

Watershed Management Plan for Western Water Resource Inventory Area 29 (Western WRIA 29)



**Adopted by the Western WRIA 29 Planning Unit
December 14, 2005**

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Prepared by Sound Resolutions, Cascadia Consulting Group, and Advanced Planning Solutions



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Acknowledgments

The following table lists the Planning Unit members at the time of plan approval. A table of additional, past members who have contributed to the development of this watershed plan can be found on the following page. Primary credit and many thanks belong to the members who volunteered countless hours of time and contributed invaluable knowledge and expertise.

Kari Fagerness and Harpreet Sandhu, both formerly of the Skamania County Department of Planning and Community Development, initiated the WRIA 29 planning process in 1999. Karen Witherspoon, who replaced Ms. Sandhu as the Department's Director in 2001, participated in and oversaw the planning process to its completion. The Skamania County Commissioners from 1999 to 2005 supported the WRIA-wide and Western WRIA 29 watershed planning efforts.

Charly Boyd took over from Ms. Fagerness as the watershed coordinator and Planning Unit facilitator for the County in autumn 2000. Ms. Boyd left the County in November of 2005, but she continued to coordinate Western WRIA 29 watershed planning as a contractor (Advanced Planning Solutions) through completion of Phase 3.

Susan Gulick of Sound Resolutions was hired in December of 2003 to manage the plan-writing consultant team and to facilitate Planning Unit discussions and negotiations. She continued as facilitator for the Western WRIA 29 Planning Unit through completion of Phase 3.

Peter Erickson of Cascadia Consulting Group was the primary plan writer, with contributions from Marley Shoaf, Christy Shelton, Laura Blackmore, Susan Gulick, Charly Boyd, and Planning Unit members of both the WRIA-wide and Western WRIA 29 Planning Units.

WESTERN WRIA 29 PLANNING UNIT MEMBERS

Interest Group	Primary Representative	Alternate Representative
Citizen	Bruce Scherling	
Citizen	Anita Gahimer-Crow	Speros Doulos
City of Stevenson	John Granholm	Mary Ann Duncan-Cole
Department of Ecology	Scott McKinney	Dave Howard
Environmental Interests	Susan James	
Land Developers	Leroy Goodrich	Tim O'Mahoney
Lower Columbia Fish Recovery Board	Jeff Breckel	Steve Manlow
Recreation Interests	Paul Newell	W.D. Truitt
Skamania County	Jim Richardson	Karen Witherspoon
Skamania Public Utility District	Bob Wittenberg	John Shields
Timber Interests	Jon Cole	
Underwood Community Council	Tim Counihan	
Underwood Conservation District	Jim White	Sherry Penney
United States Forest Service	Bengt Coffin	
Wind River Watershed Council	Dan Gunderson	
Yakama Nation	Lee Carlson	

WRIA 29-WIDE PLANNING UNIT MEMBERS

The following people served as Planning Unit representatives for the past, WRIA-wide Planning Unit effort, and in that capacity they contributed greatly to the development of this watershed plan.

Interest Group	WRIA-Wide Primary Representative	WRIA-Wide Alternate Representative	Past WRIA-Wide Representatives
Agriculture	Kelly Krepps	Mike Sandlin	
Cattlemen	Dan Frey		
Citizen – Skamania County	Bruce Scherling	Susan James	Janet Corsale
Citizen – Klickitat County	Rick Graves	Fred Childs	Brooks Heard
Citizen – At Large	George Mersereau	Mary Stadd	Amy Mann
City of Stevenson	John Granholm	Mary Ann Duncan-Cole	
City of White Salmon	Wil Keyser	Joe Balsiger	Jim Jans, Tom Smith
Department of Ecology	Scott McKinney	Dave Howard	Tom Loranger
Environmental Interests	Jim Minick	Mike Rockwell	Dennis White
Husum/BZ Community Council	Ken Burrill	Jerry Smith	
Irrigators	Robert Schmid	Terry Schmid	
Klickitat County	Jim Rhoads	Curt Dreyer	Brian Frampton, Jeff Spencer, Don Struck
Lower Columbia Fish Recovery Board	Jeff Breckel	Phil Trask	Melody Tereski, Gary Wade
Mining	Jim Fritchey	Kris Kreps	
Port of Skamania County	Keith Chamberlain	Anita Gahimer-Crow	
Recreation Interests	Bill Anderson	Rex Johnston	Jim Rhoads
Skamania County	Jim Richardson	Karen Witherspoon	Bob Talent, Al McKee, Harpreet Sandhu
Skamania County PUD	Bob Wittenberg	John Shields	Tom Vance
Snowden Community Council	Sherry Penney	Chris Connolly	
Timber Interests	Jon Cole	Steve Hansen	Chris Lipton
Trout Lake Community Council	Monte Pearson	Patricia Arnold	Denise Heard
Underwood Community Council	Ed LaMotte	Tim Counihan	Robin Schrock
Underwood Conservation District	Jim White	Paul Newell	Katherine Skinner, Larry Williams, Susan James
US Forest Service	Bengt Coffin	Nancy Ryke	Diane Rubiaco, Gregg Cox
White Salmon River Watershed Management Committee	Steve Stampfli		
Wind River Watershed Council	Dan Gundersen	Bill Thorson	
Yakama Nation	Lee Carlson		

Table of Contents

EXECUTIVE SUMMARY	3
The Watershed Planning Process	3
Key Findings in Western WRIA 29	4
Recommendations for Western WRIA 29's Water Resources	5
1. INTRODUCTION AND BACKGROUND.....	7
1.1. Watershed Planning	7
1.2. The Western WRIA 29 Planning Unit.....	8
1.3. Document Organization.....	9
2. WATER RESOURCES OF WESTERN WRIA 29	11
2.1. Description/Location/Characteristics	11
2.2. Existing Conditions.....	12
2.3. Issues	18
2.4. Options and Recommendations	23
3. ROCK CREEK SUB-BASIN	50
3.1. Description/Location/Characteristics	50
3.2. Existing Conditions.....	52
3.3. Issues	54
3.4. Options and Recommendations	55
4. WIND RIVER SUB-BASIN	59
4.1. Description/Location/Characteristics	59
4.2. Existing Conditions.....	61
4.3. Issues	66
4.4. Options and Recommendations	68
5. LITTLE WHITE SALMON RIVER SUB-BASIN	74
5.1. Description/Location/Characteristics	74
5.2. Existing Conditions.....	76
5.3. Issues	78
5.4. Options and Recommendations	79
6. WESTERN TRIBUTARIES TO THE COLUMBIA RIVER.....	81
6.1. Description/Location/Characteristics.....	81

6.2.	Existing Conditions.....	81
6.3.	Issues	83
6.4.	Options and Recommendations.....	83
7.	SUMMARY OF RECOMMENDATIONS	85
7.1.	Top Priority Planning Unit recommendations.....	85
7.2.	Recommendations to Gather Additional Data.....	85
7.3.	Recommendations Concerning Public Education and Outreach	86
7.4.	Policy and Planning Recommendations.....	87
7.5.	Other Recommendations	88
7.6.	Recommendations to Support the Continuation of Existing Efforts	90
8.	PLAN IMPLEMENTATION	91
9.	REFERENCES.....	98
10.	APPENDICES.....	102
11.	DEFINITIONS AND ACRONYMS.....	103

Executive Summary

Western Water Resource Inventory Area (WRIA) 29 is an area of more than 450 square miles contained within southwestern Washington's Skamania County. A predominantly rural area, the watershed's largest city is Stevenson (population: 1,200). Approximately 6,000 people live in the watershed.

Western WRIA 29 encompasses several rivers and streams flowing south from headwaters southwest of Mount Adams to meet the Columbia River in the Columbia River Gorge. The largest river is the Wind River. Precipitation in Western WRIA 29 varies from over 100 inches in the Wind River and Rock Creek sub-basins to less than 60 in the Underwood area. The dominant land use in the watershed is forestry, although areas of agriculture and rangeland also exist.

Western WRIA 29 contains several smaller divisions, termed *sub-basins*, which are considered individually in this watershed plan:

- Rock Creek
- Wind River
- Little White Salmon River; and
- Western Tributaries to the Columbia River.

This *Watershed Management Plan* contains a separate chapter and separate recommendations for each sub-basin, in addition to a chapter devoted to Western WRIA 29 as a whole.

THE WATERSHED PLANNING PROCESS

In 1998, the Washington State Legislature passed the Watershed Management Act. This law focuses on addressing water quality, water quantity, fish habitat, and instream flow at the local level. Under the act, the state grants funding to a Planning Unit, consisting of public agencies and non-governmental members, in each watershed. In Western WRIA 29, the Planning Unit consists of a broad mix of interested parties, from Skamania County, the City of Stevenson, and Yakama Nation to local community and watershed councils, citizen representatives, and numerous other interests related to conservation, timber, development, recreation, the environment, and other concerns. The WRIA 29-Wide Planning Unit worked together on watershed planning from autumn 1999 until June 2005, when – due to unresolvable points of disagreement – the group agreed to end WRIA-wide planning. The group then restructured to limit its focus to Western WRIA 29, excluding all of Klickitat County, the White Salmon River, and Jewett, Catherine, and Major Creeks – all of which are in eastern WRIA 29. The restructured Planning Unit met from September through December 2005 to complete this Western WRIA 29 Watershed Plan. The Planning Unit adopted this Western WRIA 29 Watershed Plan, which is intended to guide future water resource management in the watershed, in December, 2005.

KEY FINDINGS IN WESTERN WRIA 29

As part of its watershed planning process, the original WRIA 29 Planning Unit conducted or commissioned several scientific assessments of the entire WRIA's water quantity, water quality, fish habitat, and instream flow. These assessments provide a scientific foundation for watershed planning and identify the following conditions pertaining to Western WRIA 29.¹

- **Overall, appropriate surface and groundwater quantity and quality data are limited in Western WRIA 29.** Lack of appropriate data limits the Planning Unit's ability to identify issues in the watershed and to plan for adequate water quantity, water quality, habitat, and instream flow.
- **In most streams, the present supply of surface water appears adequate** to support existing municipal, domestic, irrigation, industrial, and other out-of-stream water uses. However, lack of data and analysis makes it difficult to know for certain if adequate water is available for existing or additional uses; lack of data also limits the ability of researchers to determine whether enough water remains in the streams to meet fish needs. Concern exists regarding the supply of sufficient, clean water in the Carson area, as well as in several small undocumented, grandfathered, community water systems serving many of Western WRIA 29's residents.
- **In most streams, water quality meets standards.** Relatively low population, few sources of pollution, and the high proportion of public forested lands likely account for the relatively high quality of Western WRIA 29's water resources.
- **High water temperatures have been measured in several Western WRIA 29 streams,** including streams in the Wind River and Little White Salmon River sub-basins. High stream temperatures can be harmful to salmon and other aquatic organisms. The Washington State Department of Ecology has recently completed a water clean-up plan called a TMDL for temperature in the Wind River sub-basin.
- **Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many Western WRIA 29 streams.** Natural and anthropogenic sources of sediment in Western WRIA 29 contribute to high levels of stream sediment, which affects water and habitat quality for fish and other aquatic organisms. In addition, Western WRIA 29 streams manifest sedimentation problems by depositing sediment at the stream mouths and depositing fine sediments in spawning habitat and in pools.
- **Western WRIA 29 supports anadromous and resident fish,** including steelhead, coho salmon, chum salmon, chinook salmon, sea-run cutthroat trout, resident cutthroat trout, rainbow trout, bull trout, and Pacific lamprey. Natural and artificial barriers to fish migration (including waterfalls, dams, road crossings, etc.), Eurasian watermilfoil (*Myriophyllum spicatum*), low amounts of large woody

¹ All of the scientific work completed in WRIA 29 addressed all sub-basins in the full WRIA, including those that are excluded from this plan (i.e., the White Salmon River sub-basin, the Jewett, Catherine, and Major Creeks sub-basin, and the eastern portion of the Tributaries to the Columbia sub-basin). This watershed plan still relies on the existing science, but draws findings and information from the portions of those documents that pertain to the sub-basins addressed herein as Western WRIA 29: Rock Creek, Wind River, Little White Salmon River, and Western Tributaries to the Columbia sub-basins.

debris, high water temperatures, increased quantities of fine sediment, and reduced quantities of spawning gravels, among other factors, limit the extent and quality of salmon habitat in Western WRIA 29.

The Planning Unit considered the above conditions, together with numerous other issues identified by the group or by the scientific literature, in developing recommendations for Western WRIA 29.

RECOMMENDATIONS FOR WESTERN WRIA 29'S WATER RESOURCES

The Planning Unit considered dozens of options to address the key issues it identified in the watershed. After reviewing these options, the Planning Unit developed 55 final recommendations, which were adopted by consensus on December 14, 2005. The Planning Unit's recommendations are divided into five categories outlined and summarized below.

- **Collect more water quality and water quantity data.** The Planning Unit's top overarching recommendation is to collect appropriate surface and groundwater-quality and quantity data in an organized manner in the Western WRIA. In particular, the Planning Unit would like to implement those portions of the groundwater and surface-water monitoring strategies, developed in 2004, that pertain to Western WRIA 29. An additional 12 recommendations concerning data collection on topics such as hydraulic continuity, aquifer recharge, hydrographs, fecal coliform, water temperatures, erosion, and sedimentation were adopted.
- **Pursue public education and outreach** – 5 recommendations, on topics such as water conservation, water quality, land stewardship, sewer and septic systems, and problem culverts;
- **Consider or encourage new policy or planning efforts** – 14 recommendations, on topics such as incentives for water conservation, use of captured rainwater, stormwater, sewer and septic systems, and road maintenance; and
- **Support the continuation of existing efforts** – 9 recommendations supporting a variety of existing groups and efforts; as well as
- **Other recommendations** – 14 additional recommendations on a variety of topics.

All of the recommendations, as well as each option considered, are discussed further in the full *Watershed Management Plan*.

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1. Introduction and Background

This document is a watershed management plan for the western portion of Water Resource Inventory Area 29. Located in southwestern Washington State, Western WRIA 29 includes several sub-basins that flow south from headwaters southwest of Mount Adams to meet the Columbia River in the Columbia River Gorge. Compared to many other WRIAs in Washington, Western WRIA 29 has a small population and waterways with relatively clean, abundant water.

This document will describe the present state of the watershed; issues and concerns that have been identified in the watershed; and recommendations for improving the water quantity, water quality, aquatic habitat, and instream flows in Western WRIA 29.

1.1. WATERSHED PLANNING

Communities, industry, agriculture, cultures, and aquatic life all depend on reliable supplies of clean water. Yet in many areas of Washington, water quantity, water quality, and fish and wildlife habitat are threatened. To address these concerns, the State Legislature passed the Watershed Management Act in 1998. This Act provides a framework for local citizens, interest groups, and government organizations to identify and solve water-related issues collaboratively in each of 62 Water Resource Inventory Areas (WRIAs) delineated throughout the state. In its essence, the Act requires WRIAs throughout the state to determine the status of their water resources and plan for future management.

The Act (and its amendment in 2003) identified the following stages to Watershed Planning.

- **Phase I – Assemble a Planning Unit.** The Watershed Planning Act enabled specific local governments to initiate watershed planning by forming local groups, termed *Planning Units*, to conduct the planning.
- **Phase II – Assemble the available science into Technical Assessments.** The following technical documents were completed or commissioned by the WRIA 29-Wide Planning Unit, and are incorporated into this Western WRIA 29 Watershed Management Plan by reference: the *Level 1 Water Quantity and Quality Assessment* (Envirovision, 2003), the *Level 1 Habitat Assessment* (WRIA 29 Habitat Committee, 2003), the *Level 1 Instream Flow Assessment* (WRIA 29 Instream Flow Committee, 2004), the *WRIA 29 Long-Term Groundwater Monitoring Strategy* (Envirovision, 2004a), the *WRIA 29 Surface Water Monitoring Strategy* (Envirovision, 2004b), the *WRIA 29 Water Rights and Use Assessment* (Envirovision 2004c), and the *Lower Wind River Aquifer Recharge Study* (Yinger, 2004).
- **Phase III – Develop a Watershed Plan and make recommendations.** Third, Planning Units are directed to identify key issues in the watershed, develop alternative strategies to address them, and make recommendations in the form of a Watershed Plan, such as this document.
- **Phase IV – Implement the Watershed Plan.**

This document represents the culmination of Phases I, II, and III of the watershed planning process in Western WRIA 29.

1.2. THE WESTERN WRIA 29 PLANNING UNIT

In accordance with the Watershed Planning Act, the WRIA 29 Planning Unit was formed to conduct watershed planning in the Wind and White Salmon Rivers Water Resource Inventory Area. In September, 2005, the Planning Unit was restructured to focus on Western WRIA 29 exclusively (including the Rock Creek, Wind River, Little White Salmon, and Western Tributaries to the Columbia sub-basins). This restructuring was necessary after select members from the eastern portion of the WRIA blocked approval of the full WRIA 29 plan in June, 2005.

Table 1, below, lists the interests represented on the Western WRIA 29 Planning Unit; these interests have participated in the process that created this watershed plan. Please note that Skamania County serves as the lead agency for watershed planning in Western WRIA 29, as it did for the full WRIA 29 between 1999 and September, 2005.

Table 1. Western WRIA 29 Planning Unit Members

Government Members	Non-Government Members
City of Stevenson	Citizen (two positions)
Lower Columbia Fish Recovery Board	Environmental Interests
Skamania County (Lead)	Land Developer Interests
Skamania County Public Utility District	Recreation Interests
United States Forest Service	Timber Interests
Washington State Dept. of Ecology	Underwood Community Council
Yakama Nation	Underwood Conservation District
	Wind River Watershed Council

This watershed plan was approved by the Western WRIA 29 Planning Unit by consensus on December 14, 2005.

Once a plan has been approved by the Planning Unit and adopted by the County commissioners, the Planning Unit members can begin implementing the recommendations. The Watershed Planning Act requires state agencies and counties to implement any obligations agreed to in the plan. Obligations of other organizations are not legally binding, but formal agreements with other parties can be enacted to ensure that participants satisfy their agreed-upon obligations under this plan.

For more information on the watershed planning process in Washington, please refer to the Department of Ecology's website on watershed planning at <http://www.ecy.wa.gov/watershed>.

1.3. DOCUMENT ORGANIZATION

This document is organized primarily geographically, with five key, geographically defined chapters. Readers who are interested primarily in a particular region of Western WRIA 29 may wish to focus on the corresponding chapter. Please see the map of the watershed on the following, inserted page for reference. All readers are encouraged to read Chapter 2 - Water Resources of Western WRIA 29 because many of the issues and options in Western WRIA 29 are region-wide rather than occurring only in one sub-basin. The key, geographically defined chapters are as follows:

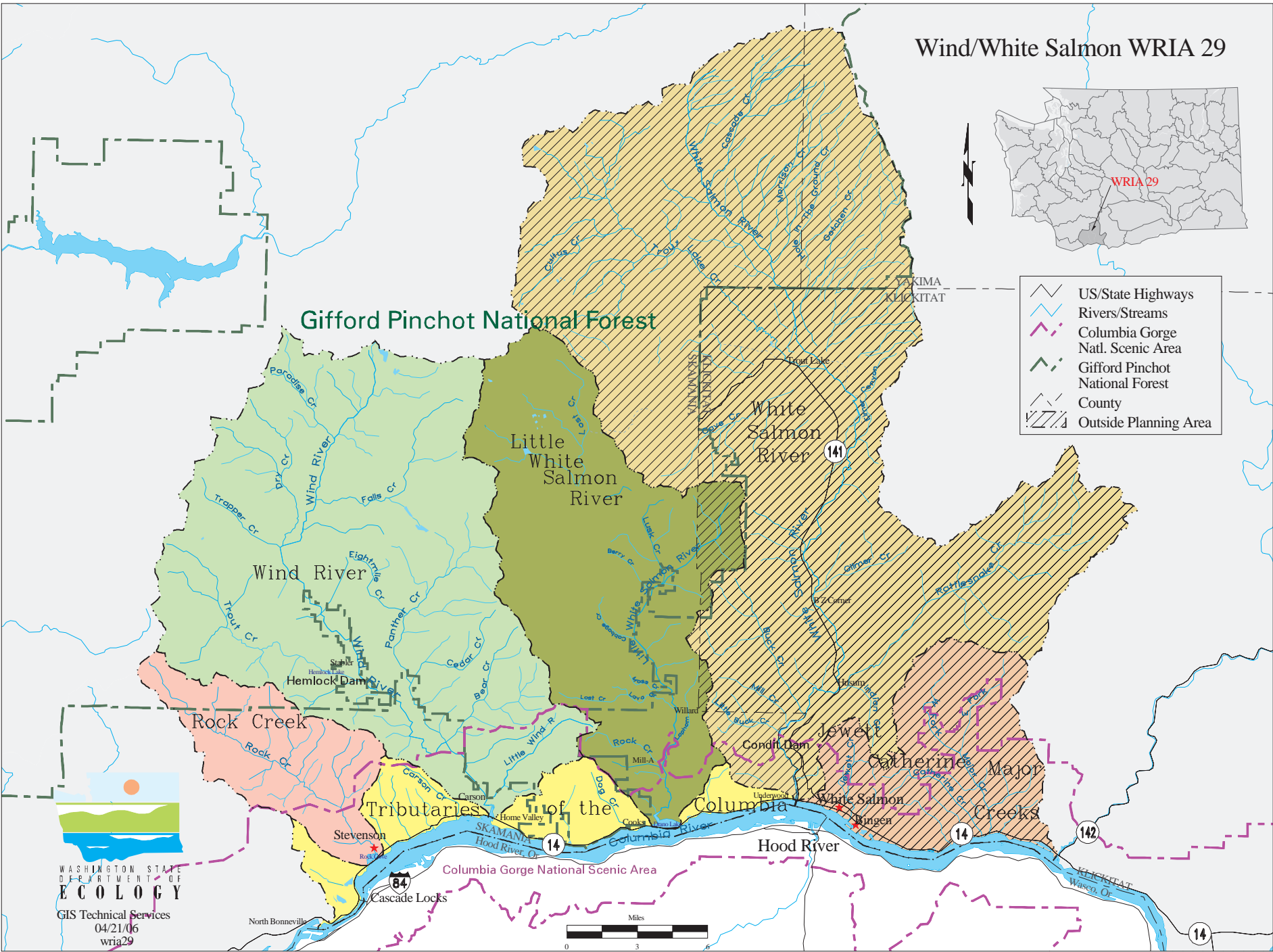
- **Chapter 2 – Water Resources of Western WRIA 29** provides an overview of Western WRIA 29, describes the existing conditions of the watershed as a whole, and identifies key issues, options, and recommendations that apply to the Western WRIA in general rather than to specific sub-basins.
- **Chapter 3 – Rock Creek Sub-basin** discusses the existing conditions, issues, options, and recommendations specific to the Rock Creek sub-basin.
- **Chapter 4 – Wind River Sub-basin** discusses the existing conditions, issues, options, and recommendations specific to the Wind River sub-basin.
- **Chapter 5 – Little White Salmon River Sub-basin** discusses the existing conditions, issues, options, and recommendations specific to the Little White Salmon River sub-basin.
- **Chapter 6 – Western Tributaries to the Columbia River** discusses the existing conditions, issues, options, and recommendations specific to the numerous small Columbia River Western tributaries present in Western WRIA 29 that are not contained within another sub-basin.

