of the Upper Nookachamps Subbasin.

System Demand and Inchoate Rights

This system is being dissolved and its customers are being absorbed by the Skagit PUD. Ecology is pursuing the purchase of Big Lake's water rights for reallocation or inclusion in the Trust Water Rights Program. This water, if it becomes available, would be used for mitigation of impacts occurring downstream of Big Lake in the Upper Nookachamps Subbasin, but would not be suitable to mitigate upstream impacts.

Willingness to Participate in a Regional Water Supply Solution

As previously discussed, Big Lake is already working with Ecology to make sure that its water rights can be used to mitigate for downstream impacts. Due to the ongoing negotiations and indication that the system is dissolving, this water system will not be considered as a potential provider of direct municipal water service.

Public Utility District No. 1 of Skagit County (DOH ID No. 79500)

Skagit PUD operates the largest water system in Skagit County. According to the Skagit PUD's website, it provides 9 million gallons of piped water to approximately 65,000 people every day. The Skagit PUD system includes nearly 600 miles of pipelines and has a total storage capacity of more than 31 million gallons. The Skagit PUD provides water to the cities of Mount Vernon, Burlington, and Sedro-Woolley, and also provides service to unincorporated and remote portions of the county. The Skagit PUD is also the county's designated satellite management agency, which means they are authorized to own and operate small water systems throughout the county. Skagit PUD's Judy Reservoir system is the distribution system that supplies customers within the study area. The Judy Reservoir system is the portion of the Skagit PUD's system that diverts water from the Cultus Mountain streams (Gilligan, Salmon, Turner, and Mundt Creeks) which are located in the East Nookachamps Subbasin, the main stem of the Skagit River, and wells located near the Skagit River and stores the water in the Judy Reservoir near Clear Lake in Skagit County for distribution through the lower Skagit River valley.

Water Rights

The Skagit PUD has a green operating permit from DOH. Systems in this category are considered adequate for existing uses and adding new service connections up to the number of approved service connections, which is unspecified by DOH for this system. Outside the boundaries of existing water systems, the PUD is authorized to serve water anywhere in Skagit County and may, under certain circumstances, serve water in Snohomish County as well (source: email communication, Mr. Chris Shaff, Skagit PUD Planning Engineer, November 19, 2012). The location of existing PUD water mains in the study area are shown in **Figure 5**.

According to the Skagit PUD's 2007 water system plan (HDR, 2007), its total certificated and recorded surface water claims and rights in the Judy Reservoir system sum to an instantaneous rate of diversion (Q_i) of 31.69 cfs, or 20.48 million gallons per day (mgd), and an annual volume of 18,755 afy. The Q_i for the Ranney Well and the Sedro-Woolley Well totals 10.90 cfs, bringing the total current surface water rights of the Skagit PUD to 42.59 cfs (27.52 mgd). The water rights for the Skagit PUD Judy Reservoir System are shown in **Table 15**.

Table 15 – Water Rights for the Skagit PUD's Judy Reservoir System

Certificated Rights

| Name | Status | Certification # | Priority Date | Q1, Max Diversion (cfs) | (MGD) | Qa, (ac-ft) | Comments |
|--------------------------|--------------|------------------|---------------|-------------------------|-------|-------------|--|
| MUNDT CREEK | CERTIFICATED | VOL 1, PG 26 | 9/28/1917 | 2.5 | 1.62 | 1810 | TOGETH W/ S1-00737C, Q1 <= 8.0cfs & Qa <= 3886 afy |
| TURNER CREEK | CERTIFICATED | CLAIM 9333 | PRE-1917 | 4.3 | 2.78 | 2300 | Vested Right Transferred to District |
| TURNER CREEK | CERTIFICATED | S1-00739C | 10/30/1963 | 6.2 | 4.01 | 0 | SUPPLEMENTAL TO 8738 AND R1 00673C |
| MUNDT CREEK | CERTIFICATED | S1-00737C | 10/30/1963 | 8 | 5.17 | 3886 | SUPPLEMENTAL TO 26, 8738 AND R1-00673C |
| SALMON CREEK | CERTIFICATED | CLAIM 9332 | PRE-1917 | 1.8 | 1.16 | 307 | Vested Right transferred to District |
| GILLIGAN CREEK | CERTIFICATED | VOL 1, PG 441 | 10/10/1929 | 1.5 | 0.97 | 0 | From Puget Sound Pulp and Timber |
| GILLIGAN CREEK | CERTIFICATED | S1-00724C | 10/30/1963 | 7.39 | 4.78 | 3700 | Supplemental to existing 1.5cfs right |
| SKAGIT RIVER RANNEY WELL | TRANSFERRING | VOL 5, PG 2107-A | 5/12/1954 | 8.91 | 5.76 | 6400 | Approved for transfer to Skagit River Diversion |
| SEDRO WOOLLEY WELL | TRANSFERRING | VOL 4, PG 1904-A | 3/26/1953 | 2.01 | 1.30 | 1440 | Approved for transfer to Skagit River Diversion |

Claims

| Name | Status | Certification # | Priority Date | Q1, Max Diversion (cfs) | (MGD) | Qa, (ac-ft) | Comments |
|--------------------|--------|-----------------|---------------|-------------------------|-------|-------------|---|
| PIGEON CREEK | CLAIM | CLAIM 9335 | PRE-1917 | 0.2 | 0.13 | 40 | Vested Right Transferred to District - not active |
| ROCK SPRINGS CREEK | CLAIM | CLAIM 9334 | PRE-1917 | 0.2 | 0.13 | 2900 | Vested Right Transferred to District - not active |
| UNNAMED CREEK | CLAIM | CLAIM 9336 | PRE-1917 | 0.1 | 0.06 | 20 | Vested Right Transferred to District - not active |
| COLD SPRINGS CREEK | CLAIM | CLAIM 9337 | PRE-1917 | 0.2 | 0.13 | 40 | Vested Right Transferred to District - not active |
| E FORK NOOKACHAMPS | CLAIM | CLAIM 9338 | PRE-1917 | - | - | - | Vested Right Transferred to District - not active |

Applications

| Name | Status | Application # | Priority Date | Q1, Max Diversion (cfs) | (MGD) | Qa, (ac-ft) | Comments |
|---------------------------|-------------|---------------|---------------|-------------------------|-------|-------------|---------------------------------------|
| MUNDT CREEK | APPLICATION | S1-27861 | 10/22/1997 | 18.56 | 10.38 | | Part of MOA |
| TURNER CREEK | APPLICATION | S1-27862 | 10/22/1997 | 6.6 | 4.27 | | Part of MOA |
| SALMON CREEK | APPLICATION | S1-18219 | 10/30/1963 | 4.0 | 2.58 | | Part of MOA, Oring Applic for 0.1 cfs |
| GILLIGAN CREEK | APPLICATION | S1-25128 | 11/16/1987 | 13.15 | 8.50 | | Part of MOA, Oring Applic for 9.6 cfs |
| SKAGIT RIVER PUMP STATION | APPLICATION | S1-27860 | | 12.8 | 8.27 | | Part of MOA |
| JANICKI CREEK | APPLICATION | S1-18220 | | 9.0 | 5.82 | | |
| DAY CREEK | | 4586, 14220 | | - | - | | |
| STARBIRD, T33, R04, 28 | APPLICATION | G1-26742 | 9/29/1992 | 1.11 | 0.72 | | |
| STARBIRD, T33, R04, 33 | APPLICATION | G1-27030 | 3/31/1993 | 0.78 | 0.50 | | |

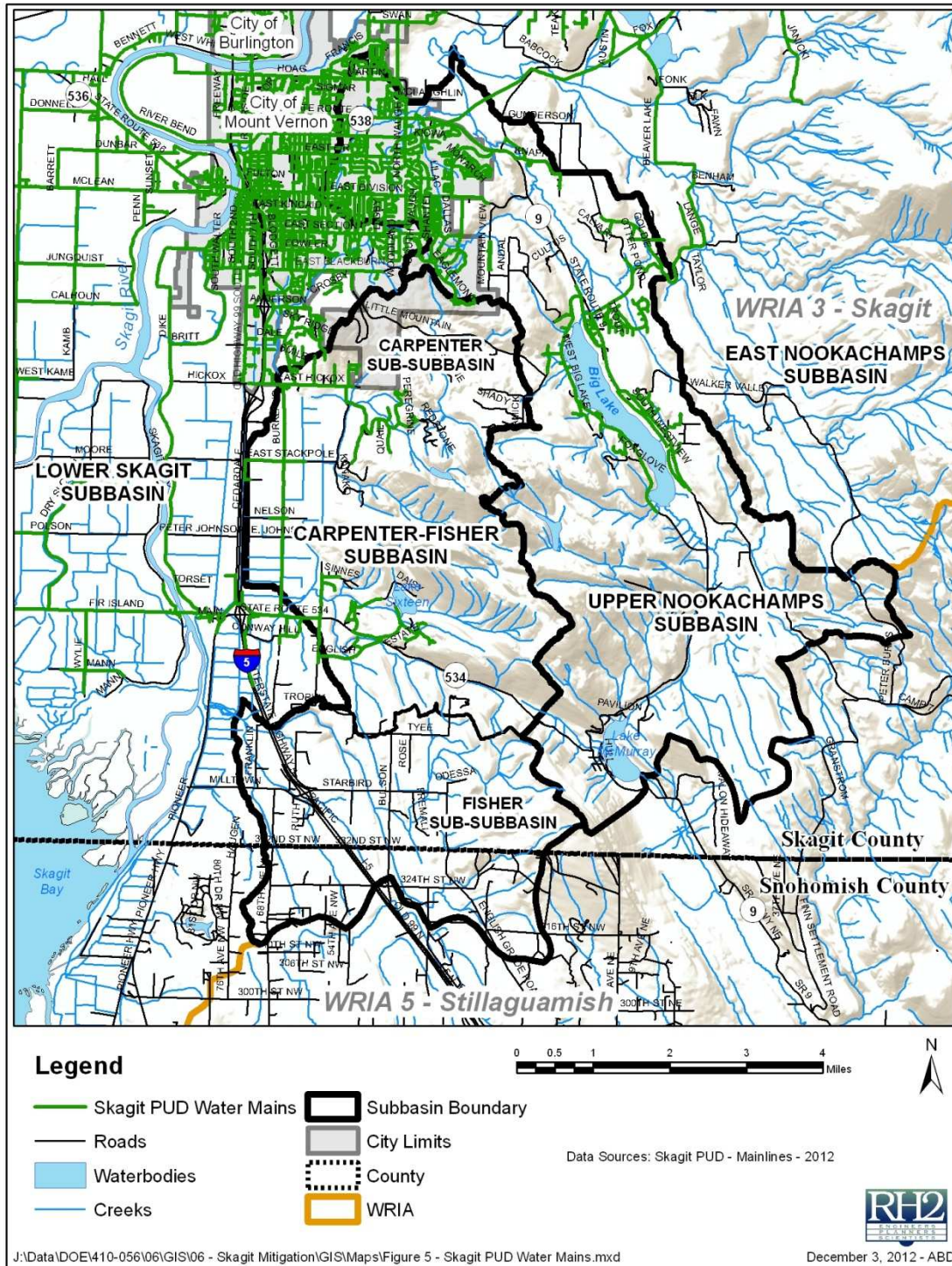
Certificated Storage Rights

| Name | Status | Certification # | Permit # | Priority Date | Volume (ac-ft) |
|----------------|--------------|-----------------|------------|---------------|----------------|
| JUDY RESERVOIR | CERTIFICATED | VOL 18, PG 8738 | R-142 | 1/16/1946 | 1500 |
| JUDY RESERVOIR | CERTIFICATED | R1-00673C | BOOK 2, R- | 4/24/1963 | 4250 |

Storage Right Applications

| Name | Status | Application # | Permit # | Priority Date | Volume (ac-ft) |
|----------|-------------|---------------|----------|---------------|----------------|
| DAY LAKE | APPLICATION | R-14221 | | 1/24/1957 | 11200 |

Figure 5 – Existing Skagit PUD Water Mains



Water System Plan Status

Skagit PUD's water system plan states that the PUD has the capacity to serve an additional 13,864 ERUs from the Judy Reservoir sources. The primary and supplemental rights quantities have not been segregated as part of this study but it is clear the PUD has the capacity to serve additional water to new customers within its service area and the study area.

System Demand and Inchoate Water Rights

Table 16 lists the Skagit PUD's water use and leakage data for 2007 through 2011.

Table 16 – Skagit PUD Water Use and Leakage

| Year | Total Water Produced and Purchased (gallons per year & afy) | Distribution System Leakage – Annual Volume (gallons per year & afy) | Distribution System Leakage – Percentage |
|-------------|--|---|--|
| 2007 | 2,903,000,000 gallons 8,909 afy | 211,000,000 gallons 647.5 afy | 7.4% |
| 2008 | 3,060,489,400 gallons 9,392 afy | 448,897,920 gallons 1,378 afy | 14.7% |
| 2009 | 2,939,197,603 gallons 9,020 afy | 209,892,211 gallons 644 afy | 7.1% |
| 2010 | 2,809,712,516 gallons 8,623 afy | 211,933,200 gallons 650 afy | 7.5% |
| 2011 | 2,803,346,000 gallons 8,603 afy | 333,826,000 gallons 1,024 afy | 11.9% |

Source: DOH Water Use Efficiency Annual Performance Report – 2007-2011 Skagit County PUD No. 1 Judy Reservoir, Water System ID No. 79500.

Willingness to Participate in a Regional Water Supply Solution

Skagit PUD has demonstrated a willingness to participate in a regional water supply solution where PUD standards related to system design and construction are satisfied.

Summary of the Water Rights of the Public Water Systems in the Study Area

To the extent they can be determined at the present, the water rights, water use, and inchoate rights for the water purveyors discussed in the previous section are summarized in **Table 17**.

Table 17 – Summary of Existing Public Water System Water Rights and Inchoate Quantities

| System Name | Reported or Estimated Water Use | Estimated Long-term Water Use ¹ | Authorized Qi/Qa ² | | Long-term Estimated Inchoate Right ³ | |
|--|--|--|-------------------------------|-----------------|---|------------------------|
| | (afy) | (afy) | (gpm) | (afy) | (gpm) | (afy) |
| Tatoosh Water Company | Max. 112.1 (2007) Average 78.3 (2000-2011) ⁴ | 392.1 (estimated) | 1,550 | 1,135 | 625 | 742.9 |
| Wilderness Ridge Community Club | 47.8 (2010 and 2011) | 81.8 | 615 | 150 | 15 | 68.2 |
| Northwest Water System | 8 (2010) | 13.7 (estimated) | 72 | 24 | Unknown | 10.3 |
| Rolf Bruun Water System | 5 (estimated) | 5 (estimated) | 20 | 4.5 | 0 | 0 |
| Camp Brotherhood | Unknown | Unknown | 300 | 84 | Not interested in participating ⁵ | |
| McHaven, Inc. | 6.5 (estimated) | 6.5 (estimated) | 27 | 6.5 | 0 | 0 |
| Leif Erikson Recreation Association | 16.5 (2010) ⁵ | 53.5 | 65 | 100 | 0 ⁶ | 46.5 ⁶ |
| Lake McMurray Recreational Resort | Unknown | Unknown | 0 ⁷ | 0 ⁷ | 0 | 0 |
| Big Lake Water Association | Unknown | 0 | 43 ⁸ | 70 ⁸ | System is disbanding and customers will be served by Skagit PUD | |
| Skagit PUD⁹ | 9,392 (2008) | Unknown | 19,116 | 18,755 | Unknown but sufficient | Unknown but sufficient |

¹ Estimated based on number of connections and assumptions of gallons per connection per day where use data is unavailable.

² From Ecology's water rights documents.

³ Obtained by subtracting reported or estimated full build-out water use from the authorized quantities.

⁴ Refer to **Table 2** for annual totals and more detail.

⁵ Telephone discussion with Mr. Phil Corey, primary contact for Camp Brotherhood, on October 23, 2012.

⁶ The LERA 2009 water system plan predicts 0 gpm and 56.5 afy surplus in 2029. System may still need some additional water for build-out at that time according to contact Mr. Larry Solheim. RH2 assumed the additional water needed will be 10 afy for the purposes of this study.

⁷ The Resort only has two pending water right applications.

⁸ Includes groundwater rights only.

⁹ Judy Reservoir system only.

As can be seen from **Table 17**, Tatoosh, Wilderness Ridge, and Skagit PUD are the municipal water suppliers with the largest inchoate water rights that have the potential to be able to provide potable or mitigation water to the subbasins.

ISSUES AND POTENTIAL SOLUTIONS

The recommendations discussed in this section are geographically specific; different solutions are proposed for different parts of the study area. The geographic areas and the proposed solutions for these areas are summarized as follows.