Finally, this watershed plan includes **Chapter 7 – Recommendations**, which summarizes all of the Planning Unit's recommendations, and **Chapter 8 – Implementation**, which describes how this plan will be implemented. In addition, a list of several technical documents completed by or for the WRIA 29 Planning Unit can be found in the appendix.

Wind/White Salmon WRIA 29



- US/State Highways
- Rivers/Streams
- Columbia Gorge Natl. Scenic Area
- Gifford Pinchot National Forest
- County
- Outside Planning Area



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2. Water Resources of Western WRIA 29

2.1. DESCRIPTION/LOCATION/CHARACTERISTICS

Western WRIA 29, located in southwestern Washington State, encompasses several sub-basins flowing south from headwaters southwest of Mount Adams to meet the Columbia River in the Columbia River Gorge. A predominantly rural area, the watershed's largest city is Stevenson (population: 1,200). In this report, individual watersheds will be discussed under one of four sub-basins, listed below.

- The **Rock Creek sub-basin** is the smallest and westernmost sub-basin in Western WRIA 29. It receives the highest annual rainfall and serves as the domestic water source for the City of Stevenson.
- The **Wind River sub-basin** is the largest sub-basin in the western half of the WRIA. Major tributaries to the Wind River include Trout Creek and Panther Creek. The Wind River sub-basin includes the community of Stabler as well as a part of the community of Carson.
- The **Little White Salmon River sub-basin** is the easternmost sub-basin in Western WRIA 29 and includes the communities of Willard and Mill A.
- The **Western Tributaries to the Columbia River sub-basin** contains numerous smaller tributaries to the Columbia River that lie within Western WRIA 29, but not within any of the sub-basins described above. Although this sub-basin comprises only a small portion of the area of Western WRIA 29, it contains a large fraction of its population, including the majorities of both Stevenson and Carson.

Volcanoes have had a profound impact on the topography and geology of Western WRIA 29. Numerous episodes of volcanic eruptions over the past several million years formed the bedrock of Western WRIA 29 and the Cascade Mountains. The most recent lava flows occurred less than 400,000 years ago – very recent in geologic time. Even more recently (about 10,000 – 18,000 years ago, in the Pleistocene geologic period), large glaciers eroded the peaks of the High Cascades. Volcanic activity melted some of the glacial ice, creating mudflows that swept down the steep drainages of the mountains.

As climate change led to further glacial melting, large glacial floods (known as the Bretz glacial floods) repeatedly swept across eastern Washington and funneled through the Columbia River Gorge between 15,300 and 12,700 years ago. These floods temporarily dammed at narrow points and created still waters that deposited fine-grained sediments in the lower portions of the watershed's streams. These deposits eroded easily and only small remnants are still present in the region today.

Mean annual precipitation varies across Western WRIA 29, from more than 100 inches of precipitation per year in the Rock Creek and Wind River sub-basins to less than 60 inches per year in the Underwood area. While mean annual precipitation varies across the watershed, the seasonal patterns are fairly consistent: dry summers and wet winters. Winter storms generally bring rain to the lower elevations and snow to the higher elevations.

In some cases, warm storms cause rain to fall on snow, an event that can cause rapid snowmelt and result in high peak flows in the creeks and rivers. In many areas of the Western WRIA, rain-on-snow is a dominant form of precipitation and a major influence on streamflow. For example, rain-on-snow is the dominant form of precipitation in an estimated 46% of the area of the Wind River sub-basin and 44% of the area in the Rock Creek sub-basin. Rain-on-snow events contribute to peak streamflows in the winter; melting snow and ice may then produce additional peak flows in the spring.

2.2. EXISTING CONDITIONS

This section summarizes the existing conditions of Western WRIA 29 in terms of water quantity, water quality, habitat, and instream flow. Most of the information presented in this section was summarized from Envirovision's *Level 1 Water Quantity and Quality Assessment* (2003), the *WRIA 29 Habitat Committee's Level 1 Habitat Assessment* (2003), and the *WRIA 29 Instream Flow Committee's Level 1 Instream Flow Assessment* (2004).

2.2.1. WATER QUANTITY

In most cases, the present supply of surface water (i.e., streams and lakes) in Western WRIA 29 is adequate to support existing out-of-stream water uses, although the adequacy of instream flows for meeting fish needs has not been determined. Comparisons of consumptive water allocations with existing streamflow records indicate that even in low-flow (drought) years there is generally enough water in the streams to support existing consumptive allocations (Envirovision, 2003).

Low-flow problems may exist in some tributaries that are not fed significantly by snowmelt and where there is not an adequate supply of groundwater. Under low-flow conditions, there may be sufficient water to meet water rights, but the resultant withdrawal of that water can cause significant water quality and aquatic habitat issues (Lee Carlson, Yakama Nation, WRIA 29 Work Session, May 4, 2004). Flow data would be required before it could be determined whether these low-flow conditions are partially caused by water withdrawals or are largely natural. The long-term effects of global climate change may have significant impact on the ability of snowpack to supply water with the same timing and quantity as in the previous century (UW Climate Impacts Group, 2004).

Perhaps the biggest immediate challenge facing Western WRIA 29's water quantity is the need for more data on stream flows and aquifer capacity and a better understanding of existing water uses and diversions. In addition, almost no groundwater-quantity information is available; current surface-water quantity data are very limited; and there are potential water-right and water-use conflicts that are poorly understood (Envirovision, 2003). New data would also be useful to help process the existing water-right applications in Western WRIA 29.

2.2.2. WATER QUALITY

Generally, water quality in Western WRIA 29 meets state standards.² Low population, few point and non-point sources of pollution, and the high proportion of public forested

² For detailed information on State water quality standards, please see the Department of Ecology's Water Quality Program web page at <http://www.ecy.wa.gov/programs/wq/standards/index.html>.

lands in the watershed likely account for the relative lack of water-quality problems (Envirovision, 2003). Some water quality problems do exist, however. For example, high temperatures³ have been measured in a number of tributaries located in the Wind and Little White Salmon sub-basins and episodic turbidity problems occur in the Wind and Little White Salmon sub-basins.

Still, little surface or groundwater-quality data are available to document the existing condition of the water or to evaluate potential impacts. In general, systematic data-collection efforts have focused primarily on temperatures in the Wind River sub-basin. Until recently, these efforts were primarily limited to stations located near the mouths of streams. The Underwood Conservation District (UCD), US Forest Service, and US Geological Survey – Biological Research Division are currently implementing a more extensive monitoring program in the Wind River sub-basin that includes multiple sites in key tributaries. The data record for UCD and partner efforts, however, is still relatively small, and so the only long-term consistent surface water-quality dataset in Western WRIA 29 is the temperature monitoring that has been conducted by the US Forest Service for the past two decades at key locations in the watershed. Furthermore, the ongoing UCD efforts are dependent on temporary Bonneville Power Administration restoration funds and therefore do not in themselves constitute a long-term water-quality monitoring strategy.



Staff of the Underwood Conservation District and U.S. Forest Service collecting water quality samples.

In the other sub-basins, some temperature-monitoring has been conducted in streams on the national forest. These systems are generally located in the upper portions of the sub-basins, but in general little or no water quality data are available elsewhere in those sub-basins (Envirovision, 2003). In addition to the quantitative data that has been collected by the Forest Service, qualitative evaluations are available for a number of tributaries or sub-basins through Watershed Analyses done by the USFS (see USFS, 1995; USFS, 2000; and USFS, 2001). While these provide excellent information on problem sources and potential solutions, they do not allow for comparison to standards or long-term trends (Envirovision, 2003).

Characteristic Uses

As of July 1, 2003, the Washington State Department of Ecology (Ecology) began basing its water-quality standards on the designated uses of each water body, rather

³ At the time the *Water Quantity and Water Quality Level 1 Technical Assessment* was conducted, State Water Quality standards for temperature were 18°C (64°F) for Class A waters and 16°C (61°F) for Class AA waters. On July 1, 2003, the Department of Ecology began basing its water quality standards on *Characteristic Uses* rather than water-body Class, as described on page 13. Because all Western WRIA 29 sub-basins are classified as core rearing habitat for salmon and trout, the new temperature standard specifies that a seven-day average of daily maximum temperatures must not exceed 16°C (61°F) (Washington State Dept. of Ecology, 2003a).

than on prior classification methods (i.e., AA, A, B, C, or Lake classes). Accordingly, Ecology has assigned characteristic uses to water bodies in Western WRIA 29. One important feature of this new system is that it allows water-quality standards for each water body to be based on the uses that can actually be supported. For example, a water body can be protected as a high-quality recreation area without also needing to be protected as a salmon spawning area if the salmon spawning use is neither existing nor attainable (Washington State Dept. of Ecology, 2003b). Characteristic uses may be revised for a given water body through a process set by Ecology. Ecology has identified the following characteristic uses for sub-basins of Western WRIA 29.

Table 2: Characteristic Uses Assigned by the Washington State Department of Ecology to Western WRIA 29 (Washington State Department of Ecology, 2003a)⁴

Uses	Use Designation	Rock Creek	Wind River	Little White Salmon River
Aquatic Life Uses	Core Salmon/Trout ⁵	X	X	X
	Non-Core Salmon/Trout ⁶	X	X	X
	Warm Water Species	X	X	X
	Salmon/Trout Rearing	X		
Recreational Uses	Extraordinary Primary Contact ⁷	X	X	X
	Primary Contact ⁸	X	X	X
Water Supply Uses	Domestic Water	X	X	X
	Industrial Water	X	X	X
	Agricultural Water	X	X	X
	Stock Water	X	X	X
Miscellaneous Uses	Wildlife Habitat	X	X	X
	Harvesting	X	X	X
	Commerce/Navigation	X	X	X
	Boating	X	X	X
	Aesthetics	X	X	X

2.2.3. HABITAT

Natural barriers may block upstream fish migration in many of the rivers and streams in Western WRIA 29. In many cases, waterfalls are present only a short distance upstream from confluences with the Columbia River. Other upstream waterfalls may

⁴ Information in this table is summarized from the WRIA 29 Habitat Level 1 Assessment (WRIA 29 Habitat Committee 2003). No information was available that is specific to the Tributaries to the Columbia River sub-basin.

⁵ *Core Salmon/Trout* is a use that refers to the protection of spawning, core rearing, and migration of salmon and trout, and other associated aquatic life. The term *core* is not presently defined by the Department of Ecology, although they are working on developing a definition with the EPA.

⁶ *Noncore Salmon/Trout* is a use that refers to the protection of spawning, noncore rearing, and migration of salmon and trout, and other associated aquatic life. The term *noncore* is not presently defined by the Department of Ecology, although they are working on developing a definition with the EPA.

⁷ *Extraordinary Primary Contact* means waters that provide extraordinary protection against waterborne disease or that serve as tributaries to extraordinary quality shellfish harvesting areas.

⁸ *Primary Contact* refers to activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

also block or significantly reduce fish passage, as do human-made barriers such as Hemlock Dam on Trout Creek, a Wind River tributary.

Stream surveys have been conducted on most fish-bearing streams on national forest lands within Western WRIA 29. These surveys have quantified habitat conditions and many streams have multiple stream surveys over time allowing for some temporal comparison of habitat conditions. These data are available at the Mt. Adams Ranger District. Specific observations regarding the quality of fish habitat in streams that are on private or state owned lands in Western WRIA 29 are more limited. The Wind River sub-basin has the most information, and a moderate amount of information is available pertaining to the Little White Salmon River sub-basin. Little to no data are available for the Rock Creek sub-basin and the Columbia River tributaries not included in one of the five other sub-basins.

Available information indicates that most Western WRIA 29 streams contain low levels of large woody debris (LWD) and spawning gravels (LCFRB, 2004). Eurasian watermilfoil (also known simply as milfoil) is also a notable problem in backwater areas of the Columbia, especially in the mouths of the Little White Salmon River, the Wind River, and Rock Creek (Pfauth and Sytsma, 2004).



Two boys from a Stevenson Elementary School class plant western red cedar at Kanaka Creek in Stevenson

The streams of Western WRIA 29 support anadromous and resident fish, including steelhead (winter and summer), coho salmon, chum salmon, chinook salmon, sea-run cutthroat trout, resident cutthroat trout, rainbow trout, bull trout, and Pacific lamprey.

The Wind River system supports the largest anadromous salmonid population in Western WRIA 29 (WRIA 29 Habitat Committee, 2003). The Wind River system – and in particular Tout Creek – continues to support a run of wild steelhead (Bengt Coffin, USFS, comments submitted November 2005).

Several of the fish species present in Western WRIA 29 are listed under the federal Endangered Species Act. Table 3 identifies the species and stocks listed, their status, and the date of listing.

Table 3: Western WRIA 29 Fish Species Listed Under the Federal Endangered Species Act

(WRIA 29 Habitat Committee, 2003 and

Dave Howard, Department of Ecology, comments submitted November 2005)

Species	Stock	Status	Date
Coho	Lower Columbia River/Southwest WA ESU	Threatened	8/05
Chinook	Lower Columbia River ESU	Threatened	3/99
Chum	Columbia River ESU	Threatened	3/99
Steelhead	Lower Columbia River ESU	Threatened	3/98
Steelhead	Middle Columbia River ESU	Threatened	3/99

Several planning processes are underway that will address fish and wildlife habitat in Western WRIA 29. The Lower Columbia Fish Recovery Board (LCFRB) completed salmon recovery planning efforts in partnership with the National Oceanic and Atmospheric Administration's Fisheries Division (NOAA Fisheries) in 2004 (LCFRB, 2005). The LCFRB has also conducted sub-basin planning⁹, in addition to undertaking activities associated with the Salmon Recovery Act. The Wind River Watershed Council is also active in Western WRIA 29 (WRIA 29 Habitat Committee, 2003).

2.2.4. INSTREAM FLOW

Water flowing in a stream is often called *stream flow*. In the context of watershed planning, the related term *instream flow* means a stream flow regime adopted as a regulation (Ecology and WDFW, 2003). An instream flow is typically a seasonally-based minimum flow rate (usually expressed in cubic feet per second, or cfs) that is set by rule to support fish habitat, although instream flows could also be set to protect water quality, recreation, or other beneficial uses that the stream provides.

Instream flows usually serve two management objectives: to determine whether and when to allow new water uses in or from a stream, and to define the minimum flows needed in each season to support habitat or other instream uses (Ecology and WDFW, 2003). Once instream flows are set by rule, they become a water right and thereby condition any water right applications made thereafter. For example, if stream flows are lower than the set instream flow, a basin may be closed to further water appropriation. However, instream flows have no effect on water rights that existed before the instream flow rule was set, as they are junior to all existing water rights at the time of their adoption (Rushton, 2003).

To recommend instream flows, Ecology directs Planning Units to identify the management objectives of the river or stream, including the statutorily protected instream resources and values present, such as salmon habitat. The Planning Unit can then evaluate the stream flows needed to provide for the resources identified; evaluate the current and future water uses in the basin; consider management alternatives for meeting the identified uses and needs; and, finally, develop instream flow recommendations. The recommendations may then be submitted to the Department of Ecology to be adopted by rule. Instream flows must be set for each day of the year and usually vary by month to protect the habitat or other resources needed at different times of the year. According to the state Watershed Planning Act of 1998 (RCW 90.82), if Planning Unit members cannot reach consensus on instream flow recommendations, Ecology can set instream flows itself, in consultation with affected Tribes.

Although no instream flow rules have been adopted in any streams in Western WRIA 29, several studies have been conducted that are relevant to the instream flow process. These include:

- **Studies of Water Quantity, Rights, and Use.** In October of 2004, the WRIA 29 Instream Flow Committee published their *Level 1 Instream Flow Assessment* (WRIA 29 Instream Flow Committee, 2004). This report compiled numerous

⁹ The LCFRB conducted sub-basin planning under the direction of the Northwest Power and Conservation Council (NPCC) and the Bonneville Power Administration (BPA).

individual data collection efforts, including exceedance curves¹⁰ for the Wind River, Trout Creek (Wind River sub-basin), and the Little White Salmon River. Additional data on water rights and use in each Western WRIA 29 sub-basin can be found in the *Level 1 Water Quantity and Quality Assessment* (Envirovision, 2003) and the *Stabler Water Quality and Quantity Study* (Kennedy/Jenks, 2003).

- **Studies of Instream Flows Required to Support Salmonid Habitat.** Two studies have directly addressed instream flow recommendations in Western WRIA 29. The first, conducted by the U.S. Geological Survey, estimated flows preferred for spawning and rearing salmon in reaches of the Wind River (Swift, 1979). The second, conducted by the Washington State Department of Ecology, estimated flows preferred for spawning and rearing salmon in Carson Creek (Western Tributaries to the Columbia sub-basin) and Rock Creek (Caldwell, 1999). Both of these studies were “toe-width” studies. Toe-width studies measure the width of a stream’s water surface at the toe, or base, of its banks. Using these measurements together with the known habitat requirements of salmonids (or other species of interest), scientists can develop recommended instream flows. This methodology often is used because it is relatively inexpensive and simpler to conduct than other methods.

These studies would be one natural starting point for efforts to set instream flows in Western WRIA 29. However, the existing information is not likely sufficient to enable instream flow recommendations (WRIA 29 Instream Flow Committee, 2004). In particular, the *Level 1 Instream Flow Assessment* concludes that the major data gap regarding instream flows in Western WRIA 29 is the lack of stream-flow information. The report also concludes that this lack of stream flow data makes it difficult to determine if flows are adequate for fish.

The City of Stevenson and the community of Carson are the two main centers where growth can occur in Western WRIA 29, due to restrictions on land development imposed by the presence of the Columbia River Gorge National Scenic Area, the Gifford Pinchot National Forest, and other state and federal lands. In the Stabler area, lands transferred to Skamania County from the USFS that were formerly part of their Wind River Nursery operations have tremendous potential for light industrial, commercial, residential and recreational use. The unincorporated communities of Home Valley, Mill A, and Underwood are also experiencing development pressure.

The proximity of the Cities of Portland, OR and Vancouver, WA has resulted in increased population growth, as well as increased visits from tourism in the Western WRIA. This is placing pressure on water supplies throughout the Western WRIA and is especially a concern for the City of Stevenson and the Skamania County PUD #1 Carson Water System since they are the largest city and the largest water purveyor in the Western WRIA. Both water purveyors are currently planning for expansion to accommodate growth and both rely on surface water withdrawals for their water supply; the City withdrawals from La Bong Creek, a Rock Creek tributary, and the PUD withdrawals from Bear Creek, a Wind River tributary. Planning is also underway to transfer surface water rights to groundwater to aid development of a portion of the former Wind River Nursery lands in Stabler, and the Home Valley, Mill A, and

¹⁰ Exceedance curves, similar to hydrographs, are plots of streamflow values throughout the year that are expected to be exceeded a specific percentage of the time. For example, if a 90% exceedance curve showed a flow of 10 cfs on January 1, it would indicate that in 90% of the years stream flow on January 1 would be greater than 10 cfs.

Underwood water systems are currently looking into how they can accommodate anticipated growth.

In planning for the expected population rise and the hard-to-measure impacts of tourism, Stevenson has determined it will need to increase its water rights and supply in the near future.

The Carson Water System situation is currently at a critical point. In late 2004, the Washington State Department of Health notified the PUD that it was exceeding its current Bear Creek water right and a moratorium on new connections to the system was enacted. The PUD has since repaired leaks and implemented other conservation measures. Groundwater is the PUD's preferred water source and it has drilled two new wells in an attempt to increase its available water supply. Unfortunately, both wells had to be abandoned due to bacteria contamination (primarily fecal coliform) and inadequate water production. Since no water has been found of a suitable quality and quantity, the moratorium on new connections is still in effect. Although the PUD continues to search for groundwater sources to meet the immediate and future needs of the Carson community, this may not be feasible. Because the Carson water situation is a recent development, it was not discussed by the Planning Unit. The PUD projects a need for a water reservation of at least 4.45 cfs (2000 gallons per minute (gpm)) from the Wind River sub-basin.

2.3. ISSUES

The Planning Unit has identified the following items as key, basin-wide issues to be addressed in this watershed plan.

- W-1. Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29** that hinder planners' ability to assess the current situation, monitor changes, and evaluate effectiveness of any implemented strategies. There have been a few quantitative studies of the degree of connectivity between surface and ground waters in the Western WRIA. The Wind River has the most water quality and quantity data, but even in this sub-basin the data are focused on surface water, and some notable data gaps exist. For example, insufficient Wind River water-quality data are available for the critical late-summer period when exceedances of water-quality parameters most often arise. Other sub-basins have few data, or in some cases they have no data (Envirovision, 2003). Lack of appropriate surface and groundwater data limits the Planning Unit's ability to identify issues in the watershed and to plan for adequate water quantity, water quality, habitat, and instream flow.
- W-2. Past measurements have resulted in several streams in Western WRIA 29 being listed on the 303(d) list of impaired water bodies.** The State of Washington is required by law under Section 303(d) of the federal Clean Water Act to assess and prepare a list of impaired water bodies. The previous 303(d) list was released in 1998, and the newest list (which in this report will be referenced as the 2004 list) was approved by the EPA in 2005. Table 4 displays a simplified summary of the 1998 and 2004 303(d) listings for Western WRIA 29.

Table 4: Summary of 303(d) Listings in Western WRIA 29¹¹
(Washington State Department of Ecology, 2005)

Sub Basin and Water Body	1998 Listing	Proposed 2004 Listing
Wind River Sub-Basin		
Bear Creek	Temp	Not Listed ¹²
Eightmile Creek	Temp	Not Listed ¹²
Trout Creek	Temp	Not Listed ¹²
Little White Salmon River Sub-Basin		
Little White Salmon River	Not Listed	Temp

Temp = Temperature

The Department of Ecology will remove water bodies from the 303(d) list once a TMDL or other form of water clean-up plan has been put in place or new data are submitted that demonstrate water-quality standards are no longer being exceeded. However, the water-quality standards were revised in July 2003, and the Department of Ecology has not yet determined the specific procedure for submitting and reviewing water clean-up plans or new data (Susan Braley, Washington State Department of Ecology, personal communication, May 4, 2004).