- Lake McMurray in the Upper Nookachamps Subbasin – The Tatoosh Water Company provides water via a new well and pipeline to Lake McMurray to provide water directly into the lake to augment stream flows. This pipeline could also branch to serve the existing

McHaven public water system. Depending on the need of other areas around Lake McMurray, this option could be expanded to include the provision of water to Skagit PUD to serve as a satellite system operator in the Lake McMurray area, providing augmentation water to the lake and a PWS to residents around the lake, including the Lake McMurray Store and Fire District No. 15. Converting existing users to this new source of water would make their current supplies available for use as mitigation for future water uses in the subbasin downstream of Lake McMurray. Creating a PWS in the Lake McMurray area would provide public health benefits, a secure supply of water for fire suppression, and water for instream flows and mitigation of downstream impacts associated with groundwater withdrawals. This option could provide both direct water service to customers and mitigation water to the subbasin.

- Upper Fisher Creek in the Fisher Sub-subbasin (East of I-5) – The Tatoosh Water Company provides water to upper Fisher Creek and extends lines west to I-5 where it could intertie with mains from Wilderness Ridge Community Club to serve water west of I-5. This option would provide mitigation water to the tributary of Fisher Creek and direct service to customers in the areas served by Tatoosh.
- Little Fisher Creek in the Fisher Sub-subbasin (West of I-5) – The Wilderness Ridge Community Club extends water mains east to I-5 to serve properties west of I-5 and to provide water to the east and west forks of Little Fisher Creek along 324th Street NW where it could intertie with the Tatoosh Water Company or remain a separate system. This option would provide direct service to customers in proximity to the water mains and mitigation water to downstream properties by providing mitigation water for discharge into the east and west forks of Little Fisher Creek.
- Carpenter Sub-subbasin – The Skagit PUD extends an existing water main to allow for the delivery of mitigation water into the headwaters of Carpenter Creek. This option would mitigate for those wishing to drill their own wells within a portion of the Carpenter Sub-subbasin. Classic extension of water mains based on requests for service will also continue to be another viable option in this sub-subbasin.

Each of these proposed solutions are discussed in more detail in the following sections.

Demand Assumptions

It is important to know that with the invalidation of the instream flow rule by the Washington State Supreme Court, the reservations of water are no longer in effect. As a result, the water used by the permit-exempt wells affected by the amended rule will now have to be added to the projected future demands identified in this report in order to determine the total amount of water for which mitigation needs to be established. The need for revision of these numbers was unanticipated and is outside the current scope of this project.

The discussion of water demand in the identified subbasins requires an understanding of the genesis of the issues related to water supply in the study area, starting with an understanding of the reservation accounting. A brief history and background of the instream flow rule, the reservation of water for specified future uses, and the allowance for mitigation of impacts are discussed below.

Skagit Reservation

When Ecology amended the Skagit Instream Flow Rule, WAC 173-503, which was adopted in May 2006, it set up a reservation system for certain new uses of water which began after April 14, 2001. Water rights that were issued prior to this date and permit-exempt uses that began prior to this date are senior to the instream flow rule and are not subject to it. In this report, RH2 discusses the reservation created for domestic, municipal, and commercial/industrial uses since that is the focus of our study. The instream flow rule divided the Skagit River Basin (WRIAs 3 and 4) into many smaller subbasins. These subbasins were created based on the surface water drainage basins for many of the tributaries to the Skagit River. The remaining area was split up into a lower, middle, and upper Skagit River subbasin. For each subbasin, the instream flow rule allocated a specific amount of water that could be removed from streamflow and put to a consumptive use. The rule also specified how the reservation should be debited for different proposed uses of permit-exempt wells (WAC 173-503-073). For instance, a home is debited at a rate of 350 gpd, while a commercial/industrial use is debited at 5,000 gpd unless actual metered use is available. The rule also specifies that if the user of reservation water uses on-site septic systems, 50 percent of the water used will be credited to the reservation for recharge. Therefore, for each new home with an on-site septic system, the result is that the reservation is debited a total of 175 gpd.

Table 18 identifies the original reservation, the quantity used as of December 31, 2011, the reservation credit based on on-site septic system return flow, and the reservation quantity remaining. The most recent Skagit Reservation Accounting Report runs through December 31, 2011.

Table 18 – Skagit Reservation Report for Targeted and Adjacent Subbasin Management Units

| Subbasin Management Unit | Reservation Quantity Max. Average Consumptive Daily Use (gpd) | Reservation Quantity Used (gpd) | Reservation Credit (gpd) | Reservation Quantity Remaining (gpd) |
|--------------------------|---|---------------------------------|--------------------------|--------------------------------------|
| Carpenter-Fisher | 11,633 | 28,450 | 13,825 | (-2,992) CLOSED |
| Upper Nookachamps | 12,279 | 18,550 | 9,275 | 3,004 |
| East Nookachamps | 14,218 | 3,150 | 1,575 | 12,643 |
| Lower Skagit | 5,254,103 | 18,550 | 8,275 | 5,244,828 |

The Carpenter-Fisher and Lower Skagit subbasins are the only two subbasins under WAC 173-503 that include both Skagit and Snohomish Counties. As can be seen from **Table 18**, the Carpenter-Fisher subbasin reservation is currently over-drafted. On June 27, 2011, Ecology officially closed the subbasin. The East Nookachamps still has appreciable reservation quantities remaining. For this reason, and due to the fact that the Skagit PUD has municipal water mains in this area, RH2 did not focus our analysis in that subbasin. The Upper Nookachamps subbasin is nearing the reservation limit. In a letter dated September 5, 2012, Ecology informed Skagit and Snohomish Counties that 75 percent of the reservation had been used within the Upper Nookachamps subbasin. If the remaining homes added under this reservation are all assumed to be hooked up to on-site septic systems (debited 175 gpd per home), the remaining reservation will only allow for 17 additional homes in the subbasin. The Lower Skagit subbasin still has a large amount of water for future uses. It is shown here because it abuts the Carpenter-Fisher subbasin to the west and could be a potential source of additional supply if needed.

WAC 173-503 allows for the submittal of a scientifically sound mitigation plan that is reviewed by Ecology. Part of the scope for this study is to review possible ways that existing municipal water rights can be utilized as a source of water for a mitigation plan. For this study, RH2 assumed that the mitigation provided by a municipal water right needs to be in-kind, in-time, and in-place. These three requirements follow the strictest interpretation of the instream flow rule. “In-kind” means that the mitigation must be water-for-water in that if the reduction to streamflow is anticipated to be 175 gpd, that same amount of water must be added to the stream to off-set the impact. “In-time” means that the timing of the introduction of mitigation water into a surface water body should match the anticipated impacts. If the impacts are year-round, the mitigation water must also be present year-round. And finally, “in-place” means that the mitigation water must be provided to the stream at or above the location where the impact is likely to occur. So, even though the reservation is lumped over the entire subbasin, the mitigation will be specific to each tributary within each subbasin. As an example, a mitigation plan that proposed to put additional water into Big Lake would not be considered adequate to mitigate for water withdrawals upstream on Lake Creek or around Lake McMurray.

Water for Mitigation vs. Direct Service to Users

Using the reservation debit and credit system that has been adopted for both the Skagit and adjacent Stillaguamish instream flow rules, RH2 is assuming that mitigation for a home on septic will be at a

rate of 175 gpd, which is 50 percent of 350 gpd. This mitigation will need to occur continuously throughout the year to offset the impacts of pumping a well.

Any water pumped into a stream or other water body will need to either be raw water, or will need to be de-chlorinated if the entity chlorinates water and the mitigation will come directly off of the municipal system. For the purposes of this study, several assumptions have been made regarding the quantity of water needed in each of these subbasins. These assumptions are consistent with the management scenarios identified in Ecology's basin management program rules for the Skagit and Stillaguamish basins. Specifically, the following assumptions have been made.

- Where water is supplied directly to users via pipes to the property, a demand of 0.6 gpm instantaneous and 350 gallons per connection per day is assumed regardless if the home is connected to a sanitary sewer or an on-site septic system.
- Where water users are obtaining water from private individual wells on their property, their demand is assumed to be 350 gallons per connection per day.
- Where water users have on-site septic systems in place and functioning properly, it is assumed that one-half of the daily demand, or 175 gallons per connection per day, is returned to the environment so the net withdrawal associated with these users is assumed to be 175 gallons per connection per day.
- Mitigation water provided directly to a surface water body will be assumed to be delivered at a rate of 175 gallons per day per connection since it is assumed that new homes with a permit-exempt well as the source of water will utilize an on-site septic system for wastewater disposal.
- As water supplies have become more limited and property owners have found themselves unable to get the desired permits for developing their land, a number of property owners have notified Ecology of their desire to develop their property. These property owners are assumed to be ready to develop their property immediately when, and if, water supplies become available. For the purposes of this study, the demand to serve water for these parcels is considered the short-term demand.
- County records indicate a significantly higher number of parcels with development potential and it is assumed that the owners of these parcels will want water someday. For the purposes of this study, this demand is considered the long-term demand.

Spatial Nature of the Problem

Geographic Information Systems (GIS) data was obtained from both Skagit and Snohomish Counties to get a better understanding of where potential demand could exist in the future under maximum density buildout scenarios under current zoning regulations. RH2 relied upon the counties to provide an estimate of maximum buildout and did not perform any separate analysis. The Skagit County data identifies the potential Conservation and Reserve Development (CaRD) of the area and is from the year 2007. The Snohomish County data is from 2009. While these data are the most current, they are several years old and changes may have occurred in the interim period.

For example, in Skagit County one area where the demand from new groundwater sources is overestimated is northeast of Big Lake in what is now referred to as the Nookachamps Hill Planned Unit Development. A group of parcels in this area was originally identified as needing water, however, comparing the area with a current Skagit PUD water main map shows that Skagit PUD is now serving

this development. The water service to these parcels lowers the Upper Nookachamps potential new home count by 75, which is 12 percent of the total. One area where the demand is underestimated within the same subbasin is the Lake McMurray Recreational Resort property. In its analysis Skagit County made a decision not to include land that fell within an existing PWS service area. However, as discussed earlier in this report, this Resort does not have water rights to cover its existing or future water use; and therefore, should be identified as a water demand even though the resort is already constructed.

Reanalyzing the potential future demand within each subbasin was beyond the scope of work for this project; however, RH2 recommends that such an analysis be performed if a decision is made to advance any of the potential solutions identified in this report. **This is especially critical now that the Skagit Instream Flow Rule has been invalidated.**

Figure 6 shows the distribution by section of potential new homes that could need water service, either through direct service by a purveyor, or through the use of a permit-exempt well. **Figure 7** shows the location of the center of the current parcels that could be developed, as well as the number of homes that could be built considering the potential for subdivision. For the most part, the potential new homes are not part of large land subdivisions, but instead are one to two homes per lot. The highest densities of potential new homes exist on the west side of Lake McMurray in the Upper Nookachamps Subbasin, within the Fisher Sub-subbasin, and in the west-central and northwest areas of the Carpenter Sub-subbasin. Outside of these areas the density of potential homes decreases, which makes direct service more difficult to justify financially.

Figure 6 – Potential New Home Demand by Section

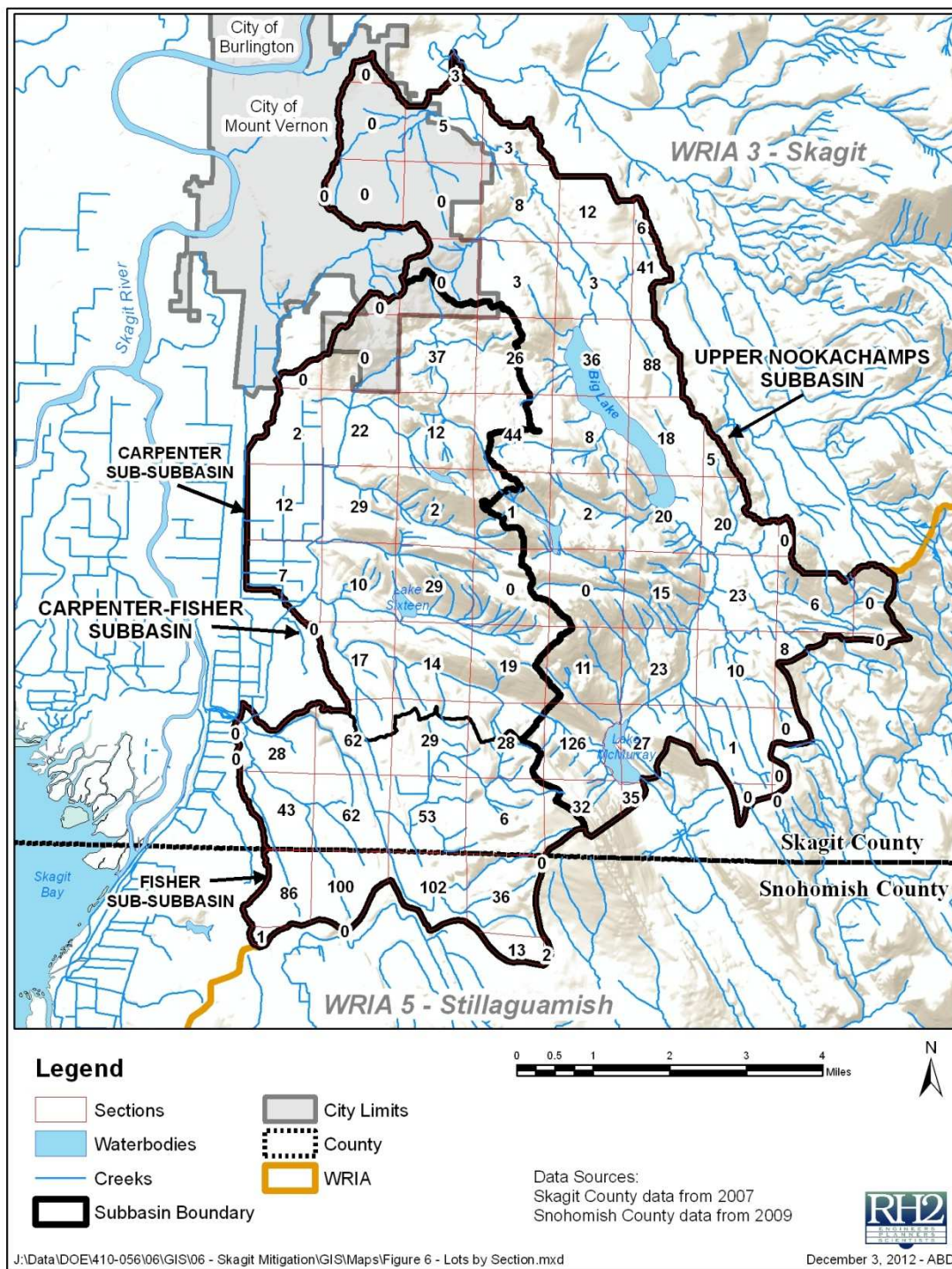
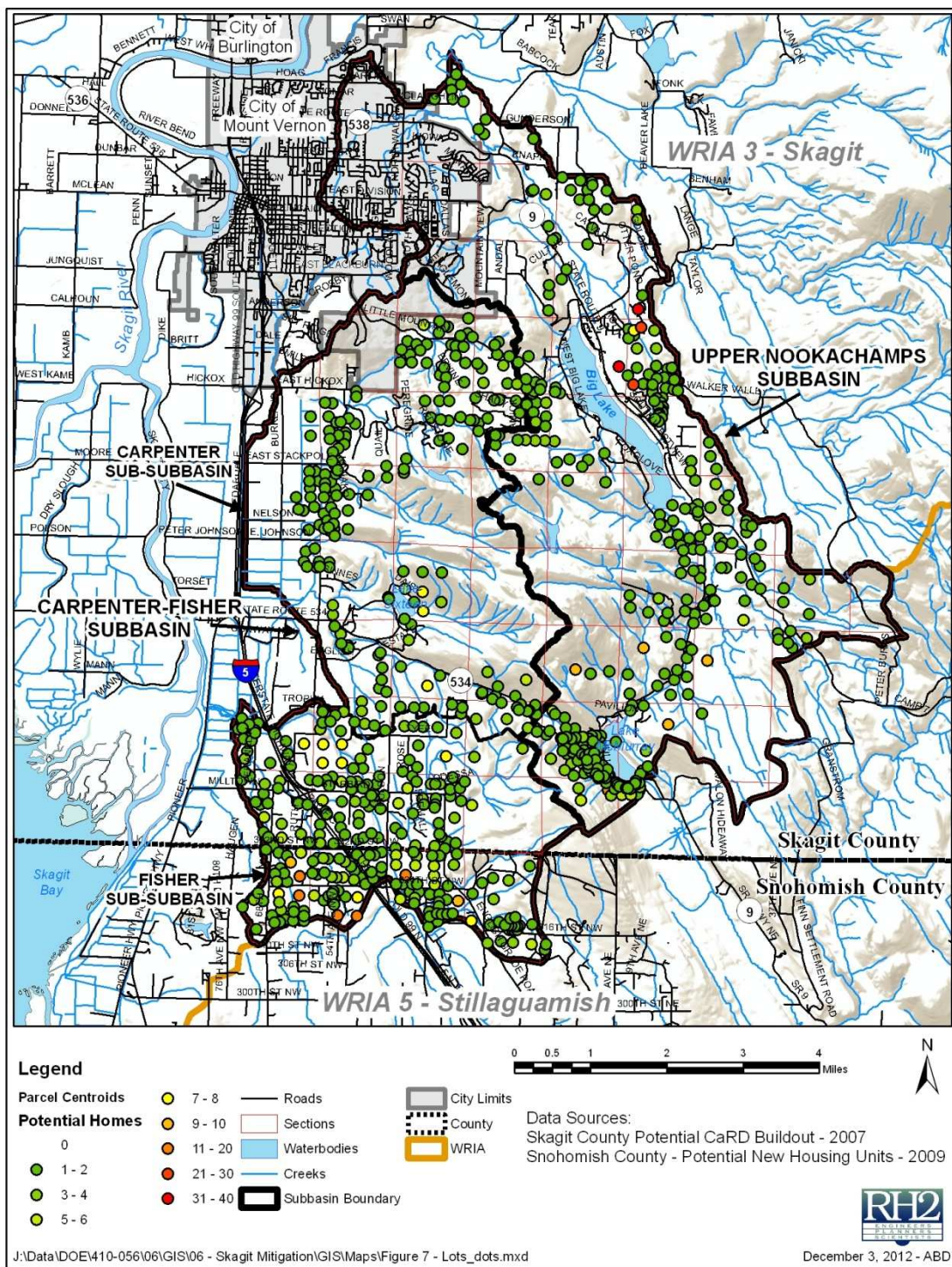


Figure 7 – Potential New Home Demand by Parcel



Issues and Solutions No. 1: Lake McMurray and the Upper Nookachamps Subbasin

The Upper Nookachamps Subbasin is one of the areas of concern with respect to water supply and the preservation or enhancement of instream flows to protect instream resources. Lake McMurray and its outlet creek, Lake Creek, are part of the Upper Nookachamps Subbasin. As mentioned earlier in this report, the reservation for the Upper Nookachamps Subbasin is currently 75 percent allocated, with many more potential connections than available reservation supply.