- W-3. Sewage treatment systems can contribute to water-quality problems.** Failed, un-permitted, or very old systems can release fecal coliform or other pollutants into the water system. At certain sites, under certain conditions, even septic systems meeting current design standards can also release fecal coliform or other pollutants. For example, in the past year the Skamania County PUD has drilled two wells in the Carson area to attempt to increase its water supply so that a moratorium on new connections imposed by the State Department of Health can be lifted. However, both wells had to be abandoned, after considerable expense, due to fecal coliform contamination of the groundwater. The WRIA 29 Lower Wind River Aquifer Study (Yinger, 2004) also found numerous wells in the Carson area and some springs near the confluence of the Columbia and Wind Rivers that were contaminated with fecal coliform (Planning Unit, 10/26/05 meeting, 2005).
- W-4. Stormwater can affect Western WRIA 29's water resources.** Development activities can cause significant changes in patterns of stormwater flow from land into receiving waters. Water quality can be affected when runoff carries sediment or other pollutants into streams, wetlands, lakes, and marine waters or into groundwater. In general, development in close proximity to streams, wetlands or other water bodies has the greatest potential for affecting water quality across the Western WRIA (LCFRB, 2005). For example, the Stabler area is of special concern because development is occurring over an aquifer with a high continuity with surface water (Kennedy/Jenks, 2003). Skamania County is currently

¹¹ Category 5 listings only for the 2004 list.

¹² Bear, Eightmile, and Trout Creek temperature listings were removed from the proposed 2004 303(d) list because the Wind River temperature TMDL plan was approved August 8, 2002.

expecting to develop a stormwater ordinance and adopt it into County code in 2005 (Tod Lefevre, Skamania County Public Works, personal communication December 21, 2004).

- W-5. Wildfires can burn vegetation and result in increased erosion.** Wildland fire, although a natural process, is a serious and growing concern in much of Western WRIA 29. Expansion of the urban interface, landscape fragmentation (caused by timber harvesting, agriculture, and roads), fire suppression, and lack of deliberate burning as formerly practiced by all inhabitants of the area means less frequent fires. Forest fuels per acre are greater now in many locations in Western WRIA 29 than they were in the past 100 to 150 years (USGS, 2003). The absence of fire alters or disrupts the cycle of natural plant succession and wildlife habitat in many areas. An intense wildfire may destroy all vegetation and the organic material in the soil may be burned away or decompose into water-repellent substances that prevent water from percolating into the soil. As a result, normal rainfall may cause unusual erosion or flooding from a burned area and heavy rain may produce destructive debris flows. Water quality and quantity can be seriously affected; the loss of a forest canopy, ground-surface cover such as needles and small branches, and the chemical transformation of burned soils make watersheds more susceptible to erosion in the short term (Planning Unit, 10/26/2005 meeting minutes, 2005).
- W-6. The Department of Ecology's water right database is out-of-date and not user-friendly.** The Department of Ecology maintains official records of water rights in Washington. Ecology also maintains a database, called the Water Right Tracking System (WRTS), containing information about water rights and claims in Washington. While the WRTS is a useful tool in assessing water rights and water use in Western WRIA 29 and other watersheds, it is not the official record, nor is it comprehensive or up-to-date.
- W-7. The Department of Ecology does not allow use of captured rainwater without a permit.** The Department of Ecology requires (RCW 90.03.010) that a water right permit be obtained before diverting or withdrawing any amount of water for beneficial use from surface or ground water supplies.¹³ Since harvesting rainwater diverts water from surface waters (e.g., ponds, lakes, and streams), an individual must technically apply for a water right permit to use captured rainwater. However, the Department of Ecology is not known ever to have pursued corrective action against any parties using captured rainwater.
- W-8. Invasive aquatic species threaten Western WRIA 29 water bodies and riparian areas.** For example, Eurasian watermilfoil (milfoil) is present in the mouths of Western WRIA 29 streams. In particular, the mouths of the Wind River, Rock Creek, and the Little White Salmon River are heavily infested with milfoil. The Department of Ecology considers milfoil to be the most problematic plant in Washington (Washington State Department of Ecology, 2003). Milfoil can dramatically alter a water body's ecology, forming very dense mats of vegetation on the surface of the water that interfere with recreational activities, create habitat for mosquitoes, deplete oxygen in the

¹³ Some exceptions apply to groundwater withdrawal.

water, clog water intake pipes, trap sediment, and decrease biodiversity. Milfoil can also affect fish habitat by impeding passage, slowing water and raising water temperatures, lowering dissolved oxygen levels, and creating wide pH fluctuations (Pfauth and Sytsma, 2004). Other species of concern include Japanese knotweed, zebra mussels, brown mudsnails, and many other non-native mussels and plants.

- W-9. Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many Western WRIA 29 streams.** Sedimentation can affect aquatic habitat as well as human uses. Sedimentation has been identified by the Planning Unit and other organizations, including the Lower Columbia Fish Recovery Board, as a concern in Western WRIA 29. Road conditions and inadequate streamside vegetation can contribute to erosion and sedimentation. Although implementation of the Northwest Forest Plan and Washington's new Forest and Fish Rules are expected to help reduce the input of sediment from forest roads and harvest practices (LCFRB, 2004), further efforts may be necessary to address sedimentation in Western WRIA 29. Increasing development in riparian corridors, road construction techniques, and forest land conversion also tend to increase the potential delivery of sediment to streams.
- W-10. Poorly designed and maintained culverts obstruct or block fish passage.** Poorly designed culverts and other impassible barriers prevent fish from reaching habitat suitable for spawning, rearing, or hiding from predators, forcing them to use less suitable habitats and exposing them to predation risks.
- W-11. Aquatic and riparian habitat has been degraded in a number of streams in Western WRIA 29.** Key habitat variables that are known to be affected in various parts of Western WRIA 29 include water temperature, sediment, instream structure, riparian and channel conditions, fish passage, nutrients, and runoff processes (Envirovision, 2003). Development of riparian areas for residential and other uses reduces streamside shade, recruitment of large woody debris to the stream, and increases the potential for introduction of sediment and other pollutants. Numerous opportunities exist to improve Western WRIA 29's fish habitat by addressing or mitigating causes of degradation.
- W-12. The Washington State Department of Natural Resources is developing a new water typing system that may under- or over-estimate fish habitat.** The Washington State Department of Natural Resources (DNR) uses a water typing system to classify and manage for the beneficial uses (e.g., fish habitat and water quality) of streams. Currently, the DNR defines and classifies stream types as 1 through 5 based on size and fish, wildlife, and human use. Recently, however, the DNR has been implementing a new water typing system based on a computer model with separate methodologies for eastern and western Washington. The computer model estimates the presence of fish habitat and classifies streams based mostly on the physical parameters of the stream, such as gradient, elevation, and presence of impassable waterfalls (Dennis McDonald, Washington Department of Natural Resources, Water Typing Project Manager, personal

communication, December 13, 2004). Some Planning Unit members are concerned that the model may under- or over-estimate fish habitat.

- W-13. Existing stream flow data are not comprehensive.** In the context of watershed planning, the term instream flow refers to a stream flow regime adopted as a regulation. An instream flow is typically a minimum flow rate that is preserved in a stream to support fish habitat, water quality, recreation, or other resources that the stream provides. Currently, instream flow regulations are not in place for any Western WRIA 29 streams. To develop these instream flows, new studies likely will be necessary to augment existing data.
- W-14. There is some concern about the watershed's ability to meet future water demands.** Although the present supply of surface water appears adequate to support existing out-of-stream uses, there is some uncertainty about the ability of Western WRIA 29's streams to meet future, growth-related demand without compromising competing in-stream (e.g., water quality, fish habitat) and out-of-stream (e.g., residential, commercial, industrial, or agricultural) uses. For example, the Stevenson and Carson areas continue to grow, placing more pressure on their existing water supplies, which come from Rock Creek and the Wind River, respectively. Urban-level growth can only occur in the designated Urban Areas of the Columbia River Gorge National Scenic Area and Carson is one of only three such areas in Western WRIA 29. It is, in fact, the largest Urban Area in Skamania County. As a result, the PUD projects a need for a water reservation set in the Wind River sub-basin, of 4.45 cfs (2000 gallons per minute (gpm)) to meet the community's current and future needs. (For more information on the existing conditions regarding instream flows in Western WRIA 29, see Section 2.2.4 of this plan, which begins on page 16. For more information on the Wind River sub-basin in particular, see Chapter 4 of this plan, which begins on page 59.)
- W-15. Reduced snowpack, increased rain-on-snow events, and conversion of forestland to other uses may alter the timing and quantity of streamflow.** Over the next few decades changing climate and weather patterns are expected to lead to reduced snowpack. Due to the dependence of some Western WRIA 29 streams on meltwater, these changes would, in turn, lead to increased winter-time flows, as more precipitation will fall as rain rather than snow, and decreased spring and summer-time flows, as snowpack is reduced. Furthermore, spring peak flows are predicted to occur two to six weeks earlier. Changes in quantity and timing of flow of this magnitude can affect the availability of water for all users (particularly agriculture), and could be detrimental to migrating juvenile salmon, which depend on cool and ample flows in the late spring for migration. Understanding how global climate change affects the Pacific Northwest's climate and water resources could help the Planning Unit more effectively manage water supplies for current and future water supply needs ((UW Climate Impacts Group, 2004). Strategic planning, such as the setting of minimum instream flows, can help reduce the negative effects of climate change on stream flows, native salmon, and humans.

- W-16. Air quality can affect water quality when air pollutants are deposited onto the surface of water bodies or land within a watershed.** Pollutants with the greatest potential to adversely affect water quality and aquatic habitat include sulfates, nitrates, and persistent bioaccumulative toxins such as mercury.

2.4. OPTIONS AND RECOMMENDATIONS

This section presents a wide variety of options for addressing water quantity, water quality, and habitat issues facing Western WRIA 29. These options were assembled by the Planning Unit for consideration; inclusion of an option in this section does not necessarily indicate its endorsement or recommendation by the Planning Unit.

OPTIONS AND RECOMMENDATIONS FOR EXPANDING OR IMPROVING DATA COLLECTION, STORAGE, OR ANALYSIS

2.4.1. IMPLEMENT THE GROUNDWATER MONITORING STRATEGY DEVELOPED IN THE LEVEL 2 ASSESSMENT

Description of Option

As part of its Level 2 Assessment, the Planning Unit contracted with Envirovision to prepare a *Long-term Groundwater Monitoring Strategy* (Envirovision, 2004a). Implementation of the *Groundwater Monitoring Strategy* would allow the Planning Unit to evaluate trends in groundwater quantity and quality and provide essential resource data for long-term management of water resources in Western WRIA 29.

Issue addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends implementation of the groundwater and surface water monitoring strategies, pertinent to Western WRIA 29, developed in the Level 2 Assessment (Chapter 7, Recommendation #1). This recommendation also applies to Option 2.4.2.

2.4.2. IMPLEMENT THE SURFACE WATER MONITORING STRATEGY DEVELOPED IN THE LEVEL 2 ASSESSMENT

Description of Option

In addition to the *Groundwater Strategy*, Envirovision has prepared a *Surface Water Monitoring Strategy* for WRIA 29 (Envirovision, 2004b). The *Surface Water Strategy* defines an approach to guide surface water monitoring in the watershed with the objective of identifying long-term trends in stream water quantity and quality. Data collected from this assessment can be used to guide future policies and support management of water resources in Western WRIA 29. The *Surface Water Strategy* also identifies optional investigative studies that the Planning Unit could implement as funding becomes available.

Issue addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends implementation of the groundwater and surface water monitoring strategies, pertinent to Western WRIA 29, developed in the Level 2 Assessment (Chapter 7, Recommendation #1). This recommendation also applies to Option 2.4.1.

2.4.3. CONDUCT HYDROGEOLOGY STUDIES TO GATHER INFORMATION ON HYDRAULIC CONTINUITY AND AQUIFER RECHARGE

Description of Option

Little information is known about the hydraulic continuity between surface water and groundwater in Western WRIA 29. Groundwater can feed surface-water streams, but streams can also provide water to groundwater. The hydraulic continuity of surface and groundwater is important information for understanding aquifer recharge as well as for other purposes such as understanding the movement of pollutants. The Planning Unit could commission hydrogeology studies to identify areas where there is high connectivity between surface water and groundwater; where groundwater enters streams (including geothermal inflow); the location of aquifer recharge areas; aquifer recharge rates; and identification of aquifer sizes and locations, similar to what was completed in the *Lower Wind River Aquifer Study* completed by Mark Yinger for Envirovision's Level 2 Assessment. Among other benefits, such studies would allow planners to ensure adequate supply of clean drinking water for future development without affecting existing water users and fish habitat.

Issue addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends hydrogeologic studies to gather information on hydraulic continuity and aquifer recharge (Chapter 7, Recommendation #2).

2.4.4. EXPAND THE FREQUENCY AND SCOPE OF WATER-QUALITY SAMPLING AND DETERMINE SOURCES OF FECAL COLIFORM

Description of Option

WRIA 29's *Surface Water Monitoring Strategy* recommends at least 8 permanent baseline monitoring stations be established in Western WRIA 29 that could form the basis of an effort to increase monitoring of fecal coliform. Additional samples could be gathered if necessary to determine the geographic sources of particular exceedances of fecal coliform standards.

Fecal coliform monitoring efforts could also include sample testing to determine the origin of the pollutant (e.g., livestock, out-of-compliance septic, and/or wildlife). Relatively inexpensive tests are available that can determine what type of animal is the source (human, livestock, bird, or wildlife) based on the ratio of two types of fecal bacteria (fecal coliform and fecal streptococcus) present in the sample. Other types of

tests, including some based on DNA, are also available; while some of these other tests may be more conclusive, they are also usually more expensive. One such DNA-based test is called *genetic finger-printing*. The number of sampling stations that should be included for this type of testing depends on the land use for each site. In general, 20-50 samples need to be taken at each site and transported to a laboratory. The cost of the genetic fingerprinting is \$7500 plus \$20 for each sample (not including costs of sample collection) (Mansour Samadpour, Institute of Environmental Health, personal communication, October 4, 2004).¹⁴ Agencies or other groups in Western WRIA 29 could work together to design and carry out a plan to identify sources of fecal coliform in the affected streams and groundwater bodies.

Issues addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1); Sewage treatment systems can contribute to water-quality problems (W-3).

Recommendation

The Planning Unit recommends expanded efforts to assess fecal coliform in areas of concern, including enhanced water-quality sampling and analyses to determine the sources of fecal coliform (Chapter 7, Recommendation #3).

2.4.5. CONDUCT A STUDY TO DETERMINE CAUSES OF HIGH STREAM TEMPERATURES

Description of Option

Elevated temperatures are documented in several Western WRIA 29 streams, and a better understanding of the causes of these elevated temperatures is needed in order to develop appropriate mitigation measures. In many cases, however, the relative contribution of several possible causes of these increased temperatures, including natural factors, is unknown. Further study may be warranted, which could include detailed analysis of temperature records collected by the USFS, UCD, and others, as well as modeling to estimate natural temperatures. In addition, the effect of water withdrawals on temperature should be considered. The Yakama Nation plans to use Forward-Looking Infrared Radar (FLIR) flights, which use infrared imagery, to measure temperature differences.

Issues addressed: Past measurements have resulted in several Western WRIA 29 streams being listed on the 303(d) list of impaired water bodies (W-2); Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends studies to determine causes of high stream temperatures (Chapter 7, Recommendation #4).

¹⁴The Institute of Environmental Health could assist the Planning Unit with source testing. Their phone number is 206-522-5432.

2.4.6. IDENTIFY SOURCES OF EXCESS SEDIMENT IN WESTERN WRIA 29 RIVERS

Description of Option

Sedimentation has been identified by the Planning Unit and other organizations, including the Lower Columbia Fish Recovery Board, as a concern in Western WRIA 29. Streams often deposit sediment when they meet the Bonneville Pool and velocities decrease. Due to the presence of the Bonneville Dam and the pool behind it, this condition is now largely unavoidable. Of equal concern is the deposition of fine sediments in spawning gravels and pools, resulting in the loss of both types of habitat. However, addressing upstream sources of excess sediment could reduce the amount of sediment deposited in these areas of concern. Sources of excess sediment in Western WRIA 29 streams include forest roads, forest harvest practices, culvert failures, and insufficiently vegetated stream banks, among others. The Planning Unit could commission or recommend a study to identify more specifically the sources of excess sediment in the streams and develop a plan to address any problems.

Issue addressed: Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many Western WRIA 29 streams (W-9); Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends identification of sources of excess sediment inputs in Western WRIA 29 rivers (Chapter 7, Recommendation #5).

2.4.7. CONDUCT IFIM OR TOE-WIDTH STUDIES OF WESTERN WRIA 29 STREAMS

Description of Option

Instream flow studies are used to recommend minimum or optimum stream flows necessary to support fish habitat. The two most common methods used in Washington include the Instream Flow Incremental Methodology (IFIM) and the toe-width method. The IFIM method is Ecology's preferred method, and it relies on a series of field measurements and computer models to predict a range of flows necessary to protect habitat resources. The toe-width method, although more narrow in scope, is also often used because it is less costly and simpler to conduct. The toe-width method relies on measurements of the width of a stream's water surface at the toe, or base, of its banks.

The Planning Unit could conduct instream-flow studies to support instream-flow planning and decision-making.

Issue addressed: Existing stream flow data are not comprehensive (W-13).

Recommendation

The Planning Unit recommends that it engage a process to determine and recommend minimum instream flows to the Department of Ecology, if funding is provided during Phase IV of watershed planning (see Option 2.4.25); decisions regarding the studies needed to complete this process have been deferred until Phase IV. If funding for instream flow studies is not available, the Planning Unit is interested in participating with

the Department of Ecology while the agency develops instream flows (Chapter 7, Recommendation #29).

2.4.8. ENCOURAGE CONTINUED RESEARCH TO IMPROVE SEPTIC SYSTEM OPERATION

Description of Option

Historically, on-site sewage treatment system designs have focused on removing fecal coliforms, suspended solids, bacteria, viruses and other similar pathogens. However, current research is documenting that these typical on-site systems have little to no treatment ability for removing nitrates, phosphorus and other trace contaminants. Trace contaminants not being removed include products such as estrogen-based birth control pills, penicillin-type medications, transplant-rejection medications, and numerous other prescription and over-the-counter pharmaceuticals. Additionally, personal care products, toiletries, cosmetics, detergents and other organic compounds also contribute complex chemicals to a growing list of trace contaminants generally not removed by typical on-site sewage treatment systems. Modern, enhanced treatment systems can be designed to remove nitrates effectively. Pressure distribution drain fields have the potential to further reduce the potential of contaminants entering the watershed or water system. This enhanced treatment comes with a substantial cost increase over traditional, gravity-type systems. Much more research is required to address the effective removal of the many other contaminants being identified in the modern sewage waste stream.

Issue addressed: Sewage treatment systems can contribute to water quality problems (W-3).

Recommendation

The Planning Unit recommends continued research to improve septic system operation (Chapter 7, Recommendation #6).

2.4.9. ENCOURAGE STUDIES TO DETERMINE EFFECTS ON NON-ESA-LISTED SPECIES.

Description of Option

The Planning Unit recognizes that there are numerous other aquatic species that are not currently listed under the Endangered Species Act (ESA) that have cultural or economic significance. These species, such as Coastal Cutthroat trout, Pacific Lamprey, freshwater Mussels, and others, are being affected by anthropogenic and natural causes, both directly and indirectly through habitat alterations.

Issues addressed: Aquatic and riparian habitat has been degraded in a number of streams in Western WRIA 29 (W-11).

Recommendation

The Planning Unit supports and encourages agencies and watershed groups to develop and conduct studies to determine the status and trends of these species throughout the WRIA and encourages projects to protect, restore, and enhance habitat or mitigate for deleterious effects (Chapter 7, Recommendation #7).

OPTIONS AND RECOMMENDATIONS FOR PUBLIC EDUCATION AND OUTREACH

2.4.10. CONDUCT EDUCATION AND OUTREACH ON WATER CONSERVATION

Description of Option

The Department of Ecology is obligated to educate the general public about water law and compliance with water law. The Planning Unit could support these efforts and work with other stakeholders to extend the education and outreach effort to include information on water conservation. Strategies could be developed for both residential users and commercial users (including agricultural users), in cooperation with the conservation districts. Education and outreach is particularly relevant to exempt well users for which financial incentives (see option 2.4.15) are not applicable.

Strategies for residential users can be challenging due to the need to capture the attention of a diverse and dispersed population. Nevertheless, education and outreach, especially when standardized and broad-based, would help encourage conservation. For example, a countywide education effort stressing water conservation and offering practical solutions could apply to both customers of public water systems as well as rural residents on individual wells. Some possible themes to consider would include low-water use gardening and lawn care practices and use of water-efficient appliances and fixtures. Simple strategies such as having homeowners place an empty tuna can in the yard to measure adequate watering can be effective at providing residents the information they need to make a change. Campaigns can also offer free or discounted water-saving products, including faucet aerators, low-flow showerheads, rain gauges, soaker hoses, hose timers, and other devices.

Issue addressed: There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit recommends education and outreach on water conservation and water quality as well as to promote a general understanding of the watershed (Chapter 7, Recommendation #14).

2.4.11. EDUCATE WATERSHED RESIDENTS ON THE BENEFITS OF MEASURING WATER USE.

Description of Option

Collecting information on water use can be useful both to the water user and to planners. Individual water users can benefit from water meters by understanding how much water they use and then measuring the success of any water conservation efforts. If the information is supplied to planners, water use data can aid in understanding typical use patterns and planning for water supply needs, as well as for measuring the success of water conservation efforts. Better water-use information also can lead to increases in the number of connections permitted on shared wells. The Planning Unit could educate watershed residents about these benefits and encourage them to meter their water use.

Issues addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1); There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit recommends education and outreach on the benefits of water metering (Chapter 7, Recommendation #15).

2.4.12. EDUCATE PRIVATE LANDOWNERS ON PROPER LAND STEWARDSHIP, INCLUDING USE AND EFFECTS OF PESTICIDES AND FERTILIZERS

Description of Option

The methods used by landowners to manage their properties can have impacts on groundwater, surface water, and fish habitat. Proper land stewardship minimizes or eliminates negative impacts through principles of resource conservation.

Education efforts could focus on practices common among landowners. Pesticides (including herbicides, insecticides, and fungicides) and fertilizers can impact water quality adversely, especially if applied near streams. Some pesticides are banned within 20 yards of salmon-bearing streams (Welch, 2004). Animal wastes, particularly from livestock, may contribute to water pollution of animals have unrestricted access to water.

Extensive education and outreach efforts have been undertaken on the topic of land stewardship in the Puget Sound region. Efforts have focused on media and promotion campaigns, which are often tied to product sales and incentives (such as Northwest Natural Yard Days); education on alternatives, such as natural slow-release fertilizers and pesticide alternatives; and watering methods to reduce pests and diseases.

The Planning Unit could encourage jurisdictions in Western WRIA 29 to undertake similar efforts.

Issue addressed: Aquatic and riparian habitat has been degraded in a number of streams in Western WRIA 29 (W-11).