The number of parcels in the Upper Nookachamps Subbasin, which constitute the short-term and long-term demand as defined previously, is shown in **Table 19** along with the estimated water demand in acre-feet associated with the daily demand of 350 gallons per connection per day and the net impact based on a daily return of 175 gallons per connection per day for those parcels on septic systems.

Table 19 – Upper Nookachamps Subbasin Demand

| Short-term Demand (Requested of Ecology) | | | | | Long-term Demand (Skagit County) | | | | |
|---|--|--|--|---|--------------------------------------|--|--|--|---|
| Number of Parcels | Daily Demand @ 175 gpd (gpd) | Annual Demand (Qa) @ 175 gpd (afy) | Daily Demand @ 350 gpd (gpd) | Annual Demand (Qa)@ 350 gpd (afy) | Number of Potential Parcels | Daily Demand @ 175 gpd (gpd) | Annual Demand (Qa) @ 175 gpd (afy) | Daily Demand @ 350 gpd (gpd) | Annual Demand (Qa)@ 350 gpd (afy) |
| 3 | 525 | 0.6 | 1,050 | 1.2 | 643 | 112,525 | 126.0 | 225,050 | 252.1 |

In the area adjacent to and surrounding Lake McMurray, there are five Group A (greater than 15 connections) public water systems, including:

- Lake McMurray Recreation Resort
- Leif Erikson Recreation Association
- McHaven Inc.
- Camp Brotherhood Inc.
- Tatoosh Water Company

In addition, there are a significant number of lots around and fronting on the lake that are not served by a Group A system and are provided water either by small Group B systems, by individual wells, or by direct surface water diversion from Lake McMurray. The following Group B water systems were identified by Skagit County Health Department in a phone discussion on September 19, 2012, existing in this area: the Lake McMurray Store; Fire District No. 15; and the Carlson, Willabelle, Front Street, and Rasmussen-Fladebo water systems, to name a few (**Figure 4**).

There appears to be in excess of 200 separate parcels in addition to the Group A systems. It is not known how many of these lots are currently occupied and using water. These users are either drawing water directly from Lake McMurray or are withdrawing groundwater from the surrounding areas and are almost certainly withdrawing water in hydraulic continuity with the lake. The result is that the water withdrawn has a consumptive impact on the quantity of water in the lake and on the flows in Lake Creek as it exits the lake.

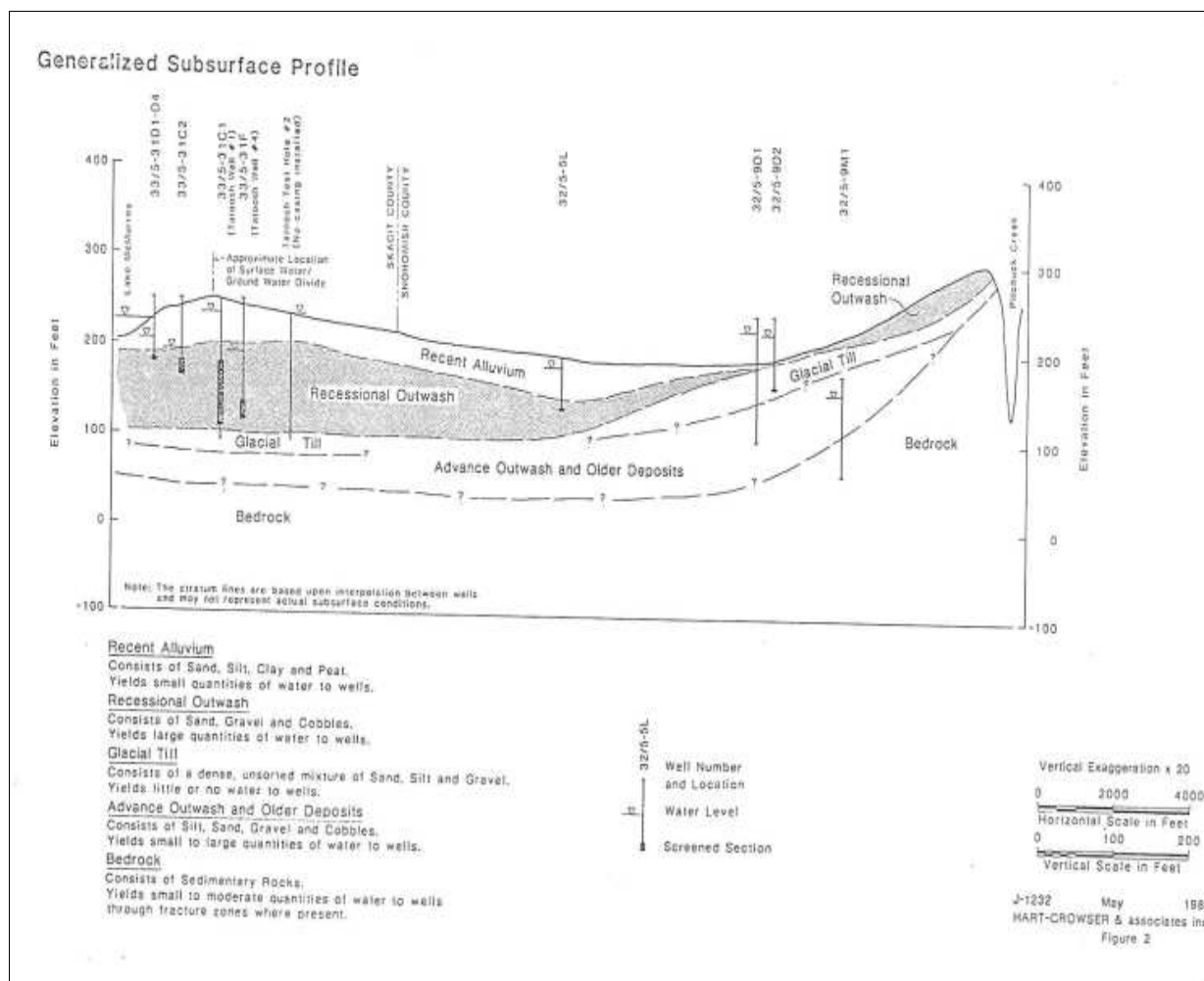
The Tatoosh Water System straddles the Skagit/Snohomish County line with most of its customers in northern Snohomish County. It is owned by PDC, a tree farm company, and has been classified by

DOH as a non-expanding water system for a number of years. Because of its non-expanding status, Tatoosh has not been required by DOH to update its comprehensive water system plan. The most recent water system plan is dated 1972 and describes the full development of the planned water system, which has not been fully implemented.

According to the DOH Sentry System (DOH's database for PWS), the Tatoosh Water Company currently serves 116 connections with a population of 249 people. It has two wells (unique well identification Nos. ABR276 & ABR277), which are operated as a well field located south of Lake McMurray just west of Highway 9 (**Figure 2**). Both wells are source metered and the water is chlorinated.

A groundwater development feasibility study, conducted for Snohomish County Public Utility District No. 1 by Hart Crowser and Associates, Inc., in 1983, reported that there is a groundwater divide just north of Tatoosh Well No. 1 and south of Lake McMurray (**Figure 8**). According to this report, water to the south of this line flows in a generally southerly direction and can be considered to be part of the Stillaguamish River Basin. Water to the north of this line flows in a generally northerly direction and can be considered to be part of the Skagit River Basin.

Figure 8 – Subsurface Profile Showing Groundwater Divide

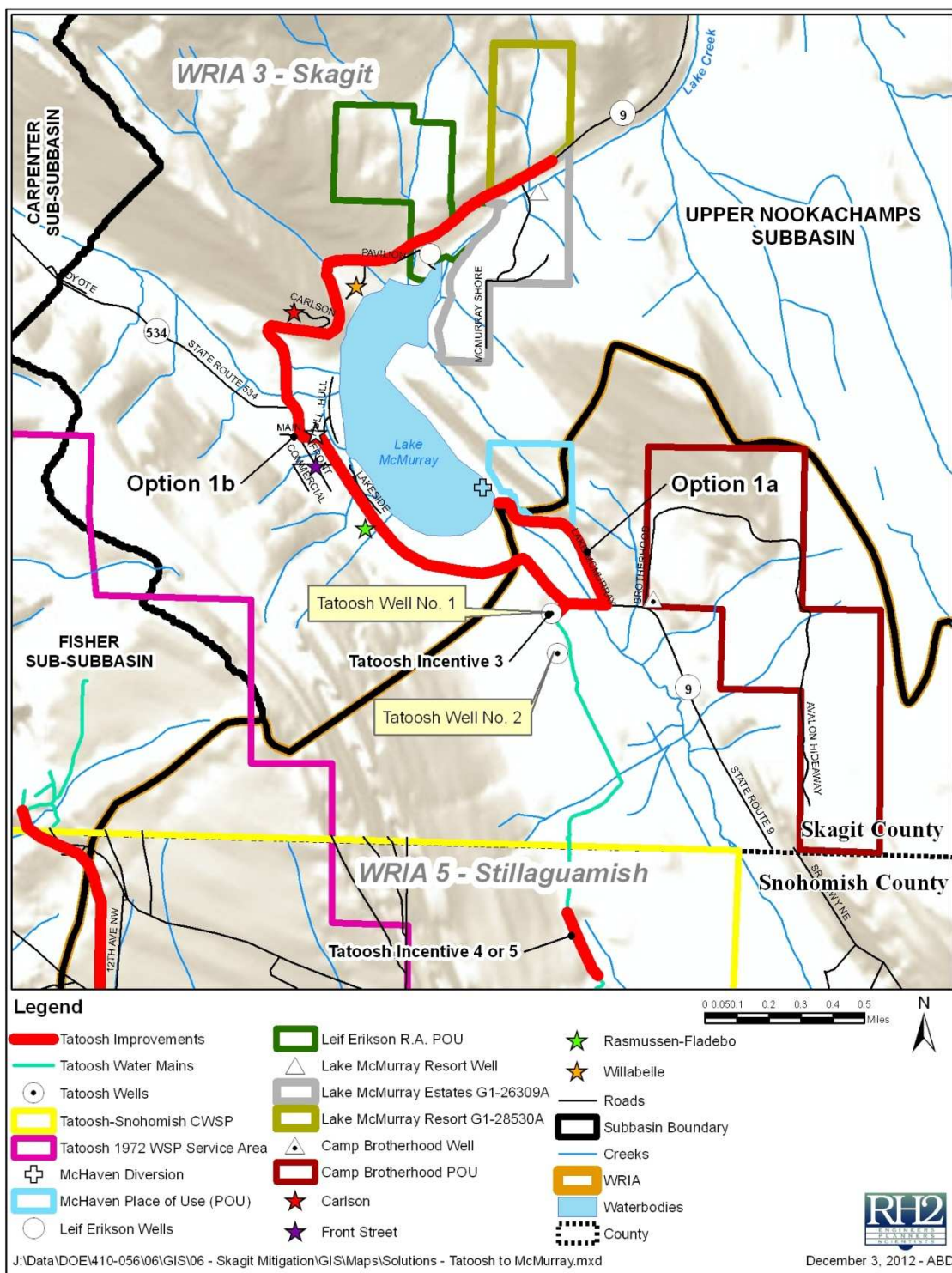


Source: Hart Crowser and Associates, Inc., Ground Water Development Feasibility Study, Lake McMurray Area, Snohomish/Skagit Counties, Washington, J-1232, June 7, 1983.

Proposed Solution

The northernmost well, Tatoosh Well No. 1 (ABR276), is located about 0.4 miles south of Lake McMurray. It would be relatively easy to utilize existing or new wells to pump water from this location north into the Lake McMurray area for either mitigation or direct municipal service. These options are illustrated in **Figure 9**.

Figure 9 – Upper Nookachamps Subbasin Options (Tatoosh Water Company)



Option 1a

Water could be pumped through a new water main directly into Lake McMurray where it could supplement lake levels and would also supplement stream flows downstream in the subbasin. This water would be provided as mitigation to offset the pumping of groundwater from wells farther downstream in the basin. For this option, RH2 proposes an alignment from the Tatoosh Well No. 1 area to Highway 9, then east and then north on Lake McMurray Lane with access to the lake via the Washington Department of Fish and Wildlife (WDFW) boat launch off of Lake McMurray Lane.

Providing water to Lake McMurray would increase stream flows and downstream users could be allowed to drill wells provided their total cumulative consumptive impacts did not exceed the quantity of mitigation water provided by the Tatoosh Water Company. One option for mitigation is to provide this water from the existing Tatoosh Well No. 1 and No. 2 via the wet well reservoir and pipe. At present, this system is chlorinated at the smaller wet well reservoir but the chlorination system could be re-plumbed to disinfect upstream of this reservoir allowing chlorine free water to be discharged to Lake McMurray.

A second option to provide mitigation water is to provide this water from a new well-constructed in proximity to the existing Tatoosh wells and have it be served with a separate metered power supply and not be connected to the Tatoosh water system. This would enable a clear separation and delineation of the construction and operation and maintenance costs for this facility. This second option within Option 1a was estimated for costs as it will ensure efficient pump sizing for the stream flows required and separates the potable and non-potable needs.

This water main could also be designed to serve water to McHaven because of the mains' proximity to the McHaven system and McHaven's interest in receiving water from a PWS. This water would be direct service water.

Option 1b

Water could also be pumped through a new water main as described in Option 1a and could split into a second new main along the west shore of Lake McMurray to supply existing and future homes in the area. It could also provide water to the existing Group A systems. If these residents could be persuaded to stop using either surface water withdrawn directly from Lake McMurray or groundwater from wells immediately adjacent to the lake, in return for receiving water from the Tatoosh water system, the lake and stream would benefit from enhanced water levels and instream flows. While similar to Option 1a, this would involve a larger quantity of water and would, therefore, provide additional mitigation potential in the Upper Nookachamps Subbasin. This option would provide direct water service to users around the west side of Lake McMurray and would also enhance stream flows indirectly via the retirement of the existing local water sources. This option is likely to provide public health benefits that go along with a PWS and would also provide a firm supply of fire suppression water for Fire District No. 15. The cost estimate for this option assumed the main would reach the Lake McMurray Recreational Resort on Highway 9 and would be 12-inch-diameter ductile iron pipe. Based on discussions with Mr. Aslanian on November 7, 2012, the Tatoosh Water Company is likely not interested in owning, operating, and maintaining a water system extension to Lake McMurray. However, Tatoosh could be interested in providing wholesale water to an entity such as Skagit PUD who could then operate and maintain a satellite water system as described in this section.

Skagit PUD is Skagit County's designated satellite water system manager. Skagit PUD has expressed a willingness to consider its participation as the water purveyor in this area. In such a case, Tatoosh could wholesale water to Skagit PUD for distribution through the new water system. The alternative is that Tatoosh would expand its service area via the water system planning process and would serve water to this area. Mr. Aslanian stated that he thought the PDC Board of Directors would be more likely to support the wholesaling of water to Skagit PUD for municipal service, as opposed to just providing water for mitigation because PDC would likely believe the public interests are better served by: 1) creating a new PWS to serve potable water to the Lake McMurray area; 2) providing for adequate fire flow; and 3) indirectly augmenting stream flows in Lake Creek. Municipal water service in this area would also be beneficial since this area has been zoned as Rural Village Residential by Skagit County, yet there is no regional water purveyor to serve the area.