Recommendation

The Planning Unit recommends education and technical assistance for public and private landowners on responsible land stewardship, including proper use and effects of pesticides and fertilizers and proper management of animal waste, particularly from livestock ((Chapter 7, Recommendation #16).

2.4.13. CONDUCT EDUCATION AND OUTREACH ON INSPECTION AND CARE OF SEPTIC SYSTEMS

Description of Option

Education and outreach efforts directed at septic tank owners throughout the watershed will likely increase interest and understanding of proper septic system care. The goal of this option is to inform residents of the importance of maintaining their septic systems as well as encourage regular inspection. The EPA has developed a suite of materials specifically for septic system education and outreach that could be incorporated into Western WRIA 29 outreach efforts (EPA, 2004b). For example, trace contaminants not

being removed include products such as estrogen-based birth control pills, penicillin-type medications, transplant-rejection medications, and numerous other prescription and over-the-counter pharmaceuticals. Additionally, personal care products, toiletries, cosmetics, detergents and other organic compounds also contribute complex chemicals to a growing list of trace contaminants generally not removed by typical on-site sewage treatment systems. The Skamania County Health Department could develop community workshops to educate septic system owners about the proper care and maintenance of septic systems. The County Health Department could incorporate existing EPA outreach materials into their workshops.

Issue addressed: Sewage treatment systems can contribute to water-quality problems (W-3).

Recommendation

The Planning Unit recommends education and outreach on the proper care of sewer and septic systems, including ongoing maintenance, the identification of problems, and the associated implications and solutions (Chapter 7, Recommendation #17). This recommendation also applies to Option 2.4.20.

2.4.14. INVENTORY AND ADDRESS PROBLEM CULVERTS

Description of Option

Poorly-designed culverts and other barriers may prevent or impede fish from reaching habitat suitable for spawning, rearing, or hiding from predators, forcing them to use less suitable habitats and exposing them to predation risks. Failed culverts can also be large sources of sediment to streams. An inventory of problem culverts could be useful for the Planning Unit to determine the extent to which culverts are affecting fish passage in Western WRIA 29. There are several habitat groups listed in Option 2.4.43 that are addressing fish passage obstructions in the watershed (WRIA 29 Habitat Committee, 2003). The Planning Unit could support the efforts of these groups and encourage the agencies to conduct inventories of problem culverts in the watershed.

Once problem culverts have been identified, the Planning Unit could encourage stakeholders, including the Washington State Department of Transportation, the USFS, counties, private landowners, railroads, residents, and volunteer groups to restore fish passages throughout the watershed (including orphaned forest roads). The Planning Unit could also encourage the groups to undertake public awareness and education campaigns on the importance of fish passage and the impacts of sedimentation. The Planning Unit could work with local governments to establish a permanent revenue stream to correct culvert barriers. The Planning Unit may also consider developing incentives to encourage private landowners to repair culverts on their property.

Issues addressed: Poorly designed and maintained culverts obstruct or block fish passage (W-10); Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many WRIA 29 streams (W-9).

Recommendation

The Planning Unit recommends that appropriate agencies in the watershed pursue funding to identify and rectify problems associated with roads, including erosion control, sedimentation, road decommissioning, and problem culverts. The Planning Unit also

recommends conducting education and outreach to private landowners to encourage them to address problem culverts, and providing them with financial assistance if available (Chapter 7, Recommendation #18).

POLICY AND PLANNING OPTIONS AND RECOMMENDATIONS

2.4.15. PROVIDE MUNICIPAL WATER USERS WITH INCENTIVES TO CONSERVE WATER

Description of Option

In the 2003 Special Session, the Washington State Legislature adopted 2E2SHB 1338, which requires all municipal water suppliers¹⁵ to establish water conservation programs. The legislation also requires the State Department of Health to establish standards for these programs by December 31, 2005. In Western WRIA 29, municipal water systems serve a significant portion of the population (Envirovision, 2003). One option for municipal water suppliers is to create incentive-based water conservation programs, which are a common and effective means of changing customer water use patterns. Consumers respond to price, and so incentives to dissuade high water use and encourage water conservation are likely to be effective. For example, municipal systems can implement rate structures that charge for the amount of water used and charge a higher rate for consumption above a certain level or during a certain period of time to encourage customers to use water more efficiently.

Following are several options for incentives for efficient water use:

- **Tiered rate structures** have a per-unit charge that increases as water consumption increases. For example, a customer could be charged a certain rate for each cubic foot of water up to a certain threshold (such as 250 gallons per day¹⁶), and a higher rate above that threshold.
- **Summer surcharges** include an additional charge for water use above a certain threshold during months when system demand is highest.
- **Rebates on water-efficient appliances, especially toilets**, help make low-flow appliances more appealing and even desirable. For example, a town on Whidbey Island offered \$200 rebates on ultra low-flush toilets and received a tremendous response. According to the mayor of Coupeville, this positive response stemmed from residents' perception that the town was participating in the solution to their water supply problem (Washington Department of Health, date unknown). Rebates could also be offered to residents on exempt wells.

Issue addressed: There is some concern about the watershed's ability to meet future water demands (W-14).

¹⁵ According to the Bill, municipal water suppliers are those that supply 15 or more residential connections, supply water used for government purposes, or supply water for other beneficial uses (such as commercial/industrial) generally associated with water use within a municipality.

¹⁶ Average domestic water use in Skamania County is estimated at 98 gallons per person per day (Lane, 2000). According to the Census Bureau, Skamania County households have an average of 2.61 people per household (U.S. Census Bureau, 2001). This implies that the average water use by a Skamania County household is 256 gallons per day.

Recommendation

The Planning Unit recommends that water purveyors consider providing municipal water users with incentives to conserve water (Chapter 7, Recommendation #19).

2.4.16. ENCOURAGE THE STATE TO ALLOW USE OF CAPTURED RAINWATER

Description of Option

According to State law, use of captured rainwater is not legal without a water right (RCW 90.03.010). The Planning Unit could collaborate with the Department of Ecology and other stakeholders to recommend that the Legislature modify existing water right laws to allow for use of captured rainwater, at least on a *de minimus* basis. As a possible model, the Island County Planning Unit (WRIA 6) has written draft options to pursue an alternate permitting process for captured rainwater (Island County WRAC, 2004).

Issues addressed: The Department of Ecology does not allow use of captured rainwater without a permit (W-7); There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit recommends that the state allow the use of small amounts of captured rainwater (Chapter 7, Recommendation #20).

2.4.17. ENCOURAGE SKAMANIA COUNTY TO ADOPT A STORMWATER PLAN OR ORDINANCE AND TO UPDATE ITS CRITICAL AREAS ORDINANCE TO MEET BEST AVAILABLE SCIENCE REQUIREMENTS

Description of Option

Stormwater management plans and ordinances can help control the quantity and quality of stormwater produced by development such that it complies with water quality standards and does not significantly impact receiving waters. To assist local jurisdictions in their efforts, the Department of Ecology has developed a *Stormwater Management Manual for Western Washington* to "provide a commonly accepted set of technical standards and guidance on stormwater management measures" (Washington State Department of Ecology, 2001). In addition, Ecology published its manual for eastern Washington in autumn 2004. Either of these documents, as well as the existing Klickitat County stormwater ordinance or stormwater management plans from other areas, could serve as useful models for efforts in Skamania County. The Skamania County Department of Public Works has conducted a stormwater study and is currently expecting to develop an ordinance and adopt it into County code in 2005 (Tod Lefevre, Skamania County Public Works, personal communication, December 21, 2004).

Issue addressed: Stormwater can affect Western WRIA 29's water resources (W-4).

Recommendation

The Planning Unit recommends that Skamania County consider adopting a stormwater plan or ordinance (Chapter 7, Recommendation #21).

2.4.18. IDENTIFY AREAS THAT NEED A COMMUNITY SEPTIC OR SEWER SYSTEM AND SUPPORT THE TRANSITION

Description of Option

Skamania County could develop criteria for identifying areas in need of either community septic or sewer systems, perhaps using Klickitat County's criteria as a model. In general, these criteria should relate to the number and duration of failing individual septic systems, the density of development in the area, and presence of elevated levels of fecal coliform in nearby waterways. Areas that may benefit from a community sewer system can be identified by their proximity to the City of Stevenson's public sewer service and failure of existing on-site septic systems.

Once these areas have been identified, the transition to the community system could be supported through the creation of a Local Improvement District (LID). A LID could be used to facilitate and fund a variety of public improvement projects, including sewer system improvements. LIDs can provide communities with affordable financing of public improvements. LIDs are established and administered according to state law and funded by property owners who will benefit from the project. Homeowners on septic systems could initiate a LID to build a community septic system or to be connected to the sewer system, if appropriate. (For detailed information, including the process to form a LID, see the City of Marysville's site on the topic: <http://ci.marysville.wa.us/lids.htm>).

Other possible funding sources include the State Revolving Loan Fund and Centennial Clean Water Fund, which provide funding to help local governments finance projects to reduce sources of water pollution by providing low interest loans and grants (Washington State Department of Ecology, 2004).

Issue addressed: Sewage treatment systems can contribute to water-quality problems (W-3).

Recommendation

The Planning Unit recommends growing communities consider establishing community septic/sewer systems (Chapter 7, Recommendation #22).

2.4.19. IDENTIFY FUNDING SOURCES TO SUPPORT SEWER AND SEPTIC SYSTEM INSPECTION AND UPGRADES

Description of Option

Several federal funding sources are available in Washington State that could be applied to sewer and septic system inspection, upgrade, and other compliance activities. Many of these sources and additional funding information are available on the website (EPA, 2004a). The following list is a brief example of possible funding opportunities.

- The EPA's **Non-point Source Implementation Grant (319) Program** provides grants to states for controlling non-point sources of pollution, such as agricultural runoff, mining activities, and malfunctioning onsite septic systems. In states where onsite systems have been identified as a significant source of such pollution, the section 319 funds may be used to construct, upgrade, or repair such systems (EPA, 2004a). The Department of Ecology administers these funds in Washington State.

- The Department of Ecology administers the **State Revolving Loan Fund and Centennial Clean Water Fund**, which provide funding to help local governments finance projects to reduce sources of water pollution by providing low interest loans and grants (Washington State Department of Ecology, 2004).
- The **National Decentralized Water Resources Capacity Development Project** is a cooperative effort funded by the EPA that identifies and funds research and development projects designed to address critical information gaps. The focus of the effort is to produce education, management and implementation tools needed to strengthen the foundations of training and practice in the field of decentralized wastewater treatment (EPA, 2004a).

The Planning Unit or the counties could research these and other funding mechanisms to support septic-system enforcement activities or other means of identifying and upgrading sewer and septic systems.

Issue addressed: Sewage treatment systems can contribute to water-quality problems (W-3).

Recommendation

The Planning Unit recommends that appropriate organizations within the watershed pursue funding in partnership with landowners, community councils, and other groups to establish incentives for sewer or septic system upgrade or repair (Chapter 7, Recommendation #23). This recommendation also applies to Option 2.4.21.

2.4.20. FACILITATE THE IDENTIFICATION OF FAILING AND OUT-OF-COMPLIANCE SEPTIC SYSTEMS

Description of Option

Current research shows that 20% to 30% of septic systems are malfunctioning. If untreated sewage comes to the ground surface or is discharged to a stream, the system is classified as failing. However, many systems' malfunctions are less severe and never show up at the surface. As a result, homeowners may be unaware that their septic systems are out of compliance and contributing to water quality problems.

The steady growth in Skamania County increases the importance of identifying failing and out-of-compliance septic systems. Currently, there is no system in place to identify these systems: the Skamania County Health Department is complaint-driven, such that a citizen must lodge a complaint about a failed drainfield before the Department may act upon it. Failed systems sometimes come to light during real-estate inspections. Ideas for ways to improve identification of failing and out-of-compliance systems include placing a tag on a property's title that specifies the operation and maintenance required to keep the property's system functioning well, or creating a new oversight entity with the authority to inspect septic systems. Education of property owners about proper operation and maintenance of systems may also help to identify malfunctioning systems and prevent new problems from occurring.

Options for incentives, education, and outreach are described in Options 2.4.21 and 2.4.13. Option 2.4.21 describes financial incentives to assist with pumping or upgrades. Option 2.4.22 encourages creation of a new ordinance requiring periodic inspection of septic systems. The Planning Unit could further recommend the State fund an

assessment of Western WRIA 29 septic systems to identify failing or out-of-compliance systems, and create an action plan to upgrade these systems.

Issue addressed: Sewage treatment systems can contribute to water-quality problems (W-3).

Recommendation

The Planning Unit supports preparation of an action plan to upgrade failing and out-of-compliance septic systems in Western WRIA 29, particularly in the Carson area (Chapter 7, Recommendation #24).

2.4.21. ESTABLISH INCENTIVES FOR SEPTIC SYSTEM UPGRADE OR REPAIR

Description of option

To encourage proper septic management practices, the Planning Unit may consider providing incentives to homeowners with failing septic systems to upgrade their systems. One possible option is to implement an incentive-based program similar to existing energy-efficiency programs. An example of this type of program is the Energy-Efficient Mortgage, which provides buyers with special benefits when purchasing an energy-efficient home or one that can be made more energy efficient through energy-saving improvements. A similar benefit could be provided to buyers purchasing a home with a septic system upgrade or to buyers who will upgrade the septic system. Another option would be to offer cost-sharing arrangements to provide direct financial assistance to landowners interested in repairing failed systems. Funds for these activities could potentially come from the sources identified in 2.4.19.

Issue addressed: Sewage treatment septic systems can contribute to water-quality problems (W-3).

Recommendation

The Planning Unit recommends that appropriate organizations within the watershed pursue funding in partnership with landowners, community councils, and other groups to establish incentives for sewer or septic system upgrade or repair (Chapter 7, Recommendation #23). This recommendation also applies to Option 2.4.19.

2.4.22. REQUIRE SEPTIC INSPECTION OR CERTIFICATION UPON THE SALE OR TRANSFER OF PROPERTY

Description of Option

Currently, health departments within Western WRIA 29 do not require the inspection or certification of septic systems upon the sale or transfer of property (Bruce Scherling, Skamania County Health Department, personal communication, September 8, 2004). Systems that are inspected during a sale are typically done so in response to requirements by the bank or mortgage company. The Planning Unit could encourage development of a law to require inspection or certification of septic systems upon the sale or transfer of property. One example is in King County where current law requires that, before closing, the seller must record a Notice of On-site Sewage System Operation and Maintenance Requirements (OSSM) at the King County Office of Records and Elections. This process acknowledges that the property is served by a septic system and describes the owner's responsibilities for maintaining the system.

Issue addressed: Sewage treatment septic systems can contribute to water-quality problems (W-3).

Recommendation

The Planning Unit recommends that Skamania County consider adopting an ordinance to require septic inspection or certification upon the sale or transfer of property (Chapter 7, Recommendation #25).

2.4.23. ENCOURAGE THE STATE TO IMPLEMENT A PERFORMANCE-BASED EFFLUENT TREATMENT STANDARD

Description of Option:

The State of Washington Department of Health (DOH), in light of current data regarding the complex chemistry of the effluent discharge contaminants, is slowly evolving from a prescriptive approach to a performance-based effluent treatment standard. Under such a standard, the system designer would be responsible for choosing the correct sewage treatment system, based on the anticipated type, amount (maximum daily flows), and strength of the generated sewage. The system designer would be responsible for showing that the treatment system would meet the effluent discharge standards set by DOH. The homeowner would be required to meet the O&M requirements with a signed contract for maintenance services with a licensed and certified individual or agency. A system would be identified as “Out of Compliance” when the lab results show the system is not performing as originally designed. The Planning Unit could encourage the State to continue its movement toward implementing a performance-based effluent treatment standard for on-site sewage treatment systems.

Issue addressed: Sewage treatment systems can contribute to water quality problems (W-3).

Recommendation

The Planning Unit encourages the State to implement a performance-based effluent treatment standard for on-site sewage treatment systems (Chapter 7, Recommendation #26).

2.4.24. ENCOURAGE IMPLEMENTATION OF A COORDINATED, WESTERN WRIA 29 ROAD MAINTENANCE EFFORT

Description of Option

Roads, road construction, and road maintenance are the principal sources of sediment in many watersheds (Brooks *et al.*, 1991). Several studies have been conducted by the USFS, state agencies, and other organizations that focus on sediment input from roads. The Planning Unit or other stakeholders could coordinate road maintenance and assemble a Western WRIA-wide road maintenance strategy based on these studies and stakeholder input. Such a strategy should set priorities, identify specific actions for various parties (DNR, USFS, volunteers, and others), include an education component, and identify funding sources. Specific recommendations to be considered could include erosion control measures in upland areas disturbed by roads, reduction of sediment delivery from roads to stream channels, road decommissioning, replacement of culverts with bridges, regulation of seasonal uses, and gating roads and trails to prevent

motorized use. Road decommissioning strategies should be carefully designed to avoid inadvertent increases in sedimentation.

Issue addressed: Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many Western WRIA 29 streams (W-9).

Recommendation

The Planning Unit recommends that federal, state, and county agencies coordinate and communicate with each other as well as with private landowners to improve road maintenance where needed (Chapter 7, Recommendation #27).

2.4.25. SUPPORT CONTINUED SPECIAL AND ROUTINE AIR QUALITY MONITORING AND REGULATORY PROGRAMS TO DETECT AND PREVENT ADVERSE EFFECTS ON WATER QUALITY.

Description of Option

Large concentrations of sulfates and nitrates can result in acidification. Nitrate deposition can cause eutrophication. Toxic air pollutants such as mercury can accumulate in the aquatic environment and adversely affect aquatic habitat and species. The Southwest Clean Air Agency, the Washington Department of Ecology, the US Forest Service, the National Park Service, and others maintain air quality monitoring and regulatory programs to detect and prevent adverse effects of air pollution on human health and the environment. In addition, the Southwest Clean Air Agency in cooperation with the Oregon Department of Environmental Quality is currently conducting a special study of air quality in the Columbia River Gorge National Scenic Area. The Southwest Clean Air Agency recommends continued support of special and routine air quality monitoring and regulatory programs to detect and prevent adverse impacts on water quality.

Issue Addressed: Air quality can affect water quality when air pollutants are deposited onto the surface of water bodies or land within a watershed (W-16).

Recommendation

The Planning Unit supports continued special and routine air quality monitoring and regulatory programs to detect and prevent adverse impacts on water quality (Chapter 7, Recommendation #25).

2.4.26. MAKE INSTREAM FLOW RECOMMENDATIONS OR RULES

Description of Option

Water Resource Inventory Area (WRIA) initiating governments can elect to recommend instream flows through a process set forth by the state Watershed Planning Act of 1998 (RCW 90.82). The law directs planning units to strive for consensus in making instream flow recommendations to Ecology. In the absence of consensus, or by Planning Unit request, the Department of Ecology is authorized to set instream flows itself, in consultation with affected tribes.

The Western WRIA 29 Planning Unit could either:

- Elect to make instream flow recommendations during Phase IV of watershed planning and request that the Department of Ecology provide additional funding (beyond that provided for plan implementation) to support the process; or
- Request that the Department of Ecology adopt instream flow rules for Western WRIA 29.

Issue Addressed: There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit recommends that it engage in a process to determine and recommend minimum instream flows to the Department of Ecology if funding is provided. If funding for an instream flow process is not available, the Planning Unit is interested in participating with the Department of Ecology while the agency develops instream flows. During the instream flow process, the Planning Unit will consider the PUD's requested reservation for the Carson Water System and a reservation for the City of Stevenson (Chapter 7, Recommendation #29).

2.4.27. DEVELOP ADAPTIVE CAPACITY TO MANAGE IMPACTS OF CLIMATE CHANGE ON WATER SUPPLY

Description of Option

One of the likely effects of climate change on Western WRIA 29 in the coming decades is that reduced snowpack will lead to lower summer stream flows. In addition, if spring peak flows occur weeks earlier (as predicted), the time between peak spring runoff and fall rains may be even longer, further affecting a basin's ability to meet water demands during the driest time of year. Finally, warmer summers may increase demand for water, even as flows are decreasing (UW Climate Impacts Group, 2004).

Water conservation is one strategy addressed by options presented elsewhere in this plan, but other approaches may also be needed to extend water supplies into the dry summer months. In particular, the Planning Unit could seek to develop adaptive capacity to prepare for and manage climate impacts. For example, increasing usable water storage (both surface water and aquifer storage and recovery) can be an effective means of saving water for summer use. When and if water storage is centralized, water systems may need to be connected via interties to be able to draw from the stored supply.

The Planning Unit and water suppliers in the watershed could begin developing adaptive capacity to prepare for summer water shortages, events that are likely to increase under climate change. This capacity could include seasonal storage and water-system connections, diversification of water sources, or use of greywater, as well as the use of seasonal forecasts to help manage if, when, and how seasonal storage is made available to water suppliers throughout western WRIA 29.

Issue Addressed: There is some concern about the watershed's ability to meet future water demands (W-14); Reduced snowpack and increased rain-on-snow events, and conversion of forestland to other uses may alter the timing and quantity of streamflow (W-15).

Recommendation

The Planning Unit recommends that regional climate change projections developed by the University of Washington's Climate Impacts Group or other qualified scientists be considered when making water resource planning decisions in Western WRIA 29; the Planning Unit also recommends that water suppliers consider developing adaptive capacity to prepare for the possibility of lower summer flows in the future (Chapter 7, Recommendation #30).

OTHER OPTIONS AND RECOMMENDATIONS

2.4.28. COMPILE A LIST OF RECOMMENDED STUDIES AND PROVIDE IT TO REGIONAL COLLEGES AND UNIVERSITIES

Description of Option

The Planning Unit could compile a list of studies it supports, but for which funding or personnel are not currently available. This list could be distributed to colleges and universities in the region so that interested students or faculty could conduct the studies as research projects using their own funding.

Issue addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends that Planning Unit members provide the list of desired studies and monitoring activities to appropriate research organizations in the region for consideration as research projects (Chapter 7, Recommendation #33).

2.4.29. ENCOURAGE SKAMANIA COUNTY TO DEVELOP GIS CAPABILITY

Description of Option

A Geographic Information System (GIS) is a type of software that allows for organization and analysis of spatial data. GIS systems have become standard in natural resource planning agencies because of their ability to combine and overlay digital map-based data from a variety of sources and databases. The Planning Unit could encourage Skamania County to invest in GIS capacity to facilitate acquisition, sharing, organization, and analysis of data in Western WRIA 29.

Issue addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends that Skamania County consider developing GIS capability (Chapter 7, Recommendation #34).