Options 1a and 1b could be undertaken simultaneously, or could be phased with Option 1a occurring first and including a junction vault where the water main in Option 1b could be connected at a later date.

Discussion

As previously stated, Hart Crowser and Associates, Inc., (1983) determined that there is a groundwater divide north of the Tatoosh Water Company wells and south of Lake McMurray. RH2 found that while there is likely a natural groundwater flow divide coincident with the surface water divide near the southern end of Lake McMurray separating the Upper Nookachamps Subbasin and Stillaguamish River watersheds, the available groundwater information is not detailed enough to positively confirm that pumping from the Tatoosh wells will not cause water from Lake McMurray to leave the lake and recharge the aquifer. This uncertainty would likely have no impact on Tatoosh's ability to provide municipal water served into the Lake McMurray area due to the Municipal Water Law under Option 1b, but it might require an additional study if the well is planned to be used for mitigation under Option 1a.

It is assumed the piping for the Skagit PUD satellite system would be placed in Highway 9 but some piping extensions could be placed in county road right-of-way or cross private property in some locations. Service lines to individual properties would also be needed and the services may need to be metered. This is discussed in more detail in the following section.

Exempt well users who receive the right to drill a well and use groundwater because of this mitigation project could be required to pay fees designed to recover the costs associated with installing a new well, a new water main and a water meter, and providing water to Lake McMurray unless the State of Washington decided to pay the costs of these developments. In this case, downstream users would be required to pay a fee to the purveyor of the water, either Tatoosh or Skagit PUD. This fee would be an appropriate portion of the project costs and the number of exempt wells allowed to be drilled because of the mitigation.

Barriers

If the solution of using existing or new wells within the Tatoosh system for mitigation or municipal service is to be effective, it would require the involvement of a number of entities, including the Tatoosh Water Company as the water supplier, property owners around the lake, property owners downstream of the lake, Skagit County, Ecology, DOH, and Skagit PUD.

Tatoosh has municipal purpose water rights with a substantial inchoate (unused) portion. However, the area around Lake McMurray is not a part of the Tatoosh service area and Tatoosh does not

currently have facilities in place to serve water to this location. In order to participate in this solution, Tatoosh will need incentives, for instance, the PDC Board of Directors may be interested in assisting the local community to resolve its water supply problems; however, this has yet to be determined. If PDC is willing to be part of the solution, it is reasonable to expect that it will not be willing to voluntarily absorb the costs associated with this proposed solution.

Incentives

In order to provide water to this area, the Tatoosh Water Company would need to update its comprehensive water system plan. This update could identify Tatoosh as the water purveyor, or could identify the area as a wholesale area with Skagit PUD as the purveyor and Tatoosh could then identify changes to its service area in the water system plan instead of having to go through the water right change application process. A potential incentive for Tatoosh could be a subsidization of its cost for the update of its water system plan. The estimated cost of the Tatoosh water system plan update is included in the cost estimate section of this report.

Developing an updated water system plan provides an opportunity to identify leaking pipes, which add to system costs, and develop a cost estimate and schedule for repairs to the system. The Bonneville Power Administration (BPA) has a program entitled Energy Smart Industrial, which could be a potential source of funding for the leakage detection and repair work for the Tatoosh system. BPA may conduct custom projects in which it evaluates piping improvements, water network optimization, and other water system elements as a means of increasing system energy efficiency. Tatoosh has identified that the 14-inch asbestos-cement (AC) and ductile iron main running from the big BPS to the 1.05 MG reservoir has leakage. Options to eliminate this leakage include replacing the pipe by pipebursting or slip-lining. Other parts of the system also appear to have leaking pipes, which may need to be addressed as well.

The Tatoosh Well No. 1 is located in a large concrete vault below ground surface. In order to access the equipment, Tatoosh staff must descend a ladder and work hunched over because of the lack of headroom. Mr. Aslanian, said the concrete top of the vault would need to be cut off, in order to replace major system components.

If the option of drilling a new well is selected, the new well could be constructed pursuant to RCW 90.44.100(3) provided it is located within the same advertised place of use as the original well and complies with the requirements of the required affidavit of compliance.

A potential incentive for Tatoosh involvement is that the existing Well No. 1 facility be modified by removing the existing top and constructing a pump house over the existing facilities. This could house the equipment associated with the existing well, and the new well if a new well is included. RH2 has evaluated the existing facility and has prepared a preliminary planning-level project cost estimate for conversion of this facility from a below-ground vault to more conventional pump house. A preliminary planning-level project cost estimate is also included for the new supply well identified above.

Estimated Costs

Estimated costs of the Tatoosh options, including the estimated cost of the new well, are shown in **Table 20A** and **20B**. The costs of these system upgrades could also be subsidized as a means of providing additional incentives to Tatoosh to supply the water for this option. The Range total at the bottom of each cost estimate table is plus or minus 10 percent of the total calculated costs.

Table 20A – Estimated Costs of Option 1a
Tatoosh Water Company System Modifications and Upgrades for the Upper Nookachamps Subbasin
Option 1a - Lake Creek via Lake McMurray and McHaven Supply

| Needed Components | Quantity | Units | \$/Unit | \$ |
|----------------------------------|----------|--------|-------------|-------------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$40,000 | \$40,000 |
| 12" Well Casing | 150 | ft | \$900 | \$135,000 |
| 6" Pump 150 gpm, | 1 | each | \$9,000 | \$9,000 |
| 6" Pump Column | 140 | ft | \$80 | \$11,200 |
| Pump Building | 1 | each | \$12,000 | \$12,000 |
| Pump Electrical | 1 | each | \$15,000 | \$15,000 |
| New Power Service | 1 | each | \$4,000 | \$4,000 |
| Pump Telemetry | 1 | each | \$18,000 | \$18,000 |
| 8" DI Pipe | 3,800 | ft | \$120 | \$456,000 |
| Hydrant | 4 | each | \$2,500 | \$10,000 |
| Air/Vac Valve | 2 | each | \$3,200 | \$6,400 |
| Blow Off Valve | 2 | each | \$3,500 | \$7,000 |
| 8" Gate Valve | 4 | each | \$1,500 | \$6,000 |
| 8" Backpressure Sustaining Valve | 1 | each | \$6,000 | \$6,000 |
| Highway 9 1-Lane Overlay | 650 | ft | \$16 | \$10,111 |
| Asphalt Grinding | 433 | sq yd | \$3.00 | \$1,300 |
| Striping | 650 | lf | \$2 | \$1,300 |
| 4" Connection to McHaven | 1 | ls | \$10,000 | \$10,000 |
| 4" Double Check and Vault | 1 | each | \$25,000 | \$25,000 |
| Outlet Structure | 1 | each | \$5,000 | \$5,000 |
| In Water Work | 1 | each | \$8,000 | \$8,000 |
| Subtotal: | | | | \$797,000 |
| Contingency | 25% | | | \$200,000 |
| Subtotal with Contingency: | | | | \$997,000 |
| Sales Tax | 7.8% | | | \$78,000 |
| Subtotal with Tax: | | | | \$1,075,000 |
| Surveying | 3% | | | \$33,000 |
| Engineering | 12% | | | \$129,000 |
| Permitting | 7% | | | \$76,000 |
| Administration | 3% | | | \$33,000 |
| | | Total: | | \$1,350,000 |
| | | Range: | \$1,220,000 | \$1,490,000 |

Table 20B – Estimated Costs of Option 1b
Tatoosh Water Company System Modifications and Upgrades for the Upper Nookachamps Subbasin
Option 1b - Satellite Water System

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------------|----------|--------|-------------|-------------|
| Modify Skagit PUD Comp Water Plan | 1 | ls | \$25,000 | \$25,000 |
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$110,000 | \$110,000 |
| 12" DI Pipe | 14,600 | ft | \$150 | \$2,190,000 |
| Air/Vac Valve | 11 | each | \$3,200 | \$35,200 |
| Services | 300 | each | \$2,500 | \$750,000 |
| Blow Off | 6 | each | \$3,500 | \$21,000 |
| Hydrant | 13 | each | \$2,500 | \$32,500 |
| 12" Gate Valve | 13 | each | \$2,200 | \$28,600 |
| 12" Intertie and Meter Vault | 1 | each | \$50,000 | \$50,000 |
| Highway 9 1 Lane Overlay | 11,900 | ft | \$16 | \$185,111 |
| Asphalt Grinding | 7,933 | sq yd | \$3.00 | \$23,800 |
| Striping | 11,900 | lf | \$2 | \$23,800 |
| Subtotal: | | | | \$3,476,000 |
| Contingency | 25% | | | \$869,000 |
| Subtotal with Contingency: | | | | \$4,345,000 |
| Sales Tax | 7.8% | | | \$339,000 |
| Subtotal with Tax: | | | | \$4,684,000 |
| Surveying | 3% | | | \$141,000 |
| Engineering | 12% | | | \$563,000 |
| Permitting | 7% | | | \$328,000 |
| Administration | 3% | | | \$141,000 |
| | | Range: | \$5,200,000 | \$6,400,000 |

Table 20C.1 – Tatoosh Water Company System Incentive 1
Water Comprehensive Plan Update

| Needed Components | Quantity | Units | \$/Unit | \$ |
|----------------------|----------|--------|----------|-----------|
| System Investigation | | | | \$25,000 |
| Planning | | | | \$25,000 |
| Report | | | | \$25,000 |
| Administration | 3% | | | \$2,250 |
| Subtotal: | | | | \$78,000 |
| Contingency | 25% | | | \$20,000 |
| | | Range: | \$90,000 | \$110,000 |

Table 20C.2 – Tatoosh Water Company System Incentive 2

Leak Detection Survey

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|----------|----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$1,000 | \$1,000 |
| Testing | 1 | ls | \$9,000 | \$9,000 |
| Report | 1 | ls | \$3,500 | \$3,500 |
| Subtotal: | | | | \$14,000 |
| Contingency | 25% | | | \$4,000 |
| Subtotal with Contingency: | | | | \$18,000 |
| Sales Tax | 7.8% | | | \$2,000 |
| Subtotal with Tax: | | | | \$20,000 |
| Surveying | 0% | | | \$0 |
| Engineering | 0% | | | \$0 |
| Permitting | 0% | | | \$0 |
| Administration | 3% | | | \$1,000 |
| | | Range: | \$27,000 | \$33,000 |

Table 20C.3 – Tatoosh Water Company System Incentive 3

Replace Well 1 Roof with Raised Structure

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|----------|----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$1,200 | \$1,200 |
| Remove Concrete Roof | 1 | ls | \$4,000 | \$4,000 |
| 2x6 Wall | 1 | ls | \$4,000 | \$4,000 |
| Truss Roof | 1 | ls | \$5,000 | \$5,000 |
| Metal Roof/Sheathing | 1 | ls | \$2,500 | \$2,500 |
| Insulation | 1 | ls | \$500 | \$500 |
| Wall Board | 1 | ls | \$700 | \$700 |
| Modify Access Door | 1 | ls | \$2,000 | \$2,000 |
| Finishing | 1 | ls | \$1,200 | \$1,200 |
| Relocation of Electrical | 1 | ls | \$4,000 | \$4,000 |
| Relocation of Telemetry | 1 | ls | \$5,000 | \$5,000 |
| Subtotal: | | | | \$31,000 |
| Contingency | 25% | | | \$8,000 |
| Subtotal with Contingency: | | | | \$39,000 |
| Sales Tax | 7.8% | | | \$4,000 |
| Subtotal with Tax: | | | | \$43,000 |
| Surveying | 3% | | | \$2,000 |
| Engineering | 12% | | | \$6,000 |
| Permitting | 7% | | | \$4,000 |
| Administration | 3% | | | \$2,000 |
| | | Range: | \$54,000 | \$66,000 |

Table 20C.4 – Tatoosh Water Company System Incentive 4
Pipeburst Leaking 14" AC Main

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|-----------|-----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$8,000 | \$8,000 |
| Pipeburst Main | 1000 | ls | \$120 | \$120,000 |
| Pipeburst Head Removal | 2 | each | \$10,000 | \$20,000 |
| Testing | 1 | ls | \$2,500 | \$2,500 |
| Disinfection | 1 | ls | \$3,500 | \$3,500 |
| Subtotal: | | | | \$154,000 |
| Contingency | 25% | | | \$39,000 |
| Subtotal with Contingency: | | | | \$193,000 |
| Sales Tax | 7.8% | | | \$16,000 |
| Subtotal with Tax: | | | | \$209,000 |
| Surveying | 3% | | | \$7,000 |
| Engineering | 12% | | | \$26,000 |
| Permitting | 7% | | | \$15,000 |
| Administration | 3% | | | \$7,000 |
| | | Range: | \$240,000 | \$300,000 |

Table 20C.5 – Tatoosh Water Company System Incentive 5
Sliplining Leaking 14" DI Main with 12" HDPE Main (10" ID)

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|-----------|-----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$5,000 | \$5,000 |
| Sliplining | 1,000 | ls | \$90 | \$90,000 |
| Testing | 1 | ls | \$2,500 | \$2,500 |
| Disinfection | 1 | ls | \$3,500 | \$3,500 |
| Subtotal: | | | | \$101,000 |
| Contingency | 25% | | | \$26,000 |
| Subtotal with Contingency: | | | | \$127,000 |
| Sales Tax | 7.8% | | | \$10,000 |
| Subtotal with Tax: | | | | \$137,000 |
| Surveying | 3% | | | \$5,000 |
| Engineering | 12% | | | \$17,000 |
| Permitting | 7% | | | \$10,000 |
| Administration | 3% | | | \$5,000 |
| | | Range: | \$160,000 | \$200,000 |

Incentives for Property Owners on Lake McMurray

The following discussion relates to the potential solution of constructing a new water supply to serve properties along the shore of Lake McMurray and does not apply if Option 1b is not pursued.

Incentives for the property owners living along the shore of Lake McMurray may be problematic. Some residents may welcome the opportunity to receive a reliable supply of high quality water from an approved water utility; however, others may wish to remain on their private sources of water.

Many of these owners have filed water right claims with the state. A water right claim is a statement by the water user that his or her water use predates the appropriate chapter of the water code (surface water adopted in 1917 and groundwater adopted in 1945) and that they are, therefore, entitled to a vested water right. Many of the claims were filed on what is called the short-form which provides very little documentation on which to judge the merits of these claims. While the long form provides more information, in most cases this information served to invalidate the claim as they state that the date of first putting water to a beneficial use was many years after the adoption of the water code, when a water right is required and a claim is not the appropriate document. The result is that many of the surface water users in this area may not, in fact, have a valid water right for the use of their water. In order for a groundwater claim to represent a valid vested groundwater right, the water use would have to have been initiated prior to the adoption of the groundwater code in 1945. In order for a surface water claim to represent a valid vested surface water right, the water use would have to have been initiated prior to the adoption of the surface water code in 1917 or prior to 1932 if a riparian right was claimed. The opportunity to eliminate this uncertainty and obtain water that has a clear legal status may be an incentive to some of these property owners but it is likely that some education efforts will be required to inform the claimants about the likely status of their claims and what they may erroneously believe constitutes a water right.

The residents in the area along the new main would need to be provided with an incentive to stop using their current source of supply and begin using water from the Tatoosh Water Company. The following is a list of possible incentives.

1. The opportunity to receive a reliable supply of high quality water from a monitored system, particularly for those with claims of questionable validity.
2. Financial incentives to assist with decommissioning existing water supply wells.
3. Financial incentives to assist with connection fees normally charged to connect to a PWS.
4. Potential subsidization of ongoing water system charges.
5. Removal of land use restrictions associated with the existence of a well on the property (well setback restrictions) to provide more flexibility for land owners to use their land.
6. Increased availability of water for fire-fighting with a potential reduction in insurance premiums.
7. Increased property values resulting from connecting to an approved Group A water system with reliable supply and quality.
8. Increased certainty regarding water supply quantity and quality could make property sales easier.

Operations and Maintenance Costs

Table 20D shows power and operations and maintenance costs for Options 1a and 1b to deliver water to Lake McMurray and residents around the west side of the lake, assuming a buildout number of connections of 300. The satellite system cost includes a crew visit every 2 days to the system. Costs are converted to present value assuming a rate of return of 3 percent for a 20-year term.

**Table 20D – Estimated Power, Operations, and Maintenance Costs of Option 1a and 1b
Tatoosh Water Company System Modifications and Upgrades for the Upper Nookachamps Subbasin
Option 1a - Well 1S to Lake McMurray and McHaven**

| | |
|--|----------|
| Present Value of 20 Years Power, Operations, and Maintenance | \$74,000 |
|--|----------|

Option 1b - Well 1 to Serve Satellite System and Well 1S to Lake McMurray

| | |
|--|-----------|
| Present Value of 20 Years Power, Operations, and Maintenance | \$379,000 |
|--|-----------|

These costs may be absorbed by the Tatoosh Water Company or Skagit PUD but should be considered with regard to water system incentives option costs.