2.4.30. ENCOURAGE THE DEPARTMENT OF ECOLOGY TO UPDATE ITS WATER RIGHT DATABASE BY COLLECTING NEW DATA AND VERIFYING EXISTING DATA

Description of Option

The Department of Ecology maintains official records of water rights in Washington. Ecology also maintains a database, called the Water Right Tracking System (WRTS), containing information about water rights and claims in Washington. While the WRTS is a useful tool in assessing water rights and water use in Western WRIA 29 and other watersheds, it is not the official record and in some cases is not up-to-date. Furthermore, the consultants who analyzed the WRTS for WRIA 29 found many blank fields in the database and noted that some water rights found on paper were not listed in the WRTS database (Envirovision, 2003). The Planning Unit could encourage the Department of Ecology to update the WRTS database to include all recognized water rights and claims, reconcile duplicate entries, complete blank fields (where possible), verify water right locations, and identify those rights subject to relinquishment under Washington water law, as codified in RCW 90.14.

Issue addressed: The Department of Ecology's water rights database is out of date and not user-friendly (W-6).

Recommendation

The Planning Unit supports efforts by the Department of Ecology to update its water right database by collecting new data and verifying existing data (Chapter 7, Recommendation #35).

2.4.31. ENCOURAGE THE DEPARTMENT OF ECOLOGY TO MAKE WATER RIGHT INFORMATION MORE ACCESSIBLE TO THE PUBLIC

Description of Option

As described under Option 2.4.30, The Department of Ecology maintains a database, called the Water Right Tracking System (WRTS), containing information about water rights and claims in Washington. Information pertaining to water right applications and change applications is downloadable by county or WRIA from Ecology's website. Detailed information on approved water rights and water right claims, however, is not readily accessible through the online WRTS system, making it difficult for the public to learn about existing water rights in the region. Furthermore, while the database does include the name of the business or individual associated with the initial water right application and the township, range, and section of the source, it can be difficult to identify the specific location of the water right. The Planning Unit could encourage the Department of Ecology to make existing water right information available to the public, include more specific and user-friendly geographic information, and improve the ease-of-use of the WRTS to the general public.

Issue addressed: The Department of Ecology's water rights database is out of date and not user-friendly (W-6).

Recommendation

The Planning Unit supports efforts by the Department of Ecology to make water right information more accessible to the public (Chapter 7, Recommendation #36).

2.4.32. ENCOURAGE WATER CONSERVATION IN IRRIGATION AND WATER TRANSPORT, WHERE FEASIBLE AND PRACTICAL, BASED ON THE WATER RIGHTS AND USE LEVEL 2 ASSESSMENT RECOMMENDATIONS

Description of Option

Envirovision's Level 2 Assessment work recommends several water conservation strategies (Envirovision, 2004c). The strategies involve changing irrigation methods, lining ditches, and piping conveyance facilities. The Planning Unit could consider encouraging the following conservation strategies: implementing on-farm water conveyance systems, improving gravity flow systems and practices, encouraging efficient irrigation methods, and supporting programs to educate farmers about cost-sharing programs.

Issue addressed: There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit recommends local agencies and irrigators pursue partnerships and find opportunities to increase water conservation in irrigation and water transport, where feasible and practical (Chapter 7, Recommendation #37).

2.4.33. ENCOURAGE PROJECTS TO INCREASE STREAM SHADING, REDUCE TEMPERATURES, AND IMPROVE HABITAT, AS NEEDED

Description of Option

Stream-bank and riparian vegetation provides shade, which helps keep stream temperatures cool. Stream-bank restoration also helps control erosion and sedimentation and regulate streamflow, which in turn can further help to control stream temperatures. Large woody debris installed in streams can provide shade and structures, which reduces water temperature and provides protected areas where fish can rest and escape predators. The Planning Unit could encourage or contribute to an evaluation of stream-shading and other habitat-improvement needs and subsequent restoration activities. The Planning Unit could also recommend that local jurisdictions and Skamania County implement programs that would encourage landowners to limit development and forest cover removal in riparian areas.

Issues addressed: Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many Western WRIA 29 streams (W-9); Past measurements have resulted in several Western WRIA 29 streams being listed on the 303(d) list of impaired water bodies (W-2).

Recommendation

The Planning Unit recommends that watershed residents and appropriate agencies work in partnership to pursue funding to implement projects to improve habitat, reduce water temperatures, and increase stream shading where needed; the Planning Unit also

recommends that local jurisdictions and Skamania County implement programs that would encourage landowners to limit development and forest cover removal in riparian areas (Chapter 7, Recommendation #38).

2.4.34. ENCOURAGE COOPERATIVE, VOLUNTARY CORRECTIVE ACTIONS TO REDUCE FECAL COLIFORM

Description of Option

If water-quality monitoring indicates areas where fecal coliform levels are still a concern (Option 2.4.4) and the sources of the fecal coliform can be identified, the Planning Unit could encourage cooperative, voluntary corrective actions to reduce fecal coliform.

These actions could include:

- Encouraging the Underwood Conservation District to work with farmers to institute farm plans, continue the required certified dairy-manure management systems; continue other existing livestock waste management efforts concerning confined animal feeding operations (CAFOs), feedlots, or other animal-keeping operations; and continue and expand stream fencing programs, where needed; and
- Work with local organizations to conduct education and outreach on strategies to reduce agricultural sources of fecal coliform. For example, such outreach might target owners of recreational hobby farms. These farms, if they include horses or other livestock, can become sources of fecal coliform bacteria if manures are not managed properly.

In addition, improved septic system management and monitoring may be needed, as discussed under Options 2.4.19 through 2.4.20.

Issue addressed: Past measurements have resulted in several Western WRIA 29 streams being listed on the 303(d) list of impaired water bodies (W-2).

Recommendation

The Planning Unit recommends that all Planning Unit members, local agencies, and organizations encourage cooperative, voluntary corrective actions to reduce fecal coliform, including education and outreach on sources of fecal coliform, preparation of farm plans, and other waste management efforts (Chapter 7, Recommendation #39).

2.4.35. REQUEST THAT THE DEPARTMENT OF ECOLOGY IDENTIFY AND INCREASE ENFORCEMENT OF ILLEGAL WATER WITHDRAWALS

Description of Option

RCW 90.03 and RCW 90.44 govern surface water withdrawals and public ground waters, respectively. Both codes describe the legal ways to obtain water rights, and the penalties for violating the codes, as follows:

- RCW 90.03.400 states that the unauthorized use of water to which another person is entitled, or the willful or negligent waste of water that harms another person, is a misdemeanor.
- RCW 90.03.410 makes interfering with, destroying, or altering water diversion structures such as dams or weirs a misdemeanor. It also states that destruction,

interference, or alteration of structures with the intent to divert water illegally is a misdemeanor.

- RCW 90.44.120 states that the unauthorized use or waste of groundwater is a misdemeanor.

In addition, RCW 90.03.600 allows the Department of Ecology to assess fines of up to \$100 per day for each violation.

RCW 90.03.065 sets forth the sequence of enforcement actions. Ecology is required to educate the general public about water law and compliance with water law. If the department notices a violation, it should attempt to achieve voluntary compliance with the law by providing information and technical assistance to the violator. If the violator fails to comply, Ecology may issue a notice of violation and levy fines. However, the code also states that Ecology can take immediate action if the violation is causing harm.

This option calls for improved enforcement of this existing code. Doing so may require increased monitoring of water withdrawals and instream flows, as well as field surveys to find unauthorized diversion structures.

Issue addressed: There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit recommends that the Department of Ecology improve their compliance monitoring and enforcement of illegal water withdrawals (Chapter 7, Recommendation #40).

2.4.36. ENCOURAGE THE DEPARTMENT OF ECOLOGY AND OTHERS TO REVIEW THE CHARACTERISTIC USES ASSIGNED TO WESTERN WRIA 29 WATER BODIES

Description of Option

As of July 1, 2003, the Washington State Department of Ecology began basing its water-quality standards on the designated Characteristic Uses of each water body, rather than on its water-body classification scheme (i.e., AA, A, B, C, or Lake classes).

Characteristic Uses are categorized as aquatic life uses (e.g., salmon/trout rearing), recreational uses (e.g., primary contact/swimming), water supply uses (e.g., domestic water), or miscellaneous uses (e.g., boating). The Characteristic Uses assigned by the Department of Ecology to Western WRIA 29 water bodies were listed in the *Existing Conditions* section of this document in Table 1. Characteristic Uses may be revised for a given water body through a process set by Ecology. Accordingly, the Planning Unit could review, or encourage others to review, the assigned Characteristic Uses to determine if any are not applicable or if new uses need to be added.

Issue addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends that local government agencies and other local experts review the characteristic uses assigned to Western WRIA 29 water bodies and recommend any revisions to Ecology (Chapter 7, Recommendation #41).

2.4.37. ENCOURAGE SKAMANIA COUNTY TO IMPLEMENT ITS *INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN*

Description of Option

In 2004, Skamania County worked with the Department of Ecology, Underwood Conservation District, Wind River Watershed Council, US Geological Survey, Portland State University Center for Lakes and Reservoirs, local, state, and federal agencies, and the public to develop its *Integrated Aquatic Vegetation Management Plan* (Pfauth and Sytsma, 2004). This plan reviews the available management techniques to control Eurasian watermilfoil (milfoil) and other invasive aquatic weeds. It also presents recommendations for each of Western WRIA 29's three primary affected water bodies: Rock Cove, the mouth of the Wind River, and Drano Lake. The primary recommendations are chemical treatment in Rock Cove and Drano Lake and dredging at the mouth of the Wind River, although other chemical and mechanical techniques are also recommended for specific sites within each area.

Research on milfoil and management techniques is being undertaken by several entities across the state. Most notably, in Western WRIA 29, the US Geological Survey's Columbia River Research Laboratory is currently mapping milfoil infestations in the Bonneville Pool of the Columbia River. Since milfoil is found throughout the Columbia River basin and is easily spread by small plant fragments moving downstream or caught on boats transferred from water body to water body, control of existing infestations and its spread to new or previously treated areas is difficult. Effectively managing this invasive weed, which affects fish habitat and water quality and harms recreation opportunities and aesthetics, requires a basin-wide effort.

The Planning Unit could encourage Skamania County to continue implementing the recommendations of its plan and to encourage the County to continue seeking supplemental funding sources to do so. The Planning Unit could also encourage federal and state agencies to fund milfoil control projects in Western WRIA 29. The Planning Unit could encourage continued research on milfoil and management techniques. Additionally, the Planning Unit could encourage the State to undertake a Columbia basin-wide effort to control milfoil and educate water body users about it, its effects, and its control.

Issue addressed: Invasive aquatic species threaten Western WRIA 29 water bodies and riparian areas (W-8); Aquatic and riparian habitat has been degraded in a number of streams in Western WRIA 29 (W-11).

Recommendation

The Planning Unit supports implementation of *Skamania County's Integrated Aquatic Vegetation Management Plan* (Pfauth and Sytsma, 2004) and encourages the County to continue seeking supplemental funding sources to do so; the Planning Unit also encourages federal and state agencies to fund milfoil control projects in Western WRIA 29; the Planning Unit encourages continued research on milfoil and management techniques and encourages the State to undertake a Columbia basin-wide effort to control milfoil and educate water users about it, its effects, and its control (Chapter 7, Recommendation #42).

2.4.38. ENCOURAGE LOCAL STAKEHOLDERS AND THE DEPARTMENT OF NATURAL RESOURCES' TO WORK TOGETHER TO IMPROVE WATER-TYPING IN WESTERN WRIA 29

Description of Option

The Department of Natural Resources (DNR) is developing a computer-based model for determining stream typing in western Washington. DNR and other governmental entities will use this stream typing model for regulatory purposes. Planning Unit members are concerned that the maps produced by this model may over- or under-estimate the extent of fish habitat (Planning Unit, 10/26/05 meeting, 2005). Therefore, the Planning Unit could encourage DNR to conduct fieldwork to verify the fish habitat determinations in Western WRIA 29.

Issue Addressed: The Washington State Department of Natural Resources is developing a new water typing system that may over- or under-estimate fish habitat (W-12).

Recommendation

The Planning Unit recommends that the State Department of Natural Resources conduct additional verification of the accuracy of the stream-typing model and maps in Western WRIA 29 and work with the local community to validate its findings with ground-truthing (Chapter 7, Recommendation #43).

2.4.39. ENCOURAGE FOREST MANAGEMENT METHODS TO MINIMIZE SUSCEPTIBILITY TO WILDFIRES

Description of Option

The Planning Unit could work with the Department of Natural Resources, United States Forest Service, local timber companies, and other private landowners to develop strategies and best management practices for minimizing forest susceptibility to wildfires, especially in the vicinity of communities. Several options could be considered and evaluated in the plan, such as the following:

- **Controlled burns.** Controlled burns are a means of removing accumulated fuels. Wildfires can take advantage of accumulated "ladder fuels" to move vertically from the ground up to the crowns of taller, mature trees. Controlled burns can therefore be an effective way to limit the destructive capacity of wildfires by preventing ladder fuels from accumulating, especially if any pre-existing ladder fuels are first mechanically removed. Controlled burns must be carefully managed, however, so that they do not become wildfires or contribute to erosion.
- **Timber thinning.** Accumulating fuels can also be physically removed. Thinning and controlled burns both have the added benefit of increasing growth in the remaining trees, but the mechanical equipment used to thin trees can lead to soil compaction or other impacts on the forest floor (USFS, 2000). Thinning activities should be focused on scrub brush and certain small trees rather than mature trees that are already fire-resistant.
- **Other forms of forest and timber management.** Other policies or practices may also be effective at managing forests to minimize susceptibility to fire.

Issue addressed: Wildfires can burn vegetation and result in increased erosion (W-5).

Recommendation

The Planning Unit recommends appropriate agencies and local landowners pursue funding and partnerships to develop strategies and implement best management practices to minimize susceptibility to wildfires (Chapter 7, Recommendation #44).

2.4.40. ENCOURAGE THE DEPARTMENT OF ECOLOGY, THE USFS, AND THE USGS TO MAINTAIN EXISTING STREAM GAUGES OVER THE LONG TERM AND INSTALL NEW GAUGES AT SELECTED LOCATIONS IN WESTERN WRIA 29

Description of Option

In order to manage flows, streams must be monitored consistently over time. At this time, the only long term continuously-recording flow gauges in Western WRIA 29 are located in the Little White Salmon River. A stream gauge was established on the Wind River near Carson RM 1.9 and operated by the USGS from 1934-1981. This gauge was inactivated by the USGS, but in the late 1990s was re-instrumented and is now being operated by the USFS with funding from Bonneville Power Administration. Continued operation of this gauge is contingent upon funding from BPA.

Issue addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1).

Recommendation

The Planning Unit recommends that sub-basins within WRIA 29 be prioritized for installation and maintenance of permanent continuously-recording stream gauges on the Wind River, Rock Creek or Little White Salmon River, and the Western Tributaries of the Columbia River; the Planning Unit also encourages the Department of Ecology, the USFS, and the US Geological Survey to maintain existing stream gauges over the long term. (Chapter 7, Recommendation #45)

2.4.41. REQUEST THAT THE DEPARTMENT OF ECOLOGY APPOINT A WATER MASTER FOR WESTERN WRIA 29

Description of Option

RCW 90.03.060 states that a water master can be appointed (depending on available funding) by the Department of Ecology if a WRIA includes such a request in its adopted watershed plan. The primary responsibilities of a water master include regulating and controlling water use in their specified district (RCW 90.03.070). The Planning Unit could request that a water master be assigned to Western WRIA 29 to oversee water-right rules and requirements within the watershed and to ensure that water-right data are comprehensive and up-to-date.

Issues addressed: Significant surface and groundwater quantity and quality data gaps exist in Western WRIA 29 (W-1); Existing stream flow data are not comprehensive (W-13); There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit elected not to make a recommendation concerning this option.

OPTIONS AND RECOMMENDATIONS TO SUPPORT THE CONTINUATION OF EXISTING EFFORTS

2.4.42. SUPPORT EFFORTS TO CONTROL EROSION AND SEDIMENTATION

Description of option

Since the mid-1990s, the Underwood Conservation District, US Forest Service, Skamania County, and other groups have conducted erosion and sedimentation-related restoration projects in several areas of Western WRIA 29. These efforts have included bank stabilization projects, road decommissioning, roadside cutbank revegetation, and riparian plantings.

In addition to helping reduce erosion and sedimentation in Western WRIA 29, these projects have improved salmon and resident fish habitat, reduced stream temperatures through shading, and promoted the development of healthy riparian ecosystems.

Issue addressed: Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many Western WRIA 29 streams (W-9); Aquatic and riparian habitat has been degraded in a number of streams in Western WRIA 29 (W-11).

Recommendation

The Planning Unit supports efforts to control erosion and sedimentation (Chapter 7, Recommendation #47).

2.4.43. SUPPORT FISH RESTORATION ACTIVITIES

Description of Option

The Lower Columbia Fish Recovery Board (LCFRB), in collaboration with federal and state agencies, tribes, local governments and the public, has developed the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (Plan). NOAA Fisheries has adopted the Plan as an interim regional recovery plan, and the Northwest Power and Conservation Council (NPCC) adopted the Plan as part of its Columbia Basin Fish and Wildlife Plan. The Plan identifies goals, strategies, measures and actions for returning ESA-listed populations of chinook, chum, coho, steelhead, and bull trout to healthy and harvestable levels and for mitigating the effects of the federal Columbia River hydroelectric system on other fish and wildlife species (LCFRB, 2005). The Plan encompasses Western WRIA 29 including the Wind River, the Little White Salmon River, and other Gorge tributaries. The strategies, measures, and actions in the Plan (LCFRB, 2005) could be incorporated by reference in the Western WRIA 29 Watershed Management Plan. In addition, fish habitat activities and projects coordinated through the LCFRB pursuant to RCW 90.82 could be incorporated as the primary non-regulatory habitat restoration and protection component for fish habitat in the Western WRIA 29 Watershed Management Plan.

The Yakama Indian Nation in cooperation with the Nez Perce, Umatilla and Warm Springs Tribes adopted a tribal salmon recovery plan for their reservation and ceded lands in the Columbia River Basin in 1995 (Nez Perce, et al, 1995). The Planning Unit could incorporate this Spirit of the Salmon plan by reference into the Western WRIA 29 Watershed Management Plan. The plan includes recommended actions to restore salmonid populations to harvestable levels.

Issues addressed: Aquatic and riparian habitat has been degraded in a number of streams in Western WRIA 29 (W-11).

Recommendation

The Planning Unit incorporates by reference the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan's (LCFRB, 2005) habitat strategies, measures, and actions for the Wind River, the Little White Salmon River, and other Gorge tributaries within Skamania County in the Western WRIA 29 Watershed Management Plan. The Planning Unit also incorporates by reference the habitat protection and restoration activities coordinated through the Lower Columbia Fish Recovery Board as a key non-regulatory habitat component of the Western WRIA 29 Watershed Management Plan. Additionally, the Planning Unit incorporates by reference the tribal anadromous fish plan, WY-KAN-USH-MI WA-KISH-WIT, Spirit of the Salmon (Nez Perce et al, 1995), into the Western WRIA 29 Watershed Management Plan (Chapter 7, Recommendation #48).

2.4.44. ENCOURAGE CONTINUATION OF THE FIREWISE PROGRAM

Description of Option

FireWise is a federally-funded fire prevention program administered through the Washington State Department of Natural Resources. The program provides information to homeowners on how to increase the chances of a home surviving a wildfire. In addition, individual property owners are eligible for on-site assistance in creating a "defensible space" around their homes, an area surrounding a home where the vegetation has been modified to reduce the wildfire threat and provide an opportunity for firefighters to defend the home, if needed. The Planning Unit could encourage publicity of the FireWise program and encourage landowners to implement the program's recommendations in accordance with existing laws.

Issue addressed: Wildfires can burn vegetation and result in increased erosion (W-5).

Recommendation

The Planning Unit supports and encourages ongoing education on wildfire prevention, hazards, and preparedness (Chapter 7, Recommendation #49).

2.4.45. ENCOURAGE JURISDICTIONS TO CONTINUE TO PLAN FOR THE IMPACT OF GROWTH ON WATER SUPPLY AND WATER QUALITY

The Planning Unit could encourage local jurisdictions to continue to plan for growth and the increased demands on the water supply and water quality that will result. Emphasis could be placed on improved land stewardship (see also Option 2.4.12) and control of pollutants from urbanization, such as stormwater (see also Option 2.4.17) and residential pesticides (see also Option 2.4.12).

Issues addressed: There is some concern about the watershed's ability to meet future water demands (W-14).

Recommendation

The Planning Unit supports and encourages local government efforts to plan for the impact of growth on water supply and water quality (Chapter 7, Recommendation #50).

3. Rock Creek Sub-basin

3.1. DESCRIPTION/LOCATION/CHARACTERISTICS

Rock Creek is the westernmost sub-basin in Western WRIA 29, and is almost entirely contained within State and National forest ownership. The Rock Creek headwaters begin at Lookout Mountain at an elevation of over 4,000 feet, and Rock Creek empties into the Columbia River via Rock Cove at an elevation of 80 feet. A fairly small sub-basin, Rock Creek drains 42.6 square miles. Although the vast majority of the sub-basin is forested (about 97%), there is some rural and residential development, primarily in the lower part of the sub-basin in and around Stevenson. An estimated 438 people live in the sub-basin, mostly in an around Stevenson (population 1,200, but the majority of the City lies outside the drainage basin boundary). The main stem of Rock Creek is approximately 15 miles long. There are 58.1 miles of perennial streams and 262 miles of intermittent streams in this sub-basin (Envirovision, 2003).