Preliminary Implementation Steps

The following is a preliminary list of recommended actions to take if Option 1a is selected to be implemented.

1. Confirm groundwater divide from the Hart Crowser and Associates 1983 report and calculate impacts to Lake McMurray from groundwater pumping, if any.
2. Update the Tatoosh Water Company water system plan.
3. Estimate costs for engineering design and construction for the proposed project, including a new well, water main, and discharge structure improvements to the Tatoosh pump house, and leak detection and repair.
4. Identify additional incentives for Tatoosh, if needed.
5. Identify incentives for property owners in the proposed service area (McHaven).
6. Prepare project bid documents and provide oversight for bid process.
7. Construct the project.
8. Monitor water quantity and quality.
9. Determine the quantity of water saved from withdrawal at McHaven, which would be considered mitigation water for downstream exempt well withdrawals.
10. Develop a water mitigation bank mechanism to track water available for mitigation of exempt well withdrawals and maintain the balance of available water.

In addition to the preceding list of actions, Option 1b, the provision of water for a new regional PWS around Lake McMurray, would also require the following actions.

1. Estimate costs for engineering design and construction for the proposed project elements not previously stated, such as a new distribution system.
2. Identify additional incentives for customers in the service area.
3. Wholesale water agreement between Tatoosh and the Skagit PUD if the PUD supply option is selected.
4. Establish a proposed rate structure by Skagit PUD including connection fees and water rates if the PUD supply option is selected.
5. Decommission water wells for properties with existing wells to be served by project water

Conclusion of Issues and Solution No. 1

Option 1a

The provision of water by Tatoosh Water Company to Lake McMurray (and perhaps McHaven) appears to be a feasible means of providing water to the Upper Nookachamps Subbasin for mitigation. The long-term demand projected by Skagit County would require approximately 126 afy of water (continuous 78 gpm) to be supplied for full mitigation and Tatoosh appears to have inchoate rights of approximately 743 afy of water. Further hydrogeologic analysis should be performed to determine if pumping from the Tatoosh wells will cause any impact to Lake McMurray. The magnitude of impact will help determine how much water would need to be pumped into Lake McMurray to see an increase in flow of Lake Creek of a specified rate. The costs to implement this option are estimated to be between \$1.4 million and \$1.7 million, depending on the capital costs and the water system incentive costs of the projects.

Option 1b

If there is a desire to create a regional PWS in the Lake McMurray area, then one option is to create a satellite distribution system constructed to Skagit PUD standards and maintained and operated by Skagit PUD. In this scenario, Skagit PUD would purchase water from the Tatoosh Water Company as a wholesale customer and would distribute the water to customers in the Lake McMurray area via new infrastructure. Another option, although likely not preferred by Tatoosh, is that Tatoosh Water Company could become the purveyor for water in this area. The costs to implement this option are estimated to be between \$5.5 million and \$6.8 million, depending on the capital costs and the water system incentive costs of the projects.

Issue and Solution No. 2: Upper Reaches of the Fisher Sub-subbasin

The upper reaches of the Fisher Sub-subbasin is one area of concern with respect to water supply and the preservation or enhancement of instream flows to protect instream resources. New growth and development in this watershed has been stopped in order to comply with the instream flow rules for the Skagit River Basin. It is important to note that with the invalidation of the instream flow rule by the Washington State Supreme Court, the reservations of water are no longer in effect. As a result, the water used by the permit-exempt wells affected by the amended rule will now have to be added to the projected future demands identified in this report in order to determine the total amount of water for which mitigation needs to be established. The need for revision of these numbers was unanticipated and is outside the current scope of this project.

Table 21 shows the estimated number of parcels in the Fisher Sub-subbasin that constitute the short-term and long-term demand, as defined earlier in this report.

Table 21 – Fisher Creek Sub-subbasin Demand

| County | Short-term Demand (Requested of Ecology) | | | | | Long-term Demand (Skagit and Snohomish Counties) | | | | |
|-----------|---|------------------------------|------------------------------------|------------------------------|-----------------------------------|---|------------------------------|------------------------------------|------------------------------|-----------------------------------|
| | Number of Parcels | Daily Demand @ 175 gpd (gpd) | Annual Demand (Qa) @ 175 gpd (afy) | Daily Demand @ 350 gpd (gpd) | Annual Demand (Qa)@ 350 gpd (afy) | Number of Potential Parcels | Daily Demand @ 175 gpd (gpd) | Annual Demand (Qa) @ 175 gpd (afy) | Daily Demand @ 350 gpd (gpd) | Annual Demand (Qa)@ 350 gpd (afy) |
| Both | 29 | 5,075 | 5.7 | 10,150 | 11.4 | | | | | |
| Skagit | | | | | | 269 | 47,075 | 52.7 | 94,150 | 105.5 |
| Snohomish | | | | | | 345 | 60,375 | 67.6 | 120,750 | 135.3 |
| Total: | | | | | | 614 | 107,450 | 120.4 | 214,900 | 240.7 |

The Tatoosh water system has two wells located south of Lake McMurray. Water is withdrawn from these two wells and is pumped to the big BPS which pumps the water to Tatoosh's distribution system, a large 1.05 MG reservoir at an elevation of about 820 feet above sea level. The 90,000-gallon concrete reservoir is located at an elevation of about 1,250 feet above sea level. The Pilchuck Glass School's BPS supplies water via a 3- to 4-inch PVC pipe from the 1.05 MG reservoir up to the 90,000-gallon reservoir, which provides domestic water as well as fire flow to the Pilchuck Glass School.

The 3- to 4-inch PVC water main that provides water to the 90,000-gallon reservoir runs along 12th Avenue NW through the Pilchuck Glass School and then to the reservoir. There is a small surface water reservoir (pond) referred to as the Victoria Hill Reservoir at the Pilchuck Glass School, which appears to be used for recreation. This reservoir is not part of Tatoosh's potable water system. There are three outlet pipes on the Victoria Hill Reservoir, one of which is controlled by a valve and the other two are overflow pipes. These pipes drain into the natural stream channel below the reservoir. The stream bed below the reservoir is bedrock and exhibits a defined channel down the hill in a generally southwesterly direction. This creek is a tributary of Fisher Creek and the confluence with Fisher Creek is west of English Grade Road and south of 324th Street NW. The habitat in the upper reaches of the creek appears to be in good condition. Fisher Creek flows off of the heavily wooded Victoria Hill through a rural residential and agricultural area, and back into a tree-lined channel to eventually flow beneath I-5 via a conduit and fish ladder just north of Starbird Road (**Figure 10**). This tributary was chosen for mitigation as opposed to the lower elevation tributary near 316th Street NW, because RH2 determined this creek to be perennial and any water added would contribute to flows as opposed to potentially being immediately consumed by riparian vegetation.

It appears that flow augmentation from the Victoria Hill Reservoir area could benefit a considerable length of the stream but habitat improvements would be needed to improve flow and habitat conditions in the rural agricultural area east of I-5 where there is abundant reed canary grass, a lack of channel complexity, a lack of shade, and direct access of livestock into the stream. The improvement of habitat conditions to maximize the benefit of flow augmentation water is outside the scope of this report but should be evaluated as part of any decision to make mitigation water available.

Proposed Solution

There are two options presented in this report to benefit the upper reaches in the Fisher Sub-basin.

Option 2a

The Tatoosh Water Company could pump additional water from the 1.05 MG reservoir up the hill towards the Pilchuck Glass School via a new, larger diameter water main where water could be diverted, to a Granular Activated Carbon (GAC) dechlorination facility and released directly into the

outlet creek just west of 12th Avenue NW. The water then would flow directly into the Victoria Hill Reservoir outlet stream to supplement stream flows in upper Fisher Creek (**Figure 10**). Replacing the existing 3- to 4-inch PVC pipe with a larger main would benefit fire flows to the Pilchuck Glass School and provide flows to upper Fisher Creek.

Option 2b

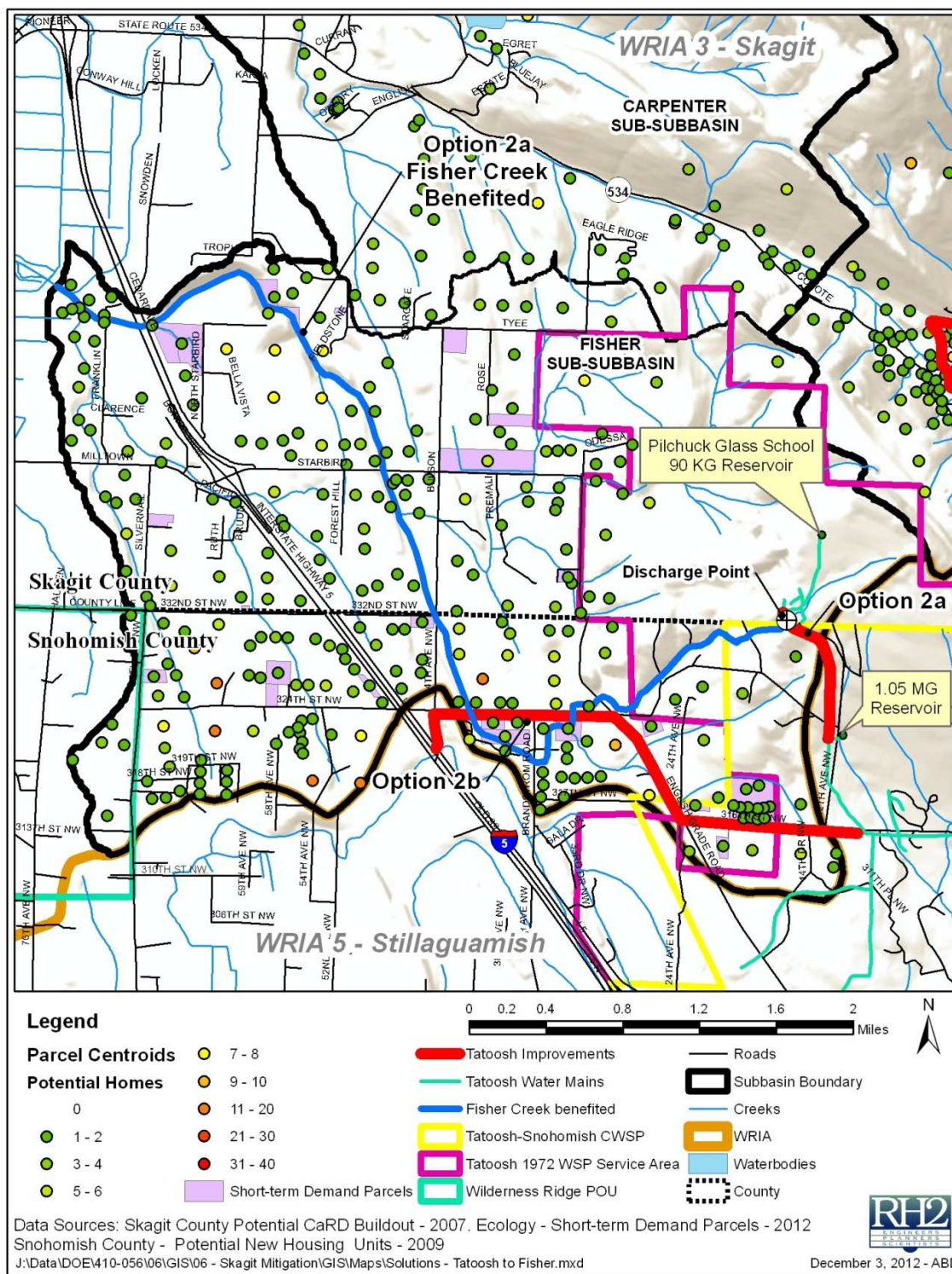
The Tatoosh Water Company main in 316th Street NE is capped near 12th Avenue just beyond where the water main turns north towards the 1.05 MG steel reservoir. This main could be extended west to English Grade Road where it would turn northwest, then west on 324th Street NW and south on 44th Avenue NW where it would cross under I-5 and either be terminated, connected to an extended water main from the Wilderness Ridge Community Club (an intertie), or extended west to serve properties in that area without connection to Wilderness Ridge, if Wilderness Ridge prefers not to be intertied with the Tatoosh Water Company (**Figure 10**). This would be direct service water on the east side of I-5 but could include both direct service and mitigation water to Little Fisher Creek on the west side of I-5.

Discussion of Option 2a

The Tatoosh Water Company would need an incentive to justify the added costs of pumping additional water from the 1.05 MG reservoir to the diversion point along 12th Avenue NW near the Victoria Hill Reservoir. The release of water would augment stream flows and habitat conditions in Fisher Creek and could be used to mitigate for future exempt well withdrawals in a portion of the Fisher Creek drainage. Tatoosh could elect to add a new purpose of use to its water right such as streamflow augmentation, but this is likely unnecessary because RCW 90.03.550 states:

Beneficial uses of water under a municipal water supply purposes water right may include water withdrawn or diverted under such a right and used for: (1) Uses that benefit fish and wildlife, water quality, or other instream resources or related habitat values.

Figure 10 – Upper Fisher Creek Area Options (Tatoosh Water Company)



This water main would need to be sized appropriately to ensure that it would provide adequate water to supply the anticipated demand. The “turnout” on this water main would need to be capable of

being regulated so that the level of water provided for mitigation can be increased as development occurs and the need to mitigate the impacts of downstream well-users increases. Due to these considerations, as well as considering head losses due to pipe length and elevation gain, an 8-inch ductile iron pipe was assumed from the Pilchuck Glass School BPS to the Pilchuck Glass School. The existing pipe is 4 inches in diameter at the bottom half of the run and 3 inches at the top half until it connects to 8-inch main at the Pilchuck Glass School. New pumps (duplicative) would also be needed to maintain flow for stream augmentation for Upper Fisher Creek.

Discussion of Option 2b

Extending the water main in 316th Street NW would allow Tatoosh to serve properties east of I-5. In addition, an intertie with Wilderness Ridge would provide redundancy to Wilderness Ridge system, as well as the Tatoosh system. The extension to I-5 would be approximately 2.7 miles in length. Expanding the Wilderness Ridge Community Club service area is discussed in the **Issue and Solution Nos. 3 and 4 Lower Fisher Creek Area in the Fisher Sub-subbasin** section.

Barriers

Wilderness Ridge Community Club has expressed concerns about an intertie with the Tatoosh Water Company, because Tatoosh chlorinates its water and Wilderness Ridge does not. Wilderness Ridge does not want chlorinated water in its system; therefore, if an intertie is constructed, Wilderness Ridge would likely only use it in the case of emergencies. If Wilderness Ridge is not interested in expanding its system in the area west of I-5, the Tatoosh system could be extended under the freeway and could provide direct service and mitigation water to areas west of I-5, including the east and west forks of Little Fisher Creek.

Incentives

The Tatoosh Water Company currently has three pumps and one empty bay in its existing big BPS. One pump has the capacity of 250 gpm and two have a capacity of 750 gpm. In order to reduce electrical expenses, Tatoosh operates only the 250 gpm pump. This pump has been in operation for over 30 years and is likely nearing the end of its service life. One proposed incentive may be to replace the 250 gpm pump with a new pump, as well as install a second pump of the same size to add redundancy. These upgrades would help Tatoosh meet future demands on the far side of its system more efficiently.

Estimated Costs

Estimated costs of the Upper Fisher Sub-subbasin options are shown in **Tables 22A and 22B**. The costs estimates include a range total which is plus or minus 10 percent of the total calculated costs. The costs of these system upgrades could also be subsidized as a means of providing additional incentives to Tatoosh to supply the water for these options.