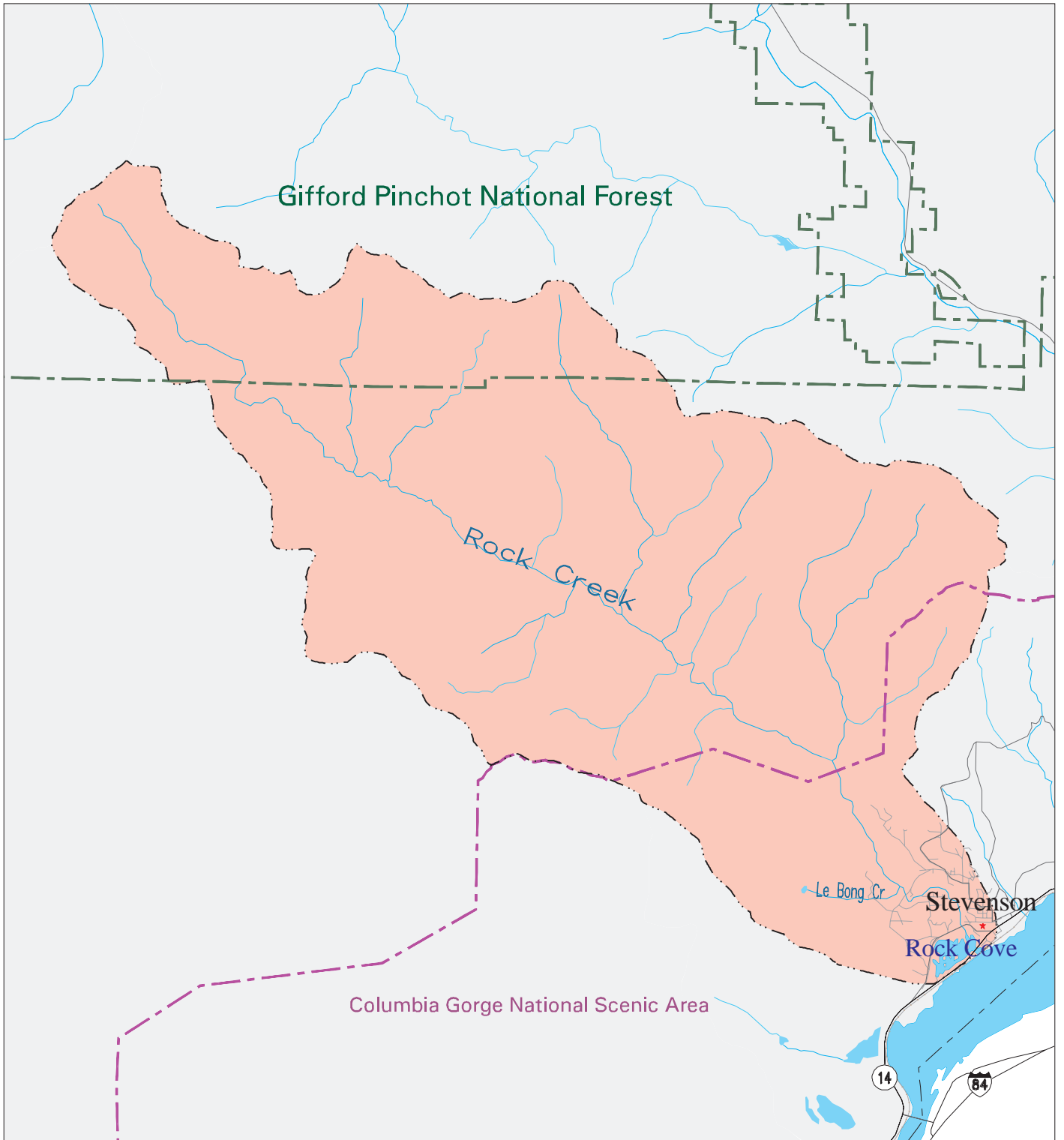
A kayaker attempts to paddle upstream in Rock Creek.

The City of Stevenson acquires its municipal and domestic water from the Rock Creek sub-basin, primarily from a spring located at the headwaters of La Bong Creek. The City owns approximately 0.56 square miles of protected, forested land in the headwaters of La Bong Creek. During periods of low flow, the City augments this supply with water taken directly from the mainstem of Rock Creek via submersible pumps below the creek bed. Although Rock Creek flows through Stevenson, most of the City lies outside the drainage basin boundary. Rock Creek empties into Rock Cove, a small lake inundated by backwater from the Columbia River's Bonneville Dam (Envirovision, 2003).

Geologically, the Rock Creek sub-basin is comprised primarily of bedrock. The bedrock is generally deeply weathered and altered volcanic rock, including basalt, andesite, tuff, conglomerate, and breccia. The Bonneville landslide underlies a large area on the west side of the sub-basin. In addition, small, thin deposits of alluvial (river-derived) sands and gravels line Rock Creek (Envirovision, 2003).

The Rock-Creek sub-basin contains two principal aquifers. The Bonneville landslide is quite permeable and provides much of the baseflow for La Bong Creek, with which it has high hydraulic continuity. La Bong Creek is the primary water source for the City of Stevenson. The other potential aquifer is the Stevenson Ridge Volcanics, a rock formation that underlies most of the Rock Creek sub-basin. This formation has low permeability, but wells intersecting open fracture zones associated with faults may be quite productive. Its potential for hydraulic continuity with surface water (and hence recharge) is low to moderate (Envirovision, 2003).

Mean annual precipitation in the Rock Creek sub-basin is 104 inches, ranging from 85 inches near the mouth to 125 inches in the upper sub-basin. The majority of the annual

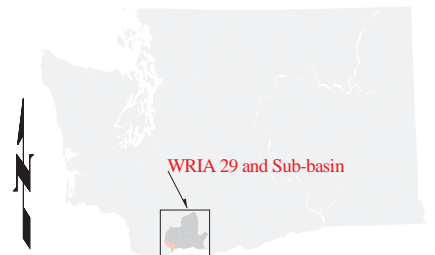


Rock Creek Sub-basin



GIS Technical Services
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wria29-6

- | | | | |
|--|-------------------|--|----------------------------------|
| | US/State Highways | | Columbia Gorge Natl. Scenic Area |
| | Secondary Roads | | Gifford Pinchot National Forest |
| | Local Paved Roads | | County |
| | Railroads | | Outside Planning Area |
| | Rivers/Streams | | Population Center |
| | Intermittent | | |



precipitation occurs from November to March. The dominant form of precipitation in the lower elevations of the sub-basin (about half of the area) is rain, with rain-on-snow dominant in the upper elevations. Only a small share (estimated at 8% of the acreage) is dominated by snow (Envirovision, 2003).

3.2. EXISTING CONDITIONS

This section summarizes the existing conditions of the Rock Creek sub-basin in terms of water quantity, water quality, and habitat. Most of the information presented in this section was summarized from Envirovision's *Level 1 Water Quantity and Quality Technical Assessment* (2003), the WRIA 29 Habitat Committee's *Level 1 Habitat Assessment* (2003), and the WRIA 29 Instream Flow Committee's *Level 1 Instream Flow Assessment* (2004).

3.2.1. WATER QUANTITY

According to the *Level 1 Water Quantity and Quality Assessment* completed by Envirovision in 2003, no streamflow records are available for the Rock Creek sub-basin. However, flow patterns in the Rock Creek sub-basin can be expected to follow the general pattern exhibited by the adjacent Wind River, in which peak flows occur in the winter months and low flows occur during the late summer months. In these basins, rainstorms generate peak flows (especially when rain falls on snow), with additional input from snowmelt (Envirovision, 2003).

By extrapolating water yield data from the Wind River, Envirovision estimated that streamflow averages a high of 279 cubic feet per second (cfs) in April and a low of 38 cfs in September. *Cubic feet per second* is a measure of the discharge of the stream, or the amount of water passing a given point per unit of time. During low-flow years, the April high discharge is estimated at 160 cfs and the September low at 30 cfs (Envirovision 2003). More detailed estimates, including hydrographs, can be found in the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003).

Similarly, no data on groundwater quantity or recharge were available. The geology of the basin provides some insight into the characteristics of the aquifers of the basin (as described above), but any quantitative analysis would require a data collection effort (Envirovision, 2003).

The Rock Creek sub-basin has a total of 15 water rights. No permits or applications are currently in process. By volume, the largest allocation of water is for municipal use, followed by multiple domestic water use. The two largest rights in the sub-basin are held by the City of Stevenson. Both rights are municipal use rights with a total diversion rate of 4.74 cfs. The largest groundwater right is for irrigation with a withdrawal rate of 11 gpm (0.02 cfs) (Envirovision, 2003).

The largest water user in the Rock Creek sub-basin is the City of Stevenson, most of which lies outside of the sub-basin. The consultants for the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003) estimate that this and other uses in the sub-basin amount to a net streamflow depletion of about 1.83 cfs in the winter and 1.85 cfs in the summer. These depletions represent up to 6% of the estimated low flow and up to 3% of the estimated average flow. The Level 1 consultants further concluded that the water rights do not represent a significant reduction in flow and that there appears to be no significant low flow problems in this sub-basin. However, actual flow

data or other studies may be needed to understand the impacts on aquatic life or salmon and verify this conclusion (Envirovision, 2003).

3.2.2. WATER QUALITY

In general, few data are available for the Rock Creek sub-basin with which to characterize the surface and groundwater quality. Although no sub-basin-specific groundwater-quality data are available, the City of Stevenson and the US Forest Service have limited surface water-quality data (Envirovision, 2003).

The City of Stevenson periodically monitors its water supply for the parameters required by the Washington State Department of Health, and levels measured consistently fall well within state standards. However, for the purposes of the sub-basin's technical assessment, use of the data is limited by the fact that the water monitored by the City is generally a mixture of its La Bong Creek and Rock Creek sources, and it therefore cannot be directly used to characterize the water quality of either stream (Envirovision, 2003).

The US Forest Service has also conducted some temperature monitoring. Spot measurements of temperature collected during August 1998 included a range of 14 degrees C (51 degrees F) near the Forest Service boundary to 21 degrees C (70 degrees F) at the mouth of Rock Creek (USFS, 2000). The researchers noted a downstream warming trend, with most of the warming occurring in the middle and lower reaches. This degree of warming was unexpected given the steep stream gradient and narrow valley floor of the sub-basin. It was suggested that either poorly shaded riparian zones or geothermal hot springs may contribute to stream warming (Envirovision, 2003).

Finally, it is important to note that two possible sources of potential water pollutants in the Rock Creek sub-basin have received only limited monitoring. For one, the golf course in the sub-basin could be a source of nutrients and pesticide runoff due to activities involved in maintaining the turf. In addition, the Skamania Lodge is built on the old Skamania County landfill, which was closed and capped in the early 1990s (Envirovision, 2003). The City of Stevenson has performed some baseline and follow-up monitoring of these sites (Planning Unit, 2004).

Any further analyses would require a new data collection effort.

3.2.3. HABITAT

Natural factors and human activity limit the accessibility and quality of the Rock Creek sub-basin's habitat. A waterfall impassable at normal flows lies less than one mile from the creek mouth and obstructs upstream migration of anadromous salmonids. Above the falls, other factors combine to affect the habitat. For one, the basin is extremely susceptible to high peak flows that can flush out the system and scour the creek bed. Pool habitat and large woody debris (LWD) abundance have been rated poor; overall stream bank condition is good to fair; and riparian conditions are poor for the majority of reaches. Little natural floodplain habitat exists due to the steep valley walls of the Columbia River Gorge, and the few floodplains that do exist in the lower reaches have been affected by development. Finally, the Rock Creek basin has high road densities that may contribute to sediment production (LCFRB, 2004).

Eurasian watermilfoil, an invasive aquatic plant species, has colonized Rock Cove, diminishing both recreational and salmon/trout characteristic uses (Pfauth and Sytsma,

2004). Milfoil can dramatically alter a water body's ecology, forming dense mats of vegetation on the surface of the water that interfere with recreational activities, create habitat for mosquitoes, clog water intake pipes, increase sedimentation, and decrease biodiversity. Milfoil can also affect fish habitat by impeding passage, raising water temperatures, lowering dissolved oxygen levels, and creating wide pH fluctuations (Pfauth and Sytsma, 2004).

Insufficient water-quality data limit the ability to assess the habitat in the Rock Creek sub-basin, and the *Limiting Factors Analysis for WRIA 29* devotes only minimal attention to this sub-basin (WCC, 1999).

Fish Species Supported

The Washington Department of Fish and Wildlife lists steelhead (winter and summer), coho salmon, chum salmon, sea-run cutthroat trout, resident cutthroat trout, and rainbow trout as priority fish species in the Rock Creek sub-basin (WRIA 29 Habitat Committee, 2003). Pacific lamprey may also be present; this is a culturally important species for tribes and is a potential candidate for listing under the Endangered Species Act (Lee Carlson, Yakama Nation, comments submitted Sept. 1, 2004).

3.3. ISSUES

Following are the key issues to be addressed in the Rock Creek sub-basin, as identified by the Planning Unit.

- RC-1. No streamflow or groundwater quantity data exist in the Rock Creek sub-basin.** According to the *Level 1 Water Quantity and Quality Technical Assessment*, there are no streamflow records in the Rock Creek sub-basin (Envirovision, 2003). Without actual data, planners must rely on streamflow modeling and other estimation techniques to assess the water quantity of the sub-basin. Although the modeling that has been conducted does not suggest water quantity problems exist (Envirovision, 2003), direct measurements of La Bong and Rock Creek streamflows could support this conclusion and facilitate future planning. The City of Stevenson, which uses La Bong Creek as its primary water source and Rock Creek as a back-up water source, supports collection of stream flow data (Planning Unit, 2004). In addition, no groundwater or aquifer recharge data are available.
- RC-2. Few water-quality data exist in the Rock Creek sub-basin.** According to the *Level 1 Water Quantity and Quality Assessment*, there are no groundwater data for the sub-basin, and the City of Stevenson and the USFS have collected only limited surface water quality data (Envirovision, 2003). This lack of water-quality information limits the ability of planners and researchers to define the existing water quality condition or to evaluate possible long-term trends.
- RC-3. High water temperatures are observed in lower Rock Creek.** Rock Creek displays a strong downstream warming trend, and most warming occurs in the middle and lower reaches. Temperatures as high as 21 degrees C (70 degrees F) have been measured, which would exceed the new water quality standards if present for seven consecutive days. Although the downstream warming could be related to geothermal activity (i.e., hot springs), the actual cause of the high temperatures is unknown (Envirovision, 2003).

RC-4. The golf course and the old County landfill are possible sources of potential pollution at the mouth of Rock Creek. The *Level 1 Water Quantity and Quality Assessment* (Envirovision, 2003) identified these two sites as possible sources of potential pollution that should be monitored in more detail. Currently, only very limited data exists with which to assess these two sites. The City of Stevenson has performed some baseline monitoring on both sites, and favors follow-up monitoring of them (Planning Unit, 2004).

RC-5. Several factors limit fish habitat in the Rock Creek sub-basin. Anadromous fish are usually present only in the first mile of Rock Creek (upstream of the Bonneville Pool), as upstream migration is impeded by waterfalls (WRIA 29 Habitat Committee, 2003). Pool habitat, large woody debris abundance, and riparian conditions have been rated poor in the sub-basin (LCFRB, 2004). In addition, fine sediment delivery associated with the road network may alter habitat, as does development on the few floodplains present in the first mile of Rock Creek (WRIA 29 Habitat Committee, 2003). According to the *WRIA 29 Level 1 Habitat Assessment*, however, a number of groups are currently working on habitat restoration activities (WRIA 29 Habitat Committee, 2003).

RC-6. Rock Creek Bridge is structurally compromised due to sediment accumulation. Rock Creek Bridge was built in 1921, before the Bonneville Dam created the Bonneville Pool, altering the profile of Rock Creek. In the years since, sediment has accumulated under the bridge, raising the water level of Rock Creek. As a result, high streamflows during storms rise to the level of the bridge deck, threatening the structural integrity of the bridge.

3.4. OPTIONS AND RECOMMENDATIONS

This section presents several options to address specific issues of the Rock Creek sub-basin. These options were assembled by the Planning Unit for consideration; inclusion of an option in this section does not necessarily indicate its endorsement or recommendation by the Planning Unit; rather, the Planning Unit's recommended action is indicated at the end of each option's discussion. For further information and a compilation of all recommendations, please see Chapter 7. In addition, please note that other, Western WRIA-wide options may also address issues identified in this sub-basin; these options are discussed under section 2.4, beginning on page 23.

3.4.1. PREPARE HYDROGRAPHS FOR ROCK CREEK AND ITS TRIBUTARIES

Description of Option

A hydrograph is a graph describing stream discharge, or flow, over time. In the process of assessing water quantity, water quality, and habitat, hydrographs are useful because they depict how much water is likely to be in a stream at different times of the year. Hydrographs are essential for recommending *instream flows*, or minimum flows that must be met in a stream to protect the resources and benefits that stream provides. When the instream flow process for Western WRIA 29 is begun, planners may wish to have hydrographs of Rock Creek and its tributaries. When sufficient stream flow measurements are not available, hydrographs are often synthesized based on available

data and the hydrographs of similar streams. The Planning Unit could commission or recommend that another party synthesize hydrographs for Rock Creek and its tributaries.

Issue addressed: No streamflow or groundwater quantity data exist in the Rock Creek sub-basin (RC-1).

Recommendation

The Planning Unit recommends that qualified experts, such as the Washington Department of Fish and Wildlife or the US Forest Service, prepare hydrographs for Rock Creek and its tributaries by synthesizing or extrapolating data from stream gauges on other similar streams, and that data collection begin to develop an actual hydrograph (Chapter 7, Recommendation #8).

3.4.2. CONDUCT FURTHER TEMPERATURE ASSESSMENTS IN THE ROCK CREEK SUB-BASIN

Description of Option

The cause of high stream temperatures in lower Rock Creek is unknown, and further assessments could be conducted to determine their causes. A new assessment could focus on the possible effect of hot springs (as recommended in the *WRIA 29 Surface Water Monitoring Strategy*), as well as the effect of streamflow on temperature. In addition, new monitoring could be conducted to assess long-term temperature trends and gauge the impact of reforestation on stream temperature in the sub-basin. The *WRIA 29 Surface Water Monitoring Strategy* recommends the establishment of two long-term temperature monitoring stations: a baseline site near the mouth and a secondary site upstream of Stevenson (Envirovision, 2004b), which could be used to support long-term monitoring and assessment.

Issues addressed: High temperatures are observed in lower Rock Creek (RC-3); Few water-quality data exist in the Rock Creek sub-basin (RC-2); No streamflow or groundwater quantity data exist in the Rock Creek sub-basin (RC-1).

Recommendation

The Planning Unit recommends that interested habitat groups and agencies assess temperatures and identify causes of any high temperatures in Rock Creek (Chapter 7, Recommendation #9).

3.4.3. DEVELOP A PLAN TO ADDRESS HIGH TEMPERATURES IN ROCK CREEK

Description of Option

Pending results of a new temperature assessment (Option 3.4.2), a plan could be developed to address temperature concerns in Rock Creek. Depending on the results of the assessment and the observed temperatures, possible plan actions could include instream restoration activities (such as placement of large woody debris) to decrease the width-to-depth ratio, an assessment of the value of current and possible stream-bank plants, and stream-bank restoration and shading projects, among others.

Issue addressed: High water temperatures are observed in lower Rock Creek (RC-3).

Recommendation

Pending results of the Rock Creek temperature assessment, the Planning Unit recommends that interested habitat groups and agencies develop a plan to address high temperatures in Rock Creek (Chapter 7, Recommendation #31).

3.4.4. CONDUCT WATER-QUALITY MONITORING OF POTENTIAL IMPACTS FROM THE GOLF COURSE AND THE OLD COUNTY LANDFILL

Description of Option

The *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003) identified these two sites as potential sources of pollution that should be monitored in more detail. The Planning Unit could encourage the City of Stevenson or other parties to conduct monitoring of these sites.

Issues addressed: The golf course and the old County landfill are possible sources of potential pollution in Rock Creek (RC-4); No streamflow or groundwater quantity data exist in the Rock Creek sub-basin (RC-1).

Recommendation

The Planning Unit recommends that the City of Stevenson, in cooperation with the owners, seek funding to conduct continued water-quality monitoring to assess if there are any impacts from the golf course and the old Skamania County landfill (Chapter 7, Recommendation #10).

3.4.5. SUPPORT THE CITY OF STEVENSON'S EFFORTS REGARDING PLANS FOR ROCK CREEK BRIDGE

Description of Option

The City of Stevenson is currently investigating options for Rock Creek Bridge, which is structurally threatened due to sedimentation and high peak flows. The city is considering whether to continue dredging, while addressing any environmental and habitat concerns, or to replace the bridge. The City, with help from Skamania County, has recently conducted further explorations of the hydrology and structural integrity of the bridge. The City is also working with the Washington State Department of Transportation's Bridge Replacement Advisory Committee on this matter (Mary Ann Duncan-Cole, City of Stevenson, personal communication, September 27, 2004). The Planning Unit could consider assisting with further study or otherwise support the City of Stevenson's decision-making process regarding Rock Creek Bridge.

Issue addressed: Rock Creek Bridge is structurally compromised due to sediment accumulation (RC-6).

Recommendation

The Planning Unit supports the City of Stevenson's efforts to address problems associated with Rock Creek Bridge (Chapter 7, Recommendation #51).

OTHER OPTIONS

Please note that several WRIA-wide options address issues identified in the Rock Creek sub-basin. In particular, for each Rock Creek sub-basin issue, the following table shows the most relevant WRIA-wide option or options. Please note this table is not intended to be entirely comprehensive; given the interrelated nature of the many issues, other Western WRIA-wide options not listed here may also help address the issues identified.

Table 5. Summary of Issues and Options in the Rock Creek Sub-basin

Rock Creek Sub-basin Issue	Rock Creek Sub-basin Options	Most relevant WRIA-Wide Options <i>Others may also apply</i>
RC-1. No streamflow or groundwater quantity data exist in the Rock Creek sub-basin.	3.4.1	2.4.1, 2.4.2, 2.4.3, 2.4.7
RC-2. Few water-quality data exist in the Rock Creek sub-basin	3.4.2, 3.4.4	2.4.1, 2.4.2, 2.4.4, 2.4.5
RC-3. High water temperatures are observed in lower Rock Creek.	3.4.3	2.4.5, 2.4.33
RC-4. The golf course and the old County landfill are potential sources of pollution in Rock Creek.	3.4.4	None
RC-5. Several factors limit fish habitat in the Rock Creek sub-basin.	3.4.3	2.4.9, 2.4.12, 2.4.14, 2.4.24, 2.4.33, 2.4.42, 2.4.43
RC-6. Rock Creek Bridge is structurally compromised due to sediment accumulation.	3.4.5	2.4.42

4. Wind River Sub-basin

4.1. DESCRIPTION/LOCATION/CHARACTERISTICS

The Wind River sub-basin is the largest sub-basin in Western WRIA 29, draining over 225 square miles of primarily forested lands. Its headwaters originate from the flanks of Gifford Peak (over 5,300 feet) to the east, Termination Point (3,996 ft) to the north, and Bare Mountain (4,360 ft) on the western border. Wind River, which is approximately 31 miles long, discharges to the Bonneville Pool of the Columbia River at river mile (RM) 154.5. The lower sub-basin, near the river mouth, lies within the Columbia River Gorge National Scenic Area. Trout Creek and Panther Creek are Wind River's largest tributaries, but Falls Creek, Dry Creek, and Bear Creek are also major tributaries. The sub-basin is home to an estimated 2,096 people, including the communities of Stabler and part of the community of Carson (Envirovision, 2003).