Table 22A – Estimated Costs of Option 2a Tatoosh Water Company System Modifications and Upgrades for the Upper Fisher Creek Area

Option 2a - Upper Fisher Creek

| Needed Components | Quantity | Units | \$/Unit | \$ |
|--|----------|--------|-------------|-------------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$41,000 | \$41,000 |
| Dechlorination System - GAC | 1 | ls | \$20,000 | \$20,000 |
| Structure | 1 | ls | \$8,000 | \$8,000 |
| Mechanical | 1 | ls | \$40,000 | \$40,000 |
| Meter and Metering Pump | 1 | ls | \$3,000 | \$3,000 |
| Electrical | 1 | ls | \$6,000 | \$6,000 |
| New Power Service | 1 | ls | \$2,000 | \$2,000 |
| Telemetry | 1 | ls | \$30,000 | \$30,000 |
| 15,000-gallon tank and Septic System | 1 | ls | \$60,000 | \$60,000 |
| 8" DI Pipe - Pump Station to Victoria Hill Reservoir | 4,100 | lf | \$120 | \$492,000 |
| 8" Gate Valves | 5 | each | \$1,500 | \$7,500 |
| 8" Pipe Connection | 1 | ls | \$3,000 | \$3,000 |
| 4" Tee and Branch | 100 | lf | \$60 | \$6,000 |
| 4" Double Check Assembly Vault | 1 | each | \$25,000 | \$25,000 |
| Outlet Structure | 1 | each | \$10,000 | \$10,000 |
| New Vertical Multistage Grundfos | 2 | ls | \$6,000 | \$12,000 |
| New Mechanical | 1 | ls | \$8,000 | \$8,000 |
| New Panel RTU | 1 | ls | \$25,000 | \$25,000 |
| New Soft Start | 2 | each | \$4,000 | \$8,000 |
| New Power | 1 | ls | \$3,000 | \$3,000 |
| New Telemetry | 1 | ls | \$12,000 | \$12,000 |
| Subtotal: | | | | \$822,000 |
| Contingency | 25% | | | \$206,000 |
| Subtotal with Contingency: | | | | \$1,028,000 |
| Sales Tax | 7.8% | | | \$81,000 |
| Subtotal with Tax: | | | | \$1,109,000 |
| Surveying | 3% | | | \$34,000 |
| Engineering | 12% | | | \$134,000 |
| Permitting | 7% | | | \$78,000 |
| Administration | 3% | | | \$34,000 |
| | | Range: | \$1,250,000 | \$1,530,000 |

Table 22B – Estimated Costs of Option 2b Tatoosh Water Company System Modifications and Upgrades for the Upper Fisher Creek Area

Option 2b - Tatoosh Water Main West to I-5

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|-------------|-------------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$135,000 | \$135,000 |
| 12" DI Pipe | 14,100 | ft | \$150 | \$2,115,000 |
| Air/Vac Valve | 4 | each | \$3,200 | \$12,800 |
| Blow Off Valve | 3 | each | \$3,500 | \$10,500 |
| Services | 200 | each | \$2,500 | \$500,000 |
| Hydrant | 3 | each | \$2,500 | \$7,500 |
| 12" Gate Valve | 15 | each | \$2,200 | \$33,000 |
| 76th Ave 1-Lane Overlay | 14,100 | ft | \$18 | \$250,667 |
| Asphalt Grinding | 9,400 | sq yd | \$3.00 | \$28,200 |
| Striping | 14,100 | lf | \$2 | \$28,200 |
| 4" Double Check and Vault | 1 | each | \$25,000 | \$25,000 |
| Outlet Structure | 1 | each | \$5,000 | \$5,000 |
| In Water Works | 1 | each | \$8,000 | \$8,000 |
| Subtotal: | | | | \$3,159,000 |
| Contingency | 25% | | | \$790,000 |
| Subtotal with Contingency: | | | | \$3,949,000 |
| Sales Tax | 7.7% | | | \$305,000 |
| Subtotal with Tax: | | | | \$4,254,000 |
| Surveying | 3% | | | \$128,000 |
| Engineering | 12% | | | \$511,000 |
| Permitting | 7% | | | \$298,000 |
| Administration | 3% | | | \$128,000 |
| | | Range: | \$4,700,000 | \$5,850,000 |

Table 22C – Tatoosh Water Company System Incentive 6

Replace Smaller Split Case in Big BPS and Add 2nd Unit

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-------------------------------------|----------|--------|-----------|-----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$6,000 | \$6,000 |
| New Split Case 50 hp pump and motor | 2 | each | \$14,000 | \$28,000 |
| New Mechanical | 1 | ls | \$8,000 | \$8,000 |
| New BPS Control Valve | 2 | each | \$5,000 | \$10,000 |
| New Panel RTU | 1 | ls | \$20,000 | \$20,000 |
| New Soft Start | 2 | each | \$8,000 | \$16,000 |
| New Power | 1 | ls | \$8,000 | \$8,000 |
| New Telemetry | 1 | ls | \$20,000 | \$20,000 |
| Subtotal: | | | | \$116,000 |
| Contingency | 25% | | | \$29,000 |
| Subtotal with Contingency: | | | | \$145,000 |
| Sales Tax | 7.8% | | | \$12,000 |
| Subtotal with Tax: | | | | \$157,000 |
| Surveying | 0% | | | \$0 |
| Engineering | 12% | | | \$19,000 |
| Permitting | 0% | | | \$0 |
| Administration | 3% | | | \$5,000 |
| | | Range: | \$170,000 | \$210,000 |

Operations and Maintenance Costs

Table 22D presents power and operations and maintenance costs to deliver water to Upper Fisher Creek and serve future connections to the west of Tatoosh Water Company's service to I-5 with a total connection count of 200. Costs are converted to present value assuming a rate of return of 3 percent for a 20-year term.

**Table 22D – Estimated Power, Operations, and Maintenance Costs of Option 2a and 2b
Tatoosh Water Company System Modifications and Upgrades for the Upper Fisher Creek Area**

Option 2a - Upper Fisher Creek Discharge

| | |
|---|-----------|
| Present Value of 20 years Power, Operations and Maintenance | \$319,000 |
|---|-----------|

Option 2b - Tatoosh Extension West to I-5

| | |
|---|----------|
| Present Value of 20 years Power, Operations and Maintenance | \$43,000 |
|---|----------|

These costs may be absorbed by Tatoosh but should be considered with regard to incentive option costs. Note that intertie power costs assume water flows via the well pump, big BPS, and then back down into the area west of the existing system at pressures ranging from 70 pounds per square inch (psi) to 220 psi range. (Typically water system pressures are in the 40 to 100 psi range.)

Preliminary Implementation Steps

1. Update the Tatoosh Water Company water system plan.
2. Estimate costs for engineering design and construction for the proposed project, including the new supply line to feed the creek with de-chlorinated water, extending the existing water main, and leak detection and repair, and the extensions to I-5.
3. Identify additional incentives for Tatoosh, if needed.
4. Identify incentives for property owners in the proposed service areas.
5. Establish a proposed rate structure including connection fees and water rates.
6. Prepare project bid documents and provide oversight for bid process.
7. Construct the project.
8. Monitor water quantity and quality.
9. Determine the quantity of water pumped considered to be mitigation water for downstream exempt well withdrawals.
10. Develop a water mitigation bank mechanism to track water available for mitigation of exempt well withdrawals and maintain the balance of available water.

Conclusion of Issues and Solution No. 2

Option 2a

The provision of water to the upper Fisher Creek area appears feasible with significant infrastructure improvements, including pumps, water main, and a dechlorination facility to be added to the Tatoosh Water Company system. Water diverted into the tributary of Fisher Creek could serve to mitigate for subsequent development of exempt wells in the subbasin. During a visit to the Fisher Sub-subbasin on August 22, 2012, it was noted that portions of the stream are choked with reed canary grass, are lacking in riparian vegetation, and provide direct access of animals to the stream. Habitat improvements in these middle reaches (east of I-5) should be pursued to ensure that the water provided to the creek upstream of these areas provides the intended benefits and truly benefits salmon and steelhead resources in the subbasin. Details related to the needed habitat improvements are beyond the scope of this project but should be considered to ensure the maximum benefit is obtained from the provision of the mitigation water.

Option 2b

The provision of a new main to supply potable water west of Tatoosh's service area requires a water main approximately 2.7 miles in length. Tatoosh Water Company appears to be able to provide water to some of the parcels in Skagit and Snohomish Counties, which fall within the Fisher Sub-basin.

Issue and Solution No. 3: Fisher Sub-subbasin

It is important to note that with the invalidation of the instream flow rule by the Washington State Supreme Court, the reservations of water are no longer in effect. As a result, the water used by the permit-exempt wells affected by the amended rule will now have to be added to the projected future demands identified in this report in order to determine the total amount of water for which mitigation

needs to be established. The need for revision of these numbers was unanticipated and is outside the current scope of this project.

Currently no wide-spread regional public water system exists within the Fisher Sub-subbasin. However, the Tatoosh Water Company, Wilderness Ridge Community Club, and Skagit PUD all have water mains in the vicinity of the area. The extension of a mainline between the Tatoosh Water Company and Wilderness Ridge is explored here to identify costs associated with what could be the first water main to transect the sub-subbasin. The proposed pipeline route stays entirely within Snohomish County and follows existing roads. This route passes near a number of the short-term demand parcels, but does not include water mains extensive enough to reach over the entire sub-subbasin to be able to provide water to all parcels (**Figure 11**).

Option 3 would require upgrading the Wilderness Ridge pumping facilities, as the Tatoosh service area is at higher elevation than could be reached by Wilderness Ridge's existing BPS. This option is labeled as Option 3 with piping and pumping costs separated.

Barriers

Wilderness Ridge has expressed reluctance to pursue an intertie with Tatoosh because it does not want chlorinated water entering its system.

Incentives

An intertie with Tatoosh would provide system redundancy and greater security of water supply in the event that one of the systems experience a failure such as loss of a reservoir, a major water main break or a significant pump failure.

Increasing the size of the Wilderness Ridge water main within its existing system to facilitate efficient movement of water to the east has been identified as a potential incentive. This incentive will be discussed in more detail under the next option.

Estimated Costs

Estimated costs of the Fisher Sub-subbasin intertie option are shown in **Tables 23A** and **23B**. The costs estimates include a range total which is plus or minus 10 percent of the total calculated costs. The costs of these system upgrades could also be subsidized as a means of providing additional incentives to Tatoosh and Wilderness Ridge to supply the water for these options.

**Figure 11 – Fisher Sub-subbasin Tatoosh Water Company
and Wilderness Ridge Community Club Intertie**

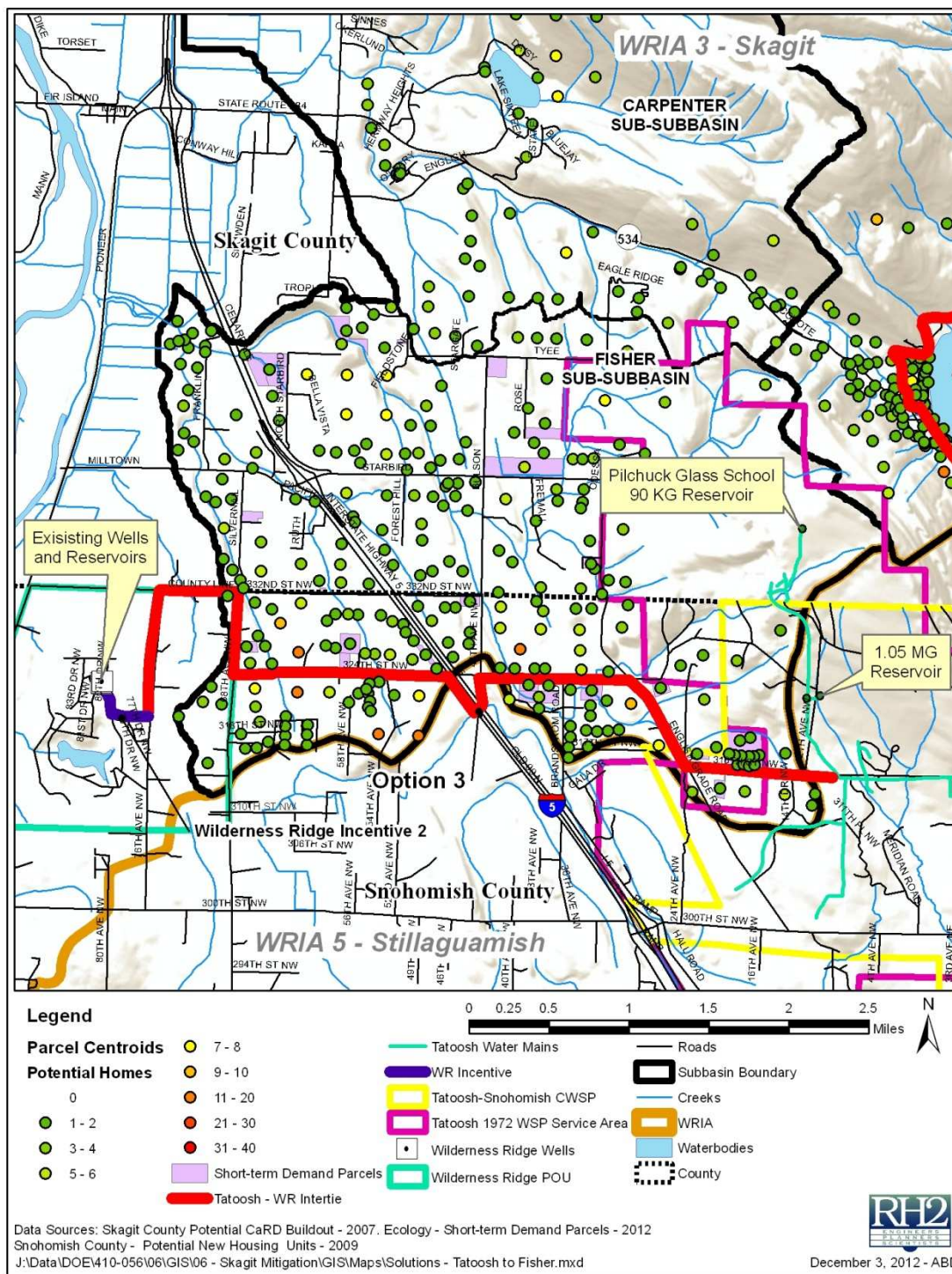


Table 23A – Estimated Costs, Tatoosh and Wilderness Ridge System Intertie Modifications and Upgrades, Fisher Sub-subbasin

Option 3 - Intertie

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|-------------|--------------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$303,000 | \$303,000 |
| 12" DI Pipe | 32,100 | ft | \$150 | \$4,815,000 |
| Air/Vac Valve | 6 | each | \$3,200 | \$19,200 |
| Blow Off Valve | 6 | each | \$3,500 | \$21,000 |
| Services | 200 | each | \$2,500 | \$500,000 |
| Hydrant | 5 | each | \$2,500 | \$12,500 |
| Meter Vault | 1 | each | \$40,000 | \$40,000 |
| 12" Gate Valve | 32 | each | \$2,200 | \$70,400 |
| 76th Ave 1-Lane Overlay | 32,100 | ft | \$18 | \$570,667 |
| Asphalt Grinding | 21,400 | sq yd | \$3.00 | \$64,200 |
| Striping | 32,100 | lf | \$2 | \$64,200 |
| 4" Double Check and Vault | 2 | each | \$25,000 | \$50,000 |
| Outlet Structure | 2 | each | \$5,000 | \$10,000 |
| In Water Works | 2 | each | \$8,000 | \$16,000 |
| Subtotal: | | | | \$6,557,000 |
| Contingency | 25% | | | \$1,640,000 |
| Subtotal with Contingency: | | | | \$8,197,000 |
| Sales Tax | 7.7% | | | \$632,000 |
| Subtotal with Tax: | | | | \$8,829,000 |
| Surveying | 3% | | | \$265,000 |
| Engineering | 12% | | | \$1,060,000 |
| Permitting | 7% | | | \$619,000 |
| Administration | 3% | | | \$265,000 |
| | | Range: | \$9,900,000 | \$12,200,000 |

Table 23B – Estimated Costs, Tatoosh and Wilderness Ridge System Intertie Wilderness Ridge System Modifications and Upgrades for Fisher Sub-subbasin

Option 3 - Wilderness Ridge Pump Station Upgrade for Intertie

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|----------|----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$3,000 | \$3,000 |
| New Centrifugal Pump | 1 | ls | \$10,000 | \$10,000 |
| New Mechanical | 1 | ls | \$6,000 | \$6,000 |
| New Panel RTU | 1 | ls | \$15,000 | \$15,000 |
| New Soft Start | 1 | each | \$4,000 | \$4,000 |
| New Telemetry | 1 | ls | \$8,000 | \$8,000 |
| Subtotal: | | | | \$46,000 |
| Contingency | 25% | | | \$12,000 |
| Subtotal with Contingency: | | | | \$58,000 |
| Sales Tax | 7.7% | | | \$5,000 |
| Subtotal with Tax: | | | | \$63,000 |
| Surveying | 0% | | | \$0 |
| Engineering | 12% | | | \$8,000 |
| Permitting | 0% | | | \$0 |
| Administration | 3% | | | \$2,000 |
| | | Range: | \$72,000 | \$88,000 |

Operations and Maintenance Costs

Table 23C presents power and operations and maintenance costs for installing an intertie between the Tatoosh and Wilderness Ridge Water systems. Costs are converted to present value assuming a rate of return of 3 percent for a 20-year term.

**Table 23C – Estimated Power, Operations, and Maintenance Costs of Option 3
Wilderness Ridge Community Club and Tatoosh Water Company System Intertie Modifications
and Upgrades for Fisher Sub-subbasin**

Option 3 - Wilderness Ridge Pumping Costs for Intertie

| | |
|--|-----------------|
| Present Value of 20 Years Power, Operations, and Maintenance | \$14,000 |
|--|-----------------|

Option 3 assumes minimal pumping to the intertie as Tatoosh's system is at a higher elevation and thus it is less expensive for Tatoosh to supply water at lower elevations.

Issue and Solution No. 3 Conclusion

Both Tatoosh and Wilderness Ridge have inchoate municipal water rights that could be used for developing an intertie between the two systems via water mains into the Fisher Sub-subbasin. The intertie would be approximately 7.1 miles in length and the benefit would be gained almost exclusively in the Snohomish County portion of the sub-subbasin along the water main alignment. The capital costs to implement this option are estimated to be between \$9.9 million and \$12.2 million, not including any water system incentive costs of the projects.