The Wind River

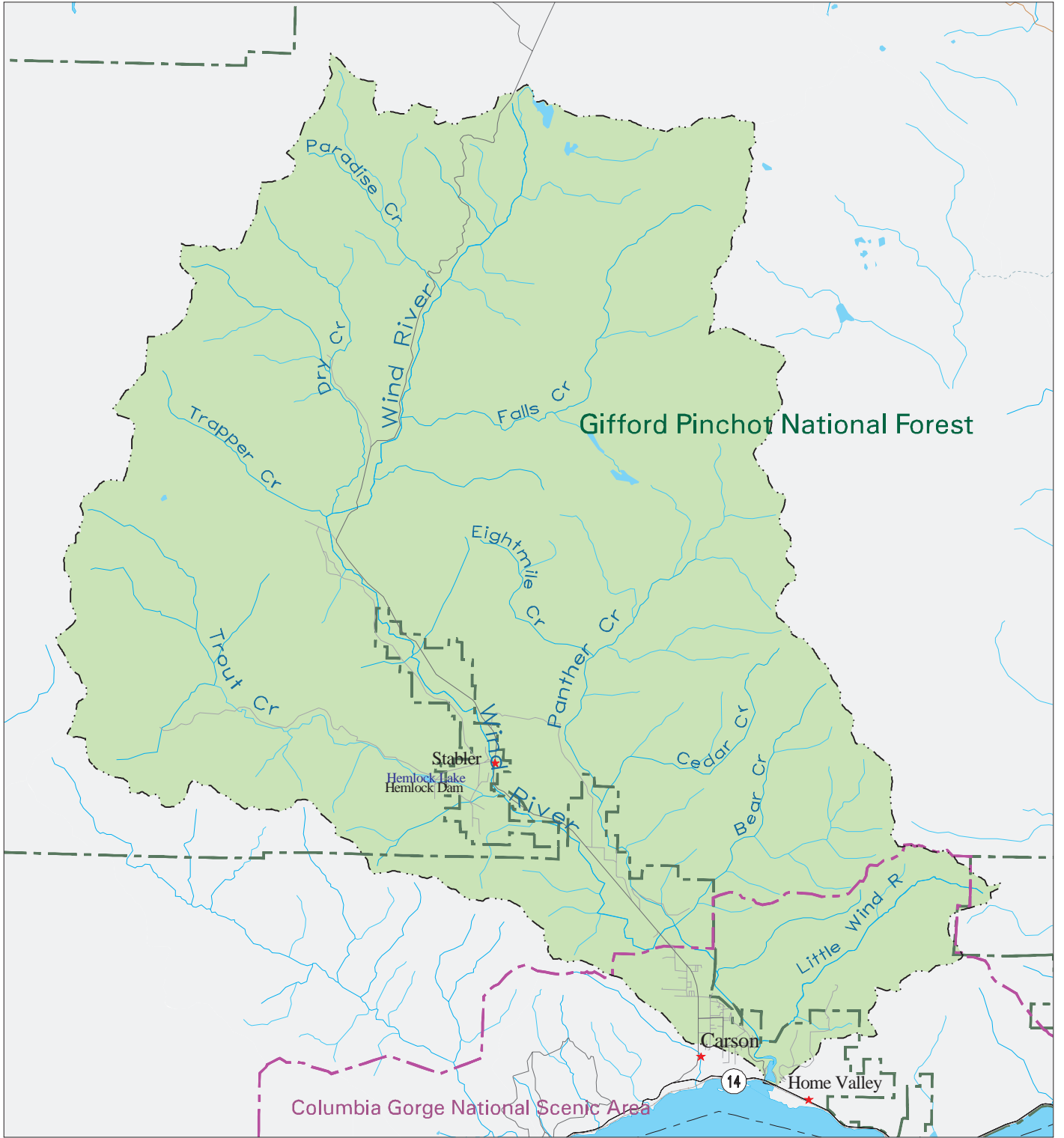
The unincorporated communities of Carson and Stabler lie within the Wind River sub-basin. The population in the Wind River sub-basin is expected to increase by about 50% between 2000 and 2020, a forecast that lends some urgency to water resources planning in the Wind River sub-basin (Kennedy/Jenks Consultants, 2003).

Volcanic rocks of the Ohanapecosh Formation underlie most of the sub-basin. This bedrock is comprised primarily of volcanic rocks known as tuff and tuff breccia, and it has been extensively weathered and altered by hot mineral-rich waters. Ridges along the southwestern border and the northeast portion of the sub-basin also include basaltic and andesitic lava flows (Envirovision, 2003).

A particularly interesting geologic feature of the Wind River sub-basin is that the Wind River valley bottom was rapidly flooded with basaltic lava flows approximately 340,000 years ago. These flows dammed the upper Wind River, Trout Creek, Panther Creek, and Bear Creek, causing the creeks to deposit up to 150 feet of sands, gravels, and finer sediments behind the lava dams. These sediments are still present today, and they serve as a shallow unconfined aquifer (Envirovision, 2003).

Additionally, there are numerous hot springs present in the Wind River sub-basin. These hot springs are associated with magma bodies that have intruded into a fracture zone in the Ohanapecosh Formation (Envirovision, 2003). Native Americans use many of these hot springs as medicine sites (Lee Carlson, Yakama Nation, WRIA 29 Work Session, May 4, 2004).

The Ohanapecosh Formation underlies most of the Wind River sub-basin, but outside of fracture zones it has low permeability, and its hydraulic continuity with surface water is low-to-moderate. Geologically recent lava flows in the northeastern corner of the sub-

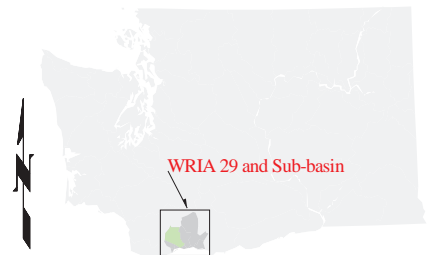


Wind River Sub-basin



GIS Technical Services
04/21/06
wria29-5

-  US/State Highways
-  Secondary Roads
-  Local Paved Roads
-  Railroads
-  Rivers/Streams
-  Intermittent
-  Columbia Gorge Natl. Scenic Area
-  Gifford Pinchot National Forest
-  County
-  Outside Planning Area
-  Population Center



basin are permeable, and precipitation readily percolates; these rock formations have medium to high hydraulic continuity with surface water. However, according to the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003), a significant portion of precipitation falling on these lava flows actually contributes to groundwater recharge in the Little White Salmon River sub-basin. The Trout Creek Hill basalt is highly permeable. The broken bottom of the flow and buried ancient Wind River gravels constitute an aquifer with high permeability and high potential for hydraulic continuity with the lower Wind River. Finally, the sands and gravels deposited in the upper Wind River and Trout Creek valley bottoms, upstream of the Trout Creek Hill basalt, are shallow unconfined aquifers (Envirovision, 2003).

Mean annual precipitation for the Wind River sub-basin is approximately 103 inches, with a range of 63 inches near the mouth to 125 inches in the upper sub-basin. Seasonal variations in precipitation are distinct: less than one inch of rain typically falls in July, while greater than 18 inches of precipitation are common during the month of December. Based on the Washington Department of Natural Resources' classifications, the Wind River falls primarily into three precipitation zones: rain-on-snow dominated (46%), rain-dominated (30%), and snow-dominated (23%) (Envirovision, 2003).

4.2. EXISTING CONDITIONS

This section summarizes the existing conditions of the Wind River sub-basin in terms of water quantity, water quality, and habitat. Most of the information presented in this section was summarized from Envirovision's *Level 1 Water Quantity and Quality Technical Assessment* (2003), the WRIA 29 Habitat Committee's *Level 1 Habitat Assessment* (2003), and the WRIA 29 Instream Flow Committee's *Level 1 Instream Flow Assessment* (2004).

4.2.1. WATER QUANTITY

Streamflow patterns in the Wind River show peak flows occurring in the winter months as a result of rain and rain-on-snow. A second period of sustained high streamflows occurs in the spring months and is attributable to snowmelt in the upper reaches of the sub-basin. Low flows occur in the late summer months. Table 6, below, shows the peak and low mean monthly flows at three gauging stations rated by the Washington State Department of Ecology as having little or no upstream regulation or diversions (Envirovision, 2003).

Table 6: Peak and Low Mean Monthly Flows in the Wind River

	Gauge: #14-128000 Panther Creek	#14-127000 Above Trout Crk	#14-128500 Carson
Drainage Area	30.1 mi ²	108 mi ²	225 mi ²
Peak Mean Flow	321 cfs (Feb.)	955 cfs (Dec.)	2,138 cfs (Feb.)
Low Mean Flow	64 cfs (Sep.)	101 cfs (Sep.)	235 cfs (Sep.)

In contrast to other sub-basins, some information on groundwater quantity and recharge is available in the Wind River sub-basin. The *Stabler Area Water Quantity and Quality Report*, completed in 2003, describes the recharge and groundwater flow of the Trout Creek Hill Basalt aquifer, which underlies Trout Creek and the Wind River in the vicinity of Stabler. The study notes that the primary recharge areas for the aquifer are Trout Creek itself, Hemlock Lake, and parts of the former USFS nursery site, all of which are in the Trout Creek watershed. The study also notes that the response of the aquifer to environmental stressors, such as groundwater pumping, is relatively quick. Therefore, it may be expected that if more wells are developed in the future, any competition for groundwater use between adjacent wells will be more severe during low water years or droughts. However, the consultants for the Stabler study also noted that the groundwater levels are likely to rebound relatively quickly following a wet period (Kennedy/Jenks, 2003).

The Wind River sub-basin contains 105 water rights. Eight applications and one change associated with one of the surface water rights are pending; two permits are in process and have not been “perfected” (demonstrated beneficial use). Thirty-four single domestic rights¹⁷ are in this sub-basin (Envirovision, 2003).

Large surface water rights in the Wind River sub-basin are used for fish hatcheries (93 cfs at the Carson National Fish Hatchery and 90 cfs held by the USFWS, both non-consumptive rights), irrigation (22.75 cfs at the now-closed Wind River nursery plus several much smaller rights), and multiple domestic¹⁸ use (22 rights totaling 2.97 cfs). Surface water rights formerly used for the now-closed Wind River Nursery were split between Skamania County and the USFS when ownership of some of the former nursery lands was transferred to the County in 2001. The approximately 187 acres of land transferred to Skamania County have tremendous potential for light industrial, commercial, residential, and recreation use and the County plans to transfer its share of the rights to groundwater (Planning Unit Work Session, 2004).

The largest groundwater rights are held by the USFS (totaling 3,990 gpm, with an annual volume limit of 237 acre-feet) and were for the Wind River Nursery. These rights are expected to be relinquished or transferred to the state Trust Water Rights Program (Envirovision, 2003).

The consultants for the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003) estimated that all consumptive uses in the watershed result in a net streamflow depletion of about 0.6 cfs in the winter and about 3.9 cfs in the summer. These withdrawals represent up to 2.4% of the low flow and up to 1.9% of the median flow. Envirovision (2003) concluded that these withdrawals likely do not represent a significant reduction in flows. However, they noted that there are significant non-consumptive water rights for fisheries and power generation for which use patterns are not adequately documented. All allocations, including consumptive plus non-consumptive use, total about 200 cfs. Comparing this use to average and low stream flows (which are 204 cfs and 164 cfs, respectively, in September) indicated there could be low flow problems in summer months. An understanding of the extent to which the non-consumptive rights are used and the location and extent of the bypass reach for each would be necessary to determine whether or not the apparent shortage is realistic

¹⁷ A “single domestic right” is a right to supply a single domestic dwelling unit.

¹⁸ “Multiple domestic rights” are those associated with more than one dwelling unit.

(Envirovision, 2003). In addition, further instream flow studies would be needed to determine whether flows are sufficient for fish needs. Limited information published by the Department of Ecology (1999) indicates that Wind River stream flow in late summer and early fall may be a factor limiting the protection of instream resources, including fish (Donna Hale, WDFW Fish Biologist, personal communication, December 15, 2004).

4.2.2. WATER QUALITY

There are several sources of data on water quality in the Wind River sub-basin. In the past, water-quality data in the Wind River sub-basin were routinely collected by the Washington State Department of Ecology, which collected data on dissolved oxygen, temperature, fecal coliform, pH, turbidity, suspended solids, and nutrients between 1972 and 1983 and again in 1994-1995. The Underwood Conservation District collected similar data (except for suspended solids) in 1999-2000 and has collected some additional data since 2001 that were not summarized in the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003).¹⁹ The US Forest Service has collected water temperature data for over two decades, and in the past decades measured summer low flow discharge, turbidity, pH and conductivity at baseline monitoring stations across the sub-basin. The Forest Service, U.S. Geological Survey and Underwood Conservation District have continued and expanded temperature monitoring in the watershed (Envirovision, 2003). Most recently, Skamania County contracted with Kennedy/Jenks Consultants to conduct a study of the surface and groundwater quality in the Wind River sub-basin near Stabler (Kennedy/Jenks, 2003).

As summarized in the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003), high stream temperatures are documented throughout the Wind River sub-basin. In the Wind River itself, maximum water temperatures have exceeded state water-quality standards in at least 15 of 22 years, reaching a maximum of 21 degrees C (70 degrees F). High temperatures are even more prevalent in Trout Creek, where water temperature criteria have been exceeded for 22 of 23 years; maximum temperatures have been measured as high as 25 degrees C (77 degrees F), often considered lethal to most salmonids; and temperatures have remained above the standard for as many as 75 days in a single summer. Basin-wide, temperatures have exceeded 17.5 degrees C (63 degrees F) at 11 of the 53 monitoring stations. Due to elevated temperatures, three streams in the Wind River sub-basin are listed on the EPA's 1998 303(d) list of impaired water bodies: Bear Creek, Eightmile Creek (a tributary to Panther Creek), and Trout Creek (Envirovision, 2003). In 2002, the Department of Ecology completed a water clean-up plan (a TMDL) for temperature in the Wind River, leading to these creeks being removed from the 303(d) list. Removal of these streams from the 303(d) list does not imply that high temperatures no longer occur in the Wind River sub-basin, only that a TMDL plan is in place to address the problem.

Temperature problems in the sub-basin are attributed to loss of shading riparian vegetation, and subsequent channel widening that increases the stream surface exposed to solar radiation, as well to damming and the possible influence of reduced summertime baseflows from water withdrawals (Howard, 2004). The Water Quality Restoration Plan (USFS, 2001) for the Wind River contains a detailed assessment of the anthropogenic (human-induced) causes of elevated temperatures within this sub-basin.

¹⁹ The Underwood Conservation District also collected one round of data in the Wind River in 2001. The District has collected data in Trout Creek since August 2002, and it has collected continuous temperature data from the sub-basin since 1999.

Analysis of the Ecology and UCD datasets indicated that all samples appeared to meet the Class A water quality standards for dissolved oxygen and fecal coliform. However, the WRIA 29 Lower Wind River Aquifer Study found numerous wells in the Carson area where groundwater was contaminated with fecal coliform (Yinger, 2004) and three subsequent attempts by the Skamania County PUD to locate new wells have had to be abandoned due to fecal coliform. Total suspended solids (TSS), total phosphorous (TP), and turbidity were also consistently low, meeting standards. However, turbidity was identified as a concern by a USFS study (USFS, 1996). Data collected in November 1995 by the USFS indicate that turbidity levels can increase notably during higher flows, especially in Ninemile, Lower Panther, and Trout Creeks, as well as in the Wind River (Envirovision, 2003).

Concentrations of pollutants and metals in groundwater consistently met national drinking water standards. Concentrations of iron in the groundwater can be somewhat elevated, but only to the point at which they might affect taste and color rather than health (Kennedy/Jenks, 2003).

4.2.3. HABITAT

The Wind River is the first major anadromous fish-bearing stream in Washington upstream of Bonneville Dam.²⁰ The sub-basin contains approximately 181 miles of fish-bearing streams, 956 miles of non-fish-bearing perennial and intermittent streams, and 293 acres of lakes and ponds (LCFRB, 2004).

Natural and human-made barriers limit access to Wind River's habitat to native summer steelhead and spring chinook. Historically, Shipherd Falls blocked the upstream migration of all salmonids other than steelhead (lamprey may have been able to pass) past river mile 2 (LCFRB, 2004). However, a fish ladder installed in the 1950s now allows spring chinook to return upstream, and a trap is used to regulate their migration. Spring chinook are raised at the Carson National Fish Hatchery at river mile 18.

Hemlock Dam, located at river mile 2.1 on Trout Creek (which joins the Wind River at river mile 10.8), is an additional fish passage barrier. Although the dam has a fish ladder, it obstructs passage of out-migrating juvenile steelhead and possibly of returning adults (WCC, 1999). The dam was constructed by the USFS in 1935 to provide irrigation water to its Wind River tree nursery, which closed in 1997 (Envirovision, 2003). In October, 2005, the USFS released a Final EIS that recommended removal of the dam and of the sediment stored behind the dam to improve migration and habitat conditions for steelhead and other aquatic organisms. Poorly designed or poorly maintained culverts also obstruct fish passage throughout the sub-basin (LCFRB, 2004).



USFS Fish Biologist Brian Bair with bank stability log structures, Wind River

²⁰ Anadromous streams and other bodies of water are those accessible to fish migrating from the ocean.

Several other factors in the basin also affect fish habitat. As noted in the water quality section above, water temperatures are high in many areas due to loss of riparian cover, channel widening, and low summer flows.²¹

Furthermore, in its *Fish Recovery Plan – Technical Foundation*, the Lower Columbia Fish Recovery Board notes that the sub-basin is susceptible to peak and low flow problems; concerns over adequate habitat structure exist; excessive input of sediment is one of the primary limiting factors; and LWD quantities and bank stability are poor. Diking and development were also identified as limiting factors in the sub-basin (LCFRB, 2004).



Hemlock Dam

Riparian function, on the other hand, is generally good throughout the sub-basin (LCFRB, 2004). Restoration efforts to improve habitat structure, LWD abundance, bank stability, and riparian cover have been completed. Along with road decommissioning and culvert upgrades. This work has primarily been done by the US Forest Service (LCFRB, 2004).

Finally, Skamania County has identified Eurasian watermilfoil as an invasive aquatic plant species affecting the mouth of the Wind River. Milfoil affects both recreational and salmon/trout characteristic uses (Pfauth and Sytsma, 2004).

Fish Species Supported

Native summer steelhead are present throughout the Wind River sub-basin. The Washington Department of Fish and Wildlife estimates that the current habitat produces up to 1,200 adults per year, approximately half the amount of historic levels (WDFW 2003). Wind River summer steelhead runs are listed as threatened by NOAA Fisheries (WRIA 29 Habitat Committee, 2003). Although the *WRIA 29 Habitat Level 1 Technical Assessment* noted that opportunities for improving habitat are limited (WRIA 29 Habitat Committee, 2003), the Lower Columbia Fish Recovery Board recommends preserving Wind River canyon between Shipherd Falls (RM 2) and the mouth of Trout Creek (RM 10.8), a critical area for steelhead rearing (LCFRB, 2004). Habitat improvements could increase summer steelhead production to as many as 1,500 fish (WDFW, 2003).

Winter steelhead, on the other hand, are much more limited. A small number spawn in the Little Wind River, and few fish pass above Shipherd Falls (LCFRB, 2004). The mainstem below Shipherd Falls, the Little Wind River, and the mainstem from Shipherd Falls to Stabler are potential habitat areas. Limiting factors in these areas are habitat diversity, temperature, and sediment (LCFRB, 2004). Both summer and winter steelhead are part of the Lower Columbia Evolutionarily Significant Unit and are listed as threatened (Donna Hale, WRIA 29 Work Session, March 2, 2004).

Other anadromous fish are generally limited to the section of Wind River below Shipherd falls. Chinook are present in limited numbers (generally less than 500), but the Washington Department of Fish and Wildlife estimates that improvements to habitat

²¹ There is also the perception in the watershed that hot springs may contribute to high temperatures (Bob Wittenberg, General Manager of Skamania County PUD No. 1, WRIA 29 Work Session, March 2, 2004).

could result in as many as 2,400 fish (LCFRB, 2004). A particular opportunity for habitat improvement is the reach immediately upstream of the Bonneville reservoir, where key habitat elements and sedimentation could be addressed (LCFRB, 2004). This reach would also need to be improved to support chum. However, few (if any) chum are able to pass the Bonneville Dam, making their reestablishment unlikely. Other anadromous fish present in this section of the Wind River sub-basin are coho salmon and sea-run cutthroat trout. Spring chinook are produced at the Carson National Fish Hatchery upstream (RM 18).

In addition to the fish discussed above, rainbow trout are also present in the Wind River sub-basin (WRIA 29 Habitat Committee, 2003). Pacific lamprey may also be present; this is a culturally important species for tribes and is a potential candidate for listing under the Endangered Species Act (Lee Carlson, Yakama Nation, comments submitted September 1, 2004).

4.3. ISSUES

The Planning Unit has identified the following key issues to be addressed in the Wind River sub-basin.

- WR-1. More water-quality data are needed in the Wind River sub-basin, particularly during late summer,** and should be coupled with stream flow measurements. Although multiple agencies collect temperature data, none collects other water-quality data such as turbidity and dissolved oxygen, on a regular basis. UCD and Ecology temperature monitoring indicate elevated temperatures during summer, however, this data is not coupled with streamflow data.
- WR-2. More streamflow data are needed in the Wind River sub-basin.** Comparison of water right allocations to streamflow in the Wind River and its tributaries indicate that withdrawals in low-flow years may have significant impacts on water quality. Most notably, water withdrawals by the community of Carson can easily affect Bear Creek, where the community's water supply (for which the Skamania County PUD #1 holds the water right) is a large fraction of the flow in extreme low flow years (Envirovision, 2003). More streamflow data could help planners monitor potential conflicts, and stream gauging at the temperature stations would be helpful in assessing the relationship between temperature and streamflow, particularly in late summer.
- WR-3. Some tributaries of the Wind River have been included on the 303(d) list for high temperatures.** Bear, Eightmile, and Trout Creeks were cited in the 1998 303(d) list of impaired waters due to temperature exceedances. According to Envirovision, poor riparian shading and channel widening have been identified as the primary causes of elevated temperatures in these creeks (Envirovision, 2003), although other factors (such as water withdrawals, stream cleanouts, ponding behind Hemlock Dam, beaver dams, and hot springs) may contribute as well (Planning Unit, 2004). High temperatures are particularly acute in Trout Creek, which has only 59% riparian shading and experiences warming due to ponded water behind Hemlock Dam (Envirovision, 2003). Some steps have been taken to address the high temperatures in the sub-basin. Most notably, the Department of

Ecology has recently completed a TMDL study for the Wind River sub-basin, as required for waters listed on Ecology's 303(d) list of impaired waters.²² In addition, the USFS is conducting channel and stream-bank restoration in the upper and middle reaches of the Wind River and in tributaries including Trout Creek (Planning Unit, 2004). Although the efforts of the USFS have been successful in terms of improving riparian and channel conditions, the effect on temperature will be determined over many years as vegetation matures and the channel narrows (Bengt Coffin, USFS, personal communication, May 25, 2004).

- WR-4. Sedimentation occurs in some areas of the Wind River sub-basin.** The Lower Columbia Fish Recovery Board cited sediment production as one of the primary limiting factors in the sub-basin. Nearly half of the streams or reaches that they studied (12 out of 26) were identified as having a high risk of sedimentation impact on aquatic habitats. The Board's *Fish Recovery Plan – Technical Foundation* noted that road conditions and inadequate vegetation were possible influences on erosion and sedimentation (LCFRB, 2004). The report also noted that where attempted, vegetation restoration projects, such as those conducted in Layout Creek, have been successful. Furthermore, new forest practices standards are expected to help reduce the input of sediment from forest roads and harvest practices (LCFRB, 2004). However, further efforts may be necessary to address sedimentation in the sub-basin and address concerns raised by the Lower Columbia Fish Recovery Board.
- WR-5. Most of the Wind River sub-basin has low quantities of large woody debris.** The Lower Columbia Fish Recovery Board has determined that these low levels (most streams have fewer than 75 pieces of LWD per mile) are attributable to loss of recruitment (due to riparian harvest) and past stream clean-outs (LCFRB, 2004). Large woody debris (LWD) provides direct salmon habitat through shade and protection and indirectly benefits salmon by affecting stream channel and pool morphology. Given the shape of the Wind River valley, some reaches (such as the Wind River Canyon) are not conducive to LWD accumulation. However, the middle Wind River (Wind Flats and Mining Reach) and portions of Trout and Panther Creek would have historically consisted of riparian forests with abundant LWD, and stream channel migrations across the valley floor would have created a patchwork of side-channel and backwater habitats (LCFRB, 2004). Initial restoration efforts in the middle Wind River by the United States Forest Service have been successful, as LWD quantities have increased by 497% in the Mining Reach (LCFRB, 2004). Other efforts may be needed to continue or expand this success into other portions of the Wind River sub-basin.
- WR-6. Hemlock Dam contributes to high temperatures in Trout Creek, and it affects migration of listed steelhead.** The USFS studied Hemlock Dam for several years and in October of 2005 released a Final, Environmental Impact Statement recommending removal of the dam and excavation of the sediment that is built up behind the dam (USFS, 2005). Currently, the dam

²² It is important to note that the completion of a TMDL for a water body means that it is removed from the 303(d) list. However, the stream's removal from the list does not mean that its water quality has improved, merely that a plan is in place to do so.

creates a passage impediment to fish and other aquatic organisms, and prevents downstream movement of sediment and woody debris. The completed FEIS is currently available on the Gifford Pinchot National Forest website.

WR-7. There is some discrepancy between low flow discharge levels on Bear Creek that were published in the *Level 1 Water Quantity and Quality Assessment* (Envirovision, 2003) and data provided to the Planning Unit by Skamania County PUD #1. Comparison of water-right allocations to stream flow provides the basis for concern in Bear Creek during extreme low-water seasons. PUD #1 holds the only known active water right, of 2 cfs (900 gpm), in Bear Creek. The Carson Water System facilities were modified in 1977 to reduce the maximum flow of the withdrawal from Bear Creek from 900 gpm (2 cfs) to 550 gpm (1.23 cfs). The PUD has measured flow over its diversion dam since 1977 – and in that time period, the lowest flow recorded was 4.06 cfs (1823 gpm) over the dam. Adding this flow to the PUD’s simultaneous withdrawal of 550 gpm (1.23 cfs) above the dam gives a total stream flow of 2373 gpm (5.29 cfs) coming into the diversion area (Unpublished data collected by PUD staff from 1979-2005 at its Bear Creek diversion while it is in full operation). This data contradicts the published measurement of 2 cfs (900 gpm) published in the *Level 1 Water Quantity and Quality Assessment* (Envirovision, 2003), for which no citation is provided. The data incorporated in the *Level 1 Water Quantity and Quality Assessment* came from US Forest Service discharge measurements of discharge on bear Creek that were taken during the 1970’s through the 1980’s. These streamflow measurements were taken upstream of the water diversion. Because the two datasets were collected from the two different locations, and probably at different times, there should be some rectification of the measurement methods, timing, and location to determine which is more representative of the flow conditions in Bear Creek during low flow conditions.

4.4. OPTIONS AND RECOMMENDATIONS

This section presents several options to address specific issues of the Wind River sub-basin. These options were assembled by the Planning Unit for consideration; inclusion of an option in this section does not necessarily indicate its endorsement or recommendation by the Planning Unit. Other, Western WRIA-wide options may also address issues identified in this sub-basin; these options are discussed under section 2.4, beginning on page 23.

4.4.1. PREPARE HYDROGRAPHS FOR BEAR AND PANTHER CREEKS AND OTHER WIND RIVER TRIBUTARIES

Description of Option

A hydrograph is a graph describing stream discharge, or flow, over time. In the process of assessing water quantity, water quality, and habitat, hydrographs are very useful because they depict how much water is likely to be in a stream at different parts of the year. Hydrographs are essential for recommending *instream flows*, or minimum flows that must be met in a stream to protect the resources and benefits that stream provides.

When the instream flow process for Western WRIA 29 is begun, planners may wish to have hydrographs of several Wind River tributaries not included in the *Instream Flow Level 1 Technical Assessment* (WRIA 29 Instream Flow Committee, 2004). When sufficient stream flow measurements are not available, hydrographs are often synthesized based on available data and the hydrographs of similar streams. The Planning Unit could commission or recommend that another party synthesize hydrographs for Wind River tributaries that are important fish production areas and for which hydrographs do not currently exist.

Issue addressed: More streamflow data are needed in the Wind River sub-basin (WR-2).

Recommendation

The Planning Unit recommends that qualified experts, such as the Washington Department of Fish and Wildlife or the US Forest Service, prepare hydrographs for Bear and Panther Creeks and other Wind River tributaries by synthesizing or extrapolating data from stream gauges on other similar streams, and that data collection begin to develop an actual hydrograph (Chapter 7, Recommendation #11).

4.4.2. ENCOURAGE EXPANDED IMPLEMENTATION OF TEMPERATURE MONITORING

Description of Option

In 2004, Envirovision completed its *WRIA 29 Surface Water Monitoring Strategy*. The report includes water-quality monitoring recommendations for the Wind River, including a recommendation to establish three baseline and six secondary monitoring sites, several of which are coincident with pre-existing sites operated by either UCD or USFS. The report calls for temperature monitoring in the vicinity of Hemlock Dam, both above (an existing baseline site) and below the dam. The report also called for temperature monitoring at the mouth of the Wind River and in other tributaries, including Trapper, Panther, and Bear Creeks (Envirovision, 2004b). The Planning Unit could encourage the responsible parties to implement the recommendations of the *WRIA 29 Surface Water Monitoring Strategy* for the Wind River Sub-basin.

Issue addressed: Some tributaries of the Wind River have been 303(d) listed for high temperatures (WR-3).

Recommendation

The Planning Unit recommends ongoing temperature monitoring in the Wind River sub-basin in accordance with the TMDL and expanded monitoring in additional tributaries (Chapter 7, Recommendation #12).

4.4.3. ENCOURAGE IMPLEMENTATION OF THE TEMPERATURE TMDL PLAN

Description of Option

The Department of Ecology is required to develop water-cleanup plans called TMDLs for water bodies that fail to meet water quality standards and are placed on the 303(d) list. In 2002, Ecology and the U.S. EPA approved the Wind River TMDL water-cleanup plan. In May, 2004, the Washington State Department of Ecology published its TMDL *Detailed Implementation Plan* for the Wind River Sub-basin (Howard, 2004). This plan includes

actions for Skamania County, the Underwood Conservation District, the USFS, and many others. The Planning Unit could encourage the various parties to implement the TMDL plan and comply with the schedule outlined by Ecology.

Issue addressed: Some tributaries of the Wind River have been 303(d) listed for high temperatures (WR-3).

Recommendation

The Planning Unit supports the implementation of the Temperature TMDL in the Wind River sub-basin (Chapter 7, Recommendation #52).

4.4.4. ENCOURAGE THE US FOREST SERVICE'S RIPARIAN ENHANCEMENT WORK IN THE WIND RIVER SUB-BASIN

Description of Option

The USFS's current work includes thinning of dense conifer and hardwood stands to accelerate growth of the remaining trees, as well as planting of conifers in areas where they are lacking. The objective of these treatments is to improve and accelerate development of shade along streams and to promote development of large coniferous trees in riparian areas (Bengt Coffin, USFS, personal communication, May 25, 2004).

Issues addressed: Some tributaries of the Wind River have been included on the 303(d) list for high temperatures (WR-3); Sedimentation occurs in some areas of the Wind River sub-basin (WR-4).

Recommendation

The Planning Unit supports continuation of riparian enhancement work in the Wind River Sub-basin (Chapter 7, Recommendation #53).

4.4.5. ENCOURAGE THE US FOREST SERVICE'S INSTREAM ENHANCEMENT WORK IN THE WIND RIVER SUB-BASIN

Description of Option

The USFS's current work includes placement of large and small woody debris in active channels, along channel margins, and on gravel bars. The objective of these treatments is to reduce low flow channel widths, stabilize channel banks and bars, and to facilitate development of riparian vegetation (Bengt Coffin, USFS, personal communication, May 25, 2004).

Issue addressed: Some tributaries of the Wind River have been included on the 303(d) list for high temperatures (WR-3); Most of the Wind River sub-basin has low quantities of large woody debris (WR-5); Sedimentation occurs in some areas of the Wind River sub-basin (WR-4).

Recommendation

The Planning Unit supports continuation of instream enhancement work in the Wind River Sub-basin (Chapter 7, Recommendation #54).

4.4.6. SUPPORT WIND RIVER WATERSHED COUNCIL RESTORATION EFFORTS

Description of Option

The Wind River Watershed Council is a stakeholder group assembled in the late 1990s to share information and recommend restoration and other activities in the Wind River Sub-basin. The Council was involved in the development of the *Skamania County Integrated Aquatic Vegetation Management Plan* (Pfauth and Sytsma, 2004), where the Council served as the vehicle for gathering public input. The Council is also involved in supporting the efforts of the United States Forest Service, Underwood Conservation District, and others to revegetate stream-banks, maintain floodplain connectivity, and reintroduce large woody debris into certain areas of the Wind River sub-basin (Jim White, Underwood Conservation District, personal communication, July 28, 2004). The Planning Unit could support the Wind River Watershed Council and its partner organizations in these efforts.

Issue addressed: Some tributaries of the Wind River have been included on the 303(d) list for high temperatures (WR-3); Sedimentation occurs in some areas of the Wind River sub-basin (WR-4); Most of the Wind River sub-basin has low quantities of large woody debris (WR-5).

Recommendation

The Planning Unit supports continuation of watershed management groups in Western WRIA 29 (Chapter 7, Recommendation #55).

4.4.7. ASSESS SOURCES OF WIND RIVER SEDIMENT

Please see Option 2.4.6 on page 26 for a discussion of this option.

4.4.8. SUPPORT SKAMANIA COUNTY'S PROPOSAL TO DREDGE THE MOUTH OF THE WIND RIVER

Description of Option

The *Skamania County Integrated Aquatic Vegetation Management Plan* (Pfauth and Sytsma, 2004) recommends dredging the mouth of the Wind River to a depth of 15 feet to control milfoil and remove enough sediment to ensure boat access between the public boat ramp and in-water fishing areas. The Western WRIA 29 Watershed Plan could support this recommendation to help with the milfoil problem; dredging would also remove accumulated sediment, although it would not prevent future sedimentation.

Issues addressed: Sedimentation occurs in some areas of the Wind River sub-basin (WR-4); Invasive aquatic species threaten Western WRIA 29 water bodies and riparian areas (W-8).

Recommendation

The Planning Unit supports Skamania County's Integrated Aquatic Vegetation Management Plan (Pfauth and Sytsma, 2004) and encourages the County to continue seeking supplemental funding sources to do so. The Planning Unit also encourages federal and state agencies to fund milfoil controls in Western WRIA 29. The Planning Unit encourages continued research on milfoil and management techniques and encourages the State to undertake a Columbia basin-wide effort to control milfoil and

educate water users about it, its effects, and its control (Chapter 7, Recommendation #42).

4.4.9. ENCOURAGE THE USFS AND THE SKAMANIA COUNTY PUD #1 TO WORK TOGETHER TO RECONCILE THEIR DATA REGARDING BEAR CREEK LOW-FLOWS.

Description of Option

The *Level 1 Water Quantity and Water Quality Technical Assessment* prepared by Envirovision (2003) cites a low flow of 2 cfs (900 gpm) based on USFS monitoring data collected from above the dam from the 1970's through the 1980's. However, the Skamania Country PUD #1 has recorded flow measurements over its diversion dam since 1977. Its data shows that the lowest flow recorded over nearly 30 years is 4.06 cfs (1823 gpm), which when added to the PUD's diversion of 550 gpm (1.23 cfs) yields a total stream flow of 2373 gpm (5.29 cfs) coming into the diversion dam area (Unpublished data collected by PUD staff from 1979-2005 at its Bear Creek diversion while it is in full operation). Because the two datasets were collected from two different locations, and probably at different times, the Planning Unit could recommend the USFS and the PUD reconcile the measurement methods, timing, and location to determine which is more representative of the flow conditions in Bear Creek during low flow conditions.

Issues Addressed: There is some discrepancy between low flow discharge levels on Bear Creek that were published in the Level 1 Water Quantity and Quality Assessment prepared for the WRIA 29 Planning Unit (Envirovision, 2003) and data provided to the Planning Unit by Skamania County PUD #1 (WR-7).

Recommendation

The Planning Unit recommends the USFS and the Skamania Country PUD work together to reconcile the measurement methods, timing, and location of their two datasets regarding Bear Creek low-flows prior to beginning any instream flow process (Chapter 7, Recommendation #46).

OTHER OPTIONS

Please note that several Western WRIA-wide options address issues identified in the Wind River sub-basin. In particular, for each Wind River sub-basin issue, the following table shows the most relevant Western WRIA-wide option or options. Please note this table is not intended to be entirely comprehensive; given the interrelated nature of the many issues, other Western WRIA-wide options not listed here may also help address the issues identified.

Table 7. Summary of Issues and Options in the Wind River Sub-basin

Wind River Sub-basin Issue	Wind River Sub-basin Options	Most relevant WRIA-Wide Options <i>Others may also apply</i>
WR-1. More water-quality data are needed in the Wind River sub-basin, particularly during late summer	4.4.2	2.4.1, 2.4.2, 2.4.4, 2.4.5
WR-2. More streamflow data are needed in the Wind River sub-basin	4.4.1	2.4.2, 2.4.7, 2.4.40
WR-3. Some tributaries of the Wind River have been 303(d)-listed for high temperatures	4.4.2, 4.4.3, 4.4.4, 4.4.5, 4.4.6	2.4.5, 2.4.33
WR-4. Sedimentation occurs in some areas of the Wind River sub-basin	4.4.4, 4.4.5, 4.4.6, 4.4.8	2.4.6, 2.4.24, 2.4.33, 2.4.42, 2.4.43
WR-5. Most of the Wind River sub-basin has low quantities of large woody debris	4.4.5, 4.4.6	2.4.43
WR-6. Hemlock Dam contributes to high temperatures in Trout Creek, and affects migration of listed steelhead	None	None
WR-7. There is some discrepancy between low flow discharge levels on Bear Creek that were published in the Level 1 Water Quantity and Quality Assessment (Envirovision, 2003) and data provided to the Planning Unit by Skamania County PUD #1.	4.4.9	None

5. Little White Salmon River Sub-basin

5.1. DESCRIPTION/LOCATION/CHARACTERISTICS

The Little White Salmon River sub-basin lies immediately to the east of the Wind River sub-basin. The second largest sub-basin in Western WRIA 29, the Little White Salmon River sub-basin encompasses 135 square miles. Its highest elevation is 5,300 feet, and its lowest is where it flows into Drano Lake, adjacent to the Bonneville Pool of the Columbia River. Important tributaries to the Little White Salmon River include Lusk, Lost, Little Huckleberry, Berry, Lapham, Cabbage, Lava, Moss, and Rock Creeks. The communities of Mill A and Willard, although small, are the largest population centers within the sub-basin; an estimated 513 people live in the sub-basin (Envirovision, 2003).

The majority of the sub-basin (79%) is federal land managed by the Gifford Pinchot National Forest. The remainder of the land is either state land or privately owned (Envirovision, 2003).

The sub-basin is underlain by altered volcanic rocks of the Ohanapecosh formation. Geologically recent basalt lavas flowed down the valley, filling the valley bottom. These basalt flows temporarily dammed the Little White Salmon River. As water backed up behind the dam, large quantities of alluvial gravels were deposited (Envirovision, 2003).

The Little White Salmon River basin also contains several historic landslide deposits, mostly found in the southern portion of the sub-basin. These landslides typically occur when thick clay developed on the Ohanapecosh Formation becomes saturated with percolating groundwater. This clay then lubricates the contact with the overlying Grande Ronde Basalt, facilitating a landslide (Envirovision, 2003).

The Little White Salmon River sub-basin contains five principal aquifers. The Ohanapecosh Formation underlies most of the Little White Salmon River sub-basin, but outside of its fracture zones it has low permeability. The formation's hydraulic continuity with surface water is low-to-moderate. In contrast, the volcanic rocks in the northern and central portion of the sub-basin are permeable and precipitation readily percolates. The sediments deposited behind the historic "Big Lava Bed" formation serve as a shallow permeable unconfined aquifer with high hydraulic continuity with surface water. The Underwood Mountain volcanic rocks, located west of the mouth of the Little White Salmon River, are permeable and precipitation readily percolates. And finally, the Columbia River basalts, in the lower Little White Salmon River area, can be a permeable and productive aquifer (Envirovision, 2003).

Mean annual precipitation for the Little White Salmon River sub-basin is approximately 74 inches, with a range of 33 inches near the mouth to 113 inches in the upper sub-basin. The majority of the annual precipitation occurs from November to March. Based on the WDNR classifications, the Little White Salmon River falls primarily into two precipitation zones: rain-on-snow (35%) and snow-dominated (42%). Most of the remaining acres are in the rain-dominated zone (19%) (Envirovision, 2003).

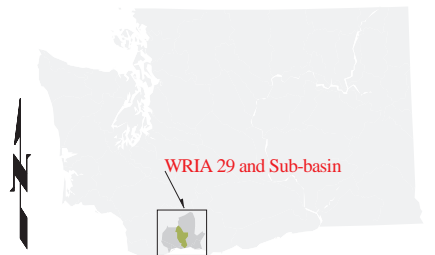
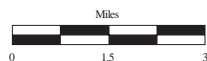


Little White Salmon River Sub-basin



GIS Technical Services
04/21/06
wria29-4

- US/State Highways
- Secondary Roads
- Local Paved Roads
- Railroads
- Rivers/Streams
- Intermittent
- Columbia Gorge Natl. Scenic Area
- Gifford Pinchot National Forest
- County
- Outside Planning Area
- Population Center



5.2. EXISTING CONDITIONS

This section summarizes the existing conditions of the Little White Salmon River sub-basin in terms of water quantity, water quality, and habitat. Most of the information presented in this section was summarized from Envirovision’s *Level 1 Water Quantity and Quality Technical Assessment* (2003), the WRIA 29 Habitat Committee’s *Level 1 Habitat Assessment* (2003), and the WRIA 29 Instream Flow Committee’s *Level 1 Instream Flow Assessment* (2004).

5.2.1. WATER QUANTITY

Streamflow patterns for the three Little White Salmon River stations show peak flows occurring in the winter months and low flows during the late summer months. Table 8, below, shows the peak and low mean monthly flows at the three gauging stations.

Table 8: Peak and Low Mean Monthly Flows in the Little White Salmon River

Gauge:	#14-124500 Near Willard	#14-125000 Above Lapham	#14-125500 Near Cook
Drainage Area	114 mi ²	117 mi ²	134 mi ²
Peak Mean Flow	774 cfs (Feb.)	893 cfs (Feb.)	976 cfs (Feb.)
Low Mean Flow	83 cfs (Sep.)	143 cfs (Sep./Oct.)	160 cfs (Oct.)

In addition to the high flows that peak in February, the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003) found a second period of sustained high streamflows in the spring months. Snowmelt in the upper basin generates most of the water for the spring high flows, while rainstorms and rain-on-snow events generate the peak flows in late fall and winter (Envirovision, 2003).

No data on groundwater quantity or recharge were available. The geology of the basin provides some insight into the characteristics of the aquifers and aquitards of the basin (as described above), but any quantitative analysis would require a data collection effort.

The Little White Salmon River sub-basin contains 69 water rights. Five applications are pending, as is one change associated with one of the surface water rights; additionally, one permit is in process. The largest allocation of surface water is for fish propagation (a non-consumptive use) at 125.5 cfs (including 118 cfs for USFWS fish hatcheries); the second largest is for stock watering, at 5.2 cfs; and the third largest is irrigation (30 rights totaling 4.64 cfs to irrigate 202 acres). The largest four individual surface water rights are held by the USFWS for fish propagation and have a total diversion rate of 118 cfs; no annual volume limits were assigned to these rights. The largest three groundwater rights are also held by the USFWS for fish propagation and have a total withdrawal rate of 2,000 gallons per minute (4.45 cfs), with an annual volume limit of 2,720 acre-feet (Envirovision, 2003). Groundwater withdrawn by the fish hatchery is returned to the Little White Salmon River.

While the largest allocation of water is for fish propagation, this water is generally returned to the stream, making it a “non-consumptive” use. Much of the water used for

irrigation, however, is consumed by plants, soil, or evaporation, and so irrigation is termed a “consumptive” use. Residential and public water use is relatively minimal, as only about 513 people live in the sub-basin. The consultants for the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003) estimated that all consumptive uses in the sub-basin result in a net streamflow depletion of 0.32 cfs in the winter and 0.98 cfs in the summer. Based on this analysis, they concluded that shortage of flows needed to support existing out-of-stream uses is unlikely. In addition, further work may be needed to determine whether flows are sufficient to meet fish needs.

5.2.2. WATER QUALITY

According to the *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003), there are limited water-quality data in the Little White Salmon River. The only notable water-quality report and data set available for the Little White Salmon River sub-basin is the Little White Salmon Watershed Analysis completed by the US Forest Service in 1995 (USFS, 1995). Data sources identified in that report include daily temperature monitoring at the Little White Salmon River and Willard National Fish Hatcheries and a long-term temperature-monitoring site operated by the USFS upstream of Moss Creek (Envirovision, 2003).

The U.S. Fish and Wildlife service (USFWS) has long identified turbidity and suspended sediments as a problem in the Lower Little White Salmon River. The USFWS and USFS have identified stream-bank cutting as a likely contributor of this sediment. Road crossings and failed culverts in the basin have also been identified, and an old slope failure may still contribute sediment to the Lusk Creek drainage. Total suspended solids concentrations appear to have declined in the early 1990s, but it is unclear whether this is a result of lower flows in that period or other factors such as improved watershed management (Envirovision, 2003).

The only other possible water-quality issue noted by Envirovision is temperature. Temperature data reviewed by the Level 1 consultants were generally well within Class A and Class AA standards. However, the USFS watershed assessment noted one possible problem observed in a segment of the river upstream of Moss and Lava Creeks. Based on further analysis, the USFS concluded that Lost Creek (north), unnamed tributaries draining into the northwest portion of the Big Lava Bed, Little Huckleberry, Berry, Lapham and Cabbage Creeks were particularly vulnerable