Issue and Solution No. 4: Lower Fisher Creek Area in the Fisher Sub-subbasin

It is important to note that with the invalidation of the instream flow rule by the Washington State Supreme Court, the reservations of water are no longer in effect. As a result, the water used by the

permit-exempt wells affected by the amended rule will now have to be added to the projected future demands identified in this report in order to determine the total amount of water for which mitigation needs to be established. The need for revision of these numbers was unanticipated and is outside the current scope of this project.

For the purposes of this study, the Lower Fisher Creek Area is defined as the area located west of I-5 and extending south of Fisher Creek to approximately 316th Street NW. A stream joins Fisher Creek just west of I-5. This stream flows from south to north and has two forks. This stream will be referred to as “Little Fisher Creek” and the two forks will be referred to as the east and west forks of Little Fisher Creek. According to Ecology staff, the east fork typically experiences lower flows than the west fork, and this area has been one of the more difficult areas in which to find water supply solutions (telephone conversation with Mr. John Rose, Department of Ecology, October 9, 2012).

Extending a water main from the Wilderness Ridge Community Club system east to I-5 near the intersection of Highway 99 and 44th Avenue NW would allow Wilderness Ridge to serve customers west of I-5 and, potentially, to rehydrate portions of the east and west forks of Little Fisher Creek (**Figure 12**). This extension could include an intertie with the Tatoosh Water Company as discussed in the previous section.

Option 4a (**Table 24A**) includes a water main extension to I-5 primarily for potable service with one mitigation discharge. The nearest opportunity to provide mitigation water to Little Fisher Creek is approximately 0.5 miles from the Wilderness Ridge service area. This is considered the west fork of Little Fisher Creek. A second fork, the east fork is approximately 1.3 miles from Wilderness Ridge’s existing service area. Options 4b and 4c (**Tables 24 B and C**) are to provide mitigation water to just the West Fork Little Fisher Creek and both the West and East Fork Little Fisher Creek, respectively.

Barriers

None identified, besides cost.

Incentives

The Wilderness Ridge Community Club is located adjacent to this subbasin and has inchoate water rights of 102.2 afy, based on the assessment of its existing water rights and the use data reported to DOH. Wilderness Ridge has reported that it still has about 150 parcels that it will likely provide with water in the future. It appears that Wilderness Ridge will have an inchoate water right of approximately 68.2 acre-feet of water after supplying water to these remaining parcels, assuming that there is one connection per parcel. Wilderness Ridge has a pending water right application for 365 gpm and if this were to be approved, the amount of water available from Wilderness Ridge could change depending on the details of that permit and whether it granted additive quantities to Wilderness Ridge.

Wilderness Ridge is in need of a comprehensive water system plan update and is slowly upgrading its smaller, 1- to 3-inch mains to 8-inch mains to provide better fire flow to customers. If these efforts could be subsidized, it may be a good incentive and could be used to trade costs for power and operations and maintenance.

Estimated Costs

Estimated costs of direct service or mitigation for Lower Fisher Creek are shown in **Tables 24A, 24B, and 24C**. The costs estimates include a range total which is plus or minus 10 percent of the total

Figure 12 – Lower Fisher Creek Area Options (Wilderness Ridge Community Club)



Table 24A – Estimated Costs of Option 4a Wilderness Ridge System Modifications and Upgrades, Lower Fisher Creek in the Fisher Sub-subbasin

Option 4a - Wilderness Ridge Water Main East to I-5

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|-------------|-------------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$216,000 | \$216,000 |
| 12" DI Pipe | 18,000 | ft | \$150 | \$2,700,000 |
| Air/Vac Valve | 2 | each | \$3,200 | \$6,400 |
| Blow Off Valve | 3 | each | \$3,500 | \$10,500 |
| Services | 365 | each | \$2,500 | \$912,500 |
| Hydrant | 3 | each | \$2,500 | \$7,500 |
| 12" Gate Valve | 19 | each | \$2,200 | \$41,800 |
| 76th Ave 1-Lane Overlay | 18,000 | ft | \$18 | \$320,000 |
| Asphalt Grinding | 12,000 | sq yd | \$3.00 | \$36,000 |
| Striping | 18,000 | lf | \$2.00 | \$36,000 |
| 4" Double Check and Vault | 1 | each | \$25,000 | \$25,000 |
| Outlet Structure | 1 | each | \$5,000 | \$5,000 |
| In Water Works | 1 | each | \$8,000 | \$8,000 |
| Subtotal: | | | | \$4,325,000 |
| Contingency | 25% | | | \$1,082,000 |
| Subtotal with Contingency: | | | | \$5,407,000 |
| Sales Tax | 7.7% | | | \$417,000 |
| Subtotal with Tax: | | | | \$5,824,000 |
| Surveying | 3% | | | \$175,000 |
| Engineering | 12% | | | \$699,000 |
| Permitting | 7% | | | \$408,000 |
| Administration | 3% | | | \$175,000 |
| | | Range: | \$6,560,000 | \$8,020,000 |

Table 24B – Estimated Costs of Option 4b Wilderness Ridge System Modifications and Upgrades, Lower Fisher Creek in the Fisher Sub-subbasin

Option 4b - West Fork Little Fisher Creek

| Needed Components | Quantity | Units | \$/Unit | \$ |
|----------------------------------|----------|--------|-------------|-------------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$22,000 | \$22,000 |
| New Split Case Centrifugal | 1 | ls | \$10,000 | \$10,000 |
| New Mechanical | 1 | ls | \$4,000 | \$4,000 |
| New Panel RTU | 1 | ls | \$12,000 | \$12,000 |
| New Soft Start | 1 | each | \$4,000 | \$4,000 |
| New Power | 1 | ls | \$3,000 | \$3,000 |
| New Telemetry | 1 | ls | \$6,000 | \$6,000 |
| 8" DI Pipe | 11,000 | ft | \$120 | \$1,320,000 |
| Air/Vac Valve | 4 | each | \$3,200 | \$12,800 |
| Blow Off Valve | 3 | each | \$3,500 | \$10,500 |
| 8" Gate Valve | 11 | each | \$1,500 | \$16,500 |
| 76th Ave 1-Lane Overlay | 11,000 | ft | \$16 | \$171,111 |
| Asphalt Grinding | 7,333 | sq yd | \$3.00 | \$22,000 |
| Striping | 11,000 | lf | \$2 | \$22,000 |
| 8" Backpressure Sustaining Valve | 1 | each | \$12,000 | \$12,000 |
| 4" Double Check and Vault | 1 | each | \$25,000 | \$25,000 |
| Outlet Structure | 1 | each | \$5,000 | \$5,000 |
| In Water Work | 1 | each | \$8,000 | \$8,000 |
| Subtotal: | | | | \$1,686,000 |
| Contingency | 25% | | | \$422,000 |
| Subtotal with Contingency: | | | | \$2,108,000 |
| Sales Tax | 7.7% | | | \$163,000 |
| Subtotal with Tax: | | | | \$2,271,000 |
| Surveying | 3% | | | \$69,000 |
| Engineering | 12% | | | \$273,000 |
| Permitting | 7% | | | \$159,000 |
| Administration | 3% | | | \$69,000 |
| | | Range: | \$2,570,000 | \$3,140,000 |

Table 24C – Estimated Costs of Option 4c Wilderness Ridge System Modifications and Upgrades, Lower Fisher Creek in the Fisher Sub-subbasin

Option 4c - West and East Forks Little Fisher Creek

| Needed Components | Quantity | Units | \$/Unit | \$ |
|----------------------------------|----------|--------|-------------|-------------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$59,000 | \$59,000 |
| New Split Case Centrifugal | 1 | ls | \$10,000 | \$10,000 |
| New Mechanical | 1 | ls | \$4,000 | \$4,000 |
| New Panel RTU | 1 | ls | \$12,000 | \$12,000 |
| New Soft Start | 1 | each | \$4,000 | \$4,000 |
| New Power | 1 | ls | \$3,000 | \$3,000 |
| New Telemetry | 1 | ls | \$6,000 | \$6,000 |
| 8" DI Pipe | 14,400 | ft | \$120 | \$1,728,000 |
| Air/Vac Valve | 6 | each | \$3,200 | \$19,200 |
| Blow Off Valve | 4 | each | \$3,500 | \$14,000 |
| 8" Gate Valve | 7 | each | \$1,500 | \$10,500 |
| 76th Ave 1-Lane Overlay | 14,400 | ft | \$16 | \$224,000 |
| Asphalt Grinding | 9,600 | sq yd | \$3.00 | \$28,800 |
| Striping | 14,400 | lf | \$2 | \$28,800 |
| 8" Backpressure Sustaining Valve | 2 | each | \$12,000 | \$24,000 |
| 4" Double Check and Vault | 2 | each | \$25,000 | \$50,000 |
| Outlet Structure | 2 | each | \$5,000 | \$10,000 |
| In Water Work | 2 | each | \$8,000 | \$16,000 |
| Subtotal: | | | | \$2,252,000 |
| Contingency | 25% | | | \$563,000 |
| Subtotal with Contingency: | | | | \$2,815,000 |
| Sales Tax | 7.7% | | | \$217,000 |
| Subtotal with Tax: | | | | \$3,032,000 |
| Surveying | 3% | | | \$91,000 |
| Engineering | 12% | | | \$364,000 |
| Permitting | 7% | | | \$213,000 |
| Administration | 3% | | | \$91,000 |
| | | Total: | | \$3,800,000 |
| | | Range: | \$3,420,000 | \$4,180,000 |

Table 24D – Wilderness Ridge Water System Incentive 1

Water Comprehensive Plan Update

| Needed Components | Quantity | Units | \$/Unit | \$ |
|----------------------|----------|--------|----------|----------|
| System Investigation | | | | \$20,000 |
| Planning | | | | \$20,000 |
| Report | | | | \$25,000 |
| Administration | 3% | | | \$1,950 |
| Subtotal: | | | | \$67,000 |
| Contingency | 25% | | | \$17,000 |
| | | Total: | | \$84,000 |
| | | Range: | \$75,000 | \$93,000 |

Table 24E – Wilderness Ridge Water System Incentive 2

Install 8" DI Main

| Needed Components | Quantity | Units | \$/Unit | \$ |
|-----------------------------|----------|--------|-----------|-----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$25,000 | \$25,000 |
| 8" DI Pipe | 3,100 | ft | \$120 | \$372,000 |
| Air/Vac Valve | 2 | each | \$3,200 | \$6,400 |
| Blow Off Valve | 1 | each | \$3,500 | \$3,500 |
| 8" Gate Valve | 8 | each | \$1,500 | \$12,000 |
| Hydrant | 4 | each | \$2,500 | \$10,000 |
| Overlay | 3,100 | ft | \$16 | \$48,222 |
| Asphalt Grinding | 2,067 | sq yd | \$3.00 | \$6,200 |
| Striping | 3,100 | lf | \$2 | \$6,200 |
| Subtotal: | | | | \$490,000 |
| Contingency | 25% | | | \$123,000 |
| Subtotal with Contingency: | | | | \$613,000 |
| Sales Tax | 7.7% | | | \$48,000 |
| Subtotal with Tax: | | | | \$661,000 |
| Surveying | 3% | | | \$20,000 |
| Engineering | 12% | | | \$80,000 |
| Permitting | 7% | | | \$47,000 |
| Administration | 3% | | | \$20,000 |
| Total: | | | | \$830,000 |
| | | Range: | \$750,000 | \$910,000 |

Operations and Maintenance Costs

Table 24F presents power and operations and maintenance costs for the various Option 4 solutions. Costs are converted to present value assuming a rate of return of 3 percent for a 20-year term.

**Table 24F – Estimated Power, Operations, and Maintenance Costs of Options 4a, 4b and 4c
Wilderness Ridge Community Club System Modifications and Upgrades for Lower Fisher Creek**

Option 4a - Wilderness Ridge Branch East to I-5

| | |
|--|------------------|
| Present Value of 20 Years Power, Operations, and Maintenance | \$127,000 |
|--|------------------|

Option 4b - West Fork, Little Fisher Creek

| | |
|--|-----------------|
| Present Value of 20 Years Power, Operations, and Maintenance | \$86,000 |
|--|-----------------|

Option 4c - West and East Forks, Little Fisher Creek

| | |
|--|-----------------|
| Present Value of 20 Years Power, Operations, and Maintenance | \$89,000 |
|--|-----------------|

These costs may be absorbed by Wilderness Ridge but should be considered with regard to incentive option costs listed in **Tables 24A, 24B, and 24C.**

Preliminary Implementation Steps

1. Update the Wilderness Ridge Community Club water system plan.
2. Estimate costs for engineering design and construction for the proposed project, including the new supply line to feed Little Fisher Creek, extension of the existing water mains, and, potentially, the extensions to I-5 to connect to Tatoosh Water Company at I-5.
3. Identify additional incentives for Wilderness Ridge, if needed.
4. Identify incentives for property owners in the proposed service areas.
5. Establish a proposed rate structure, including connection fees and water rates.
6. Prepare project bid documents and prepare oversight for the bid process.
7. Construct Project construction and oversight
8. Monitor water quantity and quality.
9. Determine the quantity of water pumped that is considered to be mitigation water for downstream exempt well withdrawals.
10. Develop a water mitigation bank mechanism to track water available for mitigation of exempt well withdrawals and maintain the balance of available water.

Issue and Solution No. 4 Conclusion

Providing water from Wilderness Ridge Community Club to the forks of Little Fisher Creek appears to be a feasible means of providing water to the lower Fisher Sub-subbasin. The capital costs to implement the options are estimated to be between \$2.5 million and \$8.1 million, not including any water system incentive costs of the projects.

Issue and Solution No. 5: Water Supply and Mitigation in the Carpenter Sub-subbasin

It is important to note that with the invalidation of the instream flow rule by the Washington State Supreme Court, the reservations of water are no longer in effect. As a result, the water used by the permit-exempt wells affected by the amended rule will now have to be added to the projected future demands identified in this report in order to determine the total amount

of water for which mitigation needs to be established. The need for revision of these numbers was unanticipated and is outside the current scope of this project.

The Carpenter Sub-subbasin has the potential for approximately 280 homes to be built that could potentially want to drill a well for potable supply (**Table 25**). Many of the lots are near existing Skagit PUD water mains, but some are not. The highest concentration of lots occurs along Carpenter Creek at the base of the hillside, and in the upland area just south of the City of Mount Vernon.

Table 25 – Carpenter Sub-subbasin Demand

| Short-term Demand (Requested of Ecology) | | | | | Long-term Demand (Skagit County) | | | | |
|---|--|--|--|---|--------------------------------------|--|--|--|---|
| Number of Parcels | Daily Demand @ 175 gpd (gpd) | Annual Demand (Qa) @ 175 gpd (afy) | Daily Demand @ 350 gpd (gpd) | Annual Demand (Qa)@ 350 gpd (afy) | Number of Potential Parcels | Daily Demand @ 175 gpd (gpd) | Annual Demand (Qa) @ 175 gpd (afy) | Daily Demand @ 350 gpd (gpd) | Annual Demand (Qa)@ 350 gpd (afy) |
| 9 | 1,575 | 1.8 | 3,150 | 3.5 | 280 | 49,000 | 54.9 | 98,000 | 109.8 |

Proposed Solution

There are two possible options for increasing the number of lots that can be built on within the Carpenter Sub-subbasin. The first option relies on parcel owners paying Skagit PUD to extend water mains to their properties. There are a number of locations where extension of the main lines for domestic service makes sense. This is the primary way that the Skagit PUDs lines have historically been extended and will remain a viable option in the future. However, as mentioned previously, there are areas where either the distance to the pipeline is great or the topography is not conducive to extending a water main. The use of Skagit PUD water for mitigation appears to be a reasonable cost solution that can be used to offset the impacts of individual well development downstream of the discharge point.

RH2 considers the most promising location for the introduction of water into the headwaters of Carpenter Creek to be on the east side of Ware Mountain. Skagit PUD already has 8-inch diameter water main up to the reservoir atop Ware Mountain, off of Cascade Ridge Drive, and the water main would only need to be extended by approximately 700 feet to the first stream crossing, where it could be discharged. This discharge location would potentially mitigate for 90 percent of the short-term demand within the sub-subbasin and would meet much of the long-term demand (**Figure 13**).

Discussion

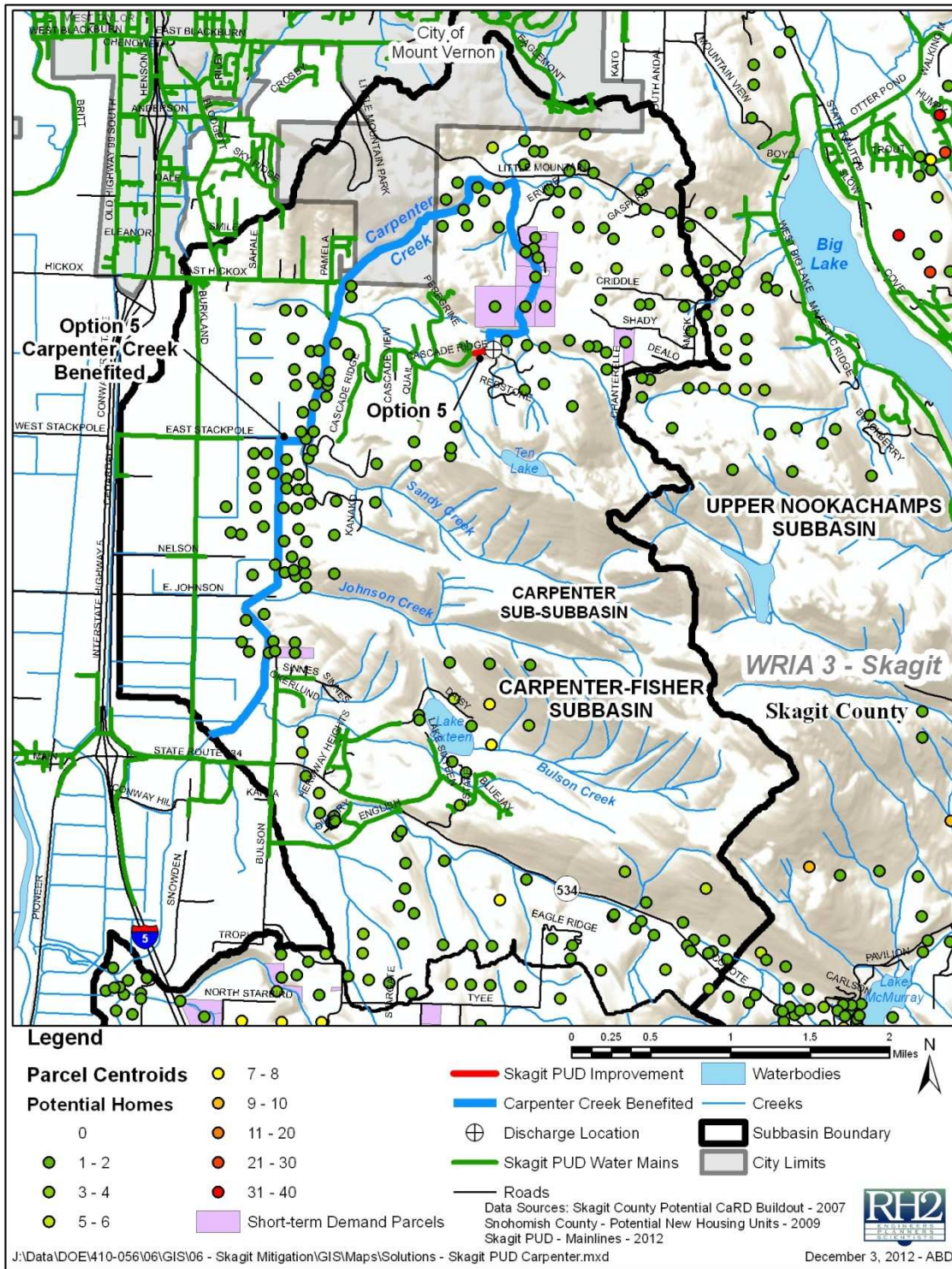
The mitigation demand for the entire Carpenter Sub-subbasin is 55 afy, which is 34 gpm continuously. However, since some wells will impact streams other than Carpenter Creek downstream of the mitigation location, the actual mitigation rate will be less than 34 gpm.

The Skagit PUD water at this location contains chloramines which need to be removed before the water can be discharged to Carpenter Creek.

Removal of chloramines is feasible. The process would involve the addition of chlorine to the Skagit PUD water to drive the chloramines through the “breakpoint process” where the chloramines are eliminated and ammonia is completely oxidized and removed from the water, leaving free chlorine. Then, the water would be treated with a vitamin C solution or an activated charcoal filter to remove

the free chlorine. The vitamin C solution and the metering pump are both readily available. Details of the process and facilities necessary for chloramine removal at this location are outside the scope of this feasibility report but are recommended for further study.

Figure 13 – Carpenter Creek Sub-subbasin Option



Barriers

The Skagit PUD has indicated that they would be willing to consider possible solutions. The use of potable water for mitigation to allow others to drill and use wells creates a new accounting and billing scheme that would need to be developed to appropriately bill the new well users for the mitigation water that Skagit PUD will be releasing on their behalf.

Incentives

No specific incentives have been identified for the Skagit PUD, but the estimated costs of the operations and maintenance have been identified so that the magnitude of a potential incentive can be understood.

Estimated Costs

RH2 assumed that additional pumps and water main would not be needed to move the water up to the Ware Mountain reservoir. Although smaller pipe could be used to transport the mitigation water, an extension of the 8-inch water main has been proposed to the discharge location so that the pipe could be utilized as a mainline for future development. A properly constructed discharge structure and dechlorination unit are included in the costs (**Table 26A**).

Table 26A – Estimated Costs of Option 5 Skagit PUD System Modifications and Upgrades for the Carpenter Sub-subbasin*

Option 5 - Carpenter Creek

| Needed Components | Quantity | Units | \$/Unit | \$ |
|--|----------|--------|-----------|-----------|
| Mob/Demob Site Prep/Cleanup | 1 | ls | \$15,000 | \$15,000 |
| Dechlorination System - GAC | 1 | ls | \$20,000 | \$20,000 |
| Structure | 1 | ls | \$8,000 | \$8,000 |
| Mechanical | 1 | ls | \$35,000 | \$35,000 |
| Meter and Metering Pump | 1 | ls | \$3,000 | \$3,000 |
| Electrical | 1 | ls | \$6,000 | \$6,000 |
| New Power Service | 1 | ls | \$2,000 | \$2,000 |
| Telemetry | 1 | ls | \$30,000 | \$30,000 |
| 5,000 gallon tank and Septic System | 1 | ls | \$40,000 | \$40,000 |
| 8" DI Pipe - to Carpenter Creek from Existing Main | 800 | lf | \$120 | \$96,000 |
| 8" Gate Valves | 2 | each | \$1,500 | \$3,000 |
| 8" Pipe Connection | 1 | ls | \$3,000 | \$3,000 |
| 2" Tee and branch | 25 | lf | \$35 | \$875 |
| 2" Double Check Assembly Vault | 1 | each | \$15,000 | \$15,000 |
| Outlet Structure | 1 | each | \$5,000 | \$5,000 |
| In Water Work | 1 | each | \$8,000 | \$8,000 |
| Subtotal: | | | | \$290,000 |
| Contingency | 25% | | | \$73,000 |
| Subtotal with Contingency: | | | | \$363,000 |
| Sales Tax | 7.8% | | | \$29,000 |
| Subtotal with Tax: | | | | \$392,000 |
| Surveying | 3% | | | \$12,000 |
| Engineering | 12% | | | \$48,000 |
| Permitting | 7% | | | \$28,000 |
| Administration | 3% | | | \$12,000 |
| | | Range: | \$450,000 | \$550,000 |

*The costs associated with dechlorination shown in Table 26A need to be reevaluated based on the discovery that the PUD water at this location includes chloramines which need to be removed from the water.

Operations and Maintenance Costs

RH2 has estimated the operations and maintenance of delivering 34 gpm at this location to include pumping costs to lift the water 660 feet, dechlorination costs, and additional staff time to check on the discharge and make sure it is functioning properly (**Table 26B**).

Table 26B – Estimated Power, Operations, and Maintenance Costs of Option 5 Skagit PUD System Modifications and Upgrades for the Carpenter Sub-subbasin

| | |
|--|-----------|
| Option 5 - Carpenter Creek Discharge | |
| Present Value of 20 Years Power, Operations, and Maintenance | \$173,000 |

Preliminary Implementation Steps

1. Obtain Skagit PUD acceptance of this element.
2. Develop planning-level design and construction cost estimates.
3. Identify and secure a source of funding for the design phase.
4. Prepare final system designs and cost estimates.
5. Identify and secure funding for construction.

Issue and Solution No. 5 Conclusion

The capital costs for this mitigation will be among the most reasonable explored. Operations and maintenance expense will be significant due to the maximum elevation of the water main leading to the discharge point (approximately 760 feet above mean sea level). Skagit PUD has sufficient water rights to be able to provide mitigation water and water for direct service in the Carpenter Subbasin. If this option is selected, discussion with Skagit PUD could be had to figure out a reasonable incentive package. The capital costs to implement this option are estimated to be between \$0.4 million and \$0.6 million, not including any water system incentive costs of the project.

OVERALL CONCLUSION

The Tatoosh Water Company and Skagit PUD are the public water systems holding the largest inchoate municipal water rights in proximity to the study area. Wilderness Ridge Community Club has inchoate rights, but to a lesser extent than the other two entities. Wilderness Ridge's wells are located in the Lower Skagit Subbasin and it might be possible for it to obtain additional water rights to meet increased demand should extension of its service area be identified as feasible and desired. Other water systems reviewed fall under the following categories; fully using their water rights, not interested in participating, do not have sufficient water rights to cover existing use, or the source of water is physically limited and cannot be expanded.

The following five primary options were identified and analyzed for enhanced water supply in the Carpenter-Fisher and Upper Nookachamps Subbasins.

Option 1:

- a. Tatoosh Water Company could provide mitigation water to the Lake McMurray area via a new well and pipeline to the lake.
- b. Tatoosh Water Company could provide water to Skagit PUD, which would then manage a regional water supply system in the Lake McMurray area.

Option 2:

- a. Tatoosh Water Company could provide mitigation water to hydrate Upper Fisher Creek via a new water main connected to its 1.05 MG reservoir near the Pilchuck Glass School.
- b. Tatoosh Water Company could extend its water main west of its current service area to I-5.

Option 3:

- a. Tatoosh Water Company and Wilderness Ridge Community Club could extend their water mains and have and intertie their systems.

Option 4:

- a. Wilderness Ridge could extend a water main east to I-5.
- b. Wilderness Ridge could provide mitigation water to the west fork of Little Fisher Creek.
- c. Wilderness Ridge could provide mitigation water to the west and east forks of Little Fisher Creek.

Option 5:

- a. Skagit PUD could provide mitigation water to the headwaters of Carpenter Creek.

Based on the preliminary total project cost estimates with operations and maintenance costs (**Table 27A**), the lowest cost projects in both the Upper Nookachamps and Carpenter-Fisher Subbasins are the mitigation-centered options (Options 1a, 2a, 4b, 4c, and 5). These options, if implemented, would provide relief to some, but not all, property owners within the two subbasins analyzed. **Table 27B** identifies the cost for incentives that are either necessary or may be desired by the water systems to participate in being part of the solution. The primary driver for capital costs is the length of water main needed. Due to the dispersed nature of the potential lots that need water, creating or expanding a municipal distribution system to serve them will always be more costly than providing mitigation water to a few stream channels and having the benefits carry all the way to the mouth of the stream. However, there may be additional reasons besides cost to favor a regional municipal water system over a mitigation system.

Table 27A – Summary of Option Planning-level Costs

| Number | Description | Purveyor | Stream Flow Augmented | Capital Cost Range | | 20 Years Operations and Maintenance Cost | Total Cost (Upper Range) |
|---|---|------------------------------|-----------------------|--------------------|--------------|--|--------------------------|
| Option 1a | Lake Creek via Lake McMurray and McHaven Supply | Tatoosh | Lake Creek | \$1,220,000 | \$1,490,000 | \$74,000 | \$1,564,000 |
| Option 1b | Satellite Water System | Tatoosh | Lake Creek | \$5,200,000 | \$6,400,000 | \$379,000 | \$6,779,000 |
| Option 2a | Upper Fisher Creek | Tatoosh | Fisher Creek | \$1,250,000 | \$1,530,000 | \$319,000 | \$1,849,000 |
| Option 2b | Tatoosh Water Main West to I-5 | Tatoosh | Fisher Creek | \$4,700,000 | \$5,850,000 | \$43,000 | \$5,893,000 |
| Option 3 | Intertie | Tatoosh and Wilderness Ridge | Fisher Creek | \$9,900,000 | \$12,200,000 | \$29,000 | \$12,229,000 |
| Option 4a | Wilderness Ridge Water Main East to I-5 * | Wilderness Ridge | Fisher Creek | \$6,640,000 | \$8,100,000 | \$14,000 | \$8,114,000 |
| Option 4b | West Fork, lower Little Fisher Creek | Wilderness Ridge | Fisher Creek | \$2,570,000 | \$3,140,000 | \$86,000 | \$3,226,000 |
| Option 4c | West and East Forks, lower Little Fisher Creek | Wilderness Ridge | Fisher Creek | \$3,420,000 | \$4,180,000 | \$89,000 | \$4,269,000 |
| Option 5 | Carpenter Creek | Skagit PUD | Carpenter Creek | \$450,000 | \$550,000 | \$173,000 | \$723,000 |
| * Costs include upgrades to the Wilderness Ridge Pump Station | | | | | | | |

Table 27B – Summary of Incentive Planning-level Costs

| Water System Incentives Costs Summary | | | | |
|--|--|------------------|---------------------|--------------|
| Number | Description | Purveyor | Capital Cost | Range |
| 1 | Water Comprehensive Plan Update | Tatoosh | \$90,000 | \$110,000 |
| 2 | Leak Detection Survey | Tatoosh | \$27,000 | \$33,000 |
| 3 | Replace Well 1 Roof with Raised Structure | Tatoosh | \$54,000 | \$66,000 |
| 4 | Pipeburst Leaking 14" AC Main | Tatoosh | \$240,000 | \$300,000 |
| 5 | Sliplining Leaking 14" DI Main with 12" HDPE Main (10" ID) | Tatoosh | \$160,000 | \$200,000 |
| 6 | Replace Smaller Split Case in Big BPS and Add 2nd Unit | Tatoosh | \$170,000 | \$210,000 |
| 1 | Water Comprehensive Plan Update | Wilderness Ridge | \$75,000 | \$93,000 |
| 2 | Install 8" DI Main | Wilderness Ridge | \$750,000 | \$920,000 |

The Tatoosh Water Company has sufficient inchoate water under its existing water rights to be able to meet the anticipated demand of all options where it has been identified as the purveyor. Wilderness Ridge Community Club has limited inchoate water under its existing water rights and might need its pending water right application processed to be able to meet all of the options identified in this report. Skagit PUD has sufficient inchoate water under its existing water rights to be able to meet the anticipated demand due to mitigation, infilling, and periodic expansion of its water system anticipated with future growth.

REFERENCES

- Economic and Engineering Services, Inc., Adopted February 1992 (November 2007 revision), *North Snohomish County Coordinated Water System Plan Water Service Areas, Large Public Water Systems*.
- Hart Crowser & Associates, Inc., June 7, 1983, *Ground Water Development Feasibility Study, Lake McMurray Area, Snohomish/Skagit Counties, Washington*, Prepared for Snohomish County Public Utility District No. 1.
- HDR, 2007, *Skagit Public Utility District No. 1 Water System Plan*.
- Hugh G. Goldsmith & Associates, Inc., April 15, 1972, *Engineering Report on Comprehensive Plan for Water System Development and Expansion for Tatoosh, Foothills Water Company, Snohomish County, Washington*.
- Northwest Hydraulic Consultants, 2005, *Final Report – Instream Flow Assessment Project*, Prepared for Shared Strategy for Puget Sound.
- RH2 Engineering, Inc., October 11, 2004, *Leif Erikson Recreation Association (Norway Park) Water System Plan*.
- Rongey, R. J., February 3, 1972, *Ground-Water Investigations, Lake McMurray Area*, Prepared for Foothills Investment Company.
- Rongey, R. J., May 21, 1971, *Ground-Water Investigations, Lake McMurray Area*, Prepared for Foothills Investment Company.
- Savoca, M.E., Johnson, K.H., Sumioka, S.S., Olsen, T.D., Fasser, E.T., and Huffman, R.L., 2009, *Hydrogeologic Framework, Groundwater Movement, and Water Budget in Tributary Subbasins and Vicinity, Lower Skagit River Basin, Skagit and Snohomish Counties, Washington*, United States Geological Survey, Scientific Investigations Report 2009-5270.
- Skagit County Geographic Information Services, October 12, 2007, *Analysis for Potential Buildout in Skagit County*. Standard_plus_Card_Buildout GIS layer obtained via email from Skagit County on November 15, 2012.
- Snohomish County Planning and Development Services, Cartography/GIS, November 8, 2012, *Snohomish County Draft Potential New Housing Units in the Carpenter – Fisher Subbasin* [2009 data]. Parcel_FLU_Resfloor_CA_calc_curr_FisherCrk GIS layer obtained via email from Snohomish County on November 19, 2012.
- Snohomish County Surface Water Management, March 2007, *State of the Stilly*, Stillaguamish Clean Water District Report.
- Trepanier Engineering, February 1995, *Revised Water System Plan for Wilderness Ridge Community Club, Inc.*
- Washington State Department of Health, obtained October 2, 2012, Water System File documents for Camp Brotherhood Water System.
- Washington State Department of Health, obtained October 2, 2012, Water System File documents for Lake McMurray Recreational Resort Water System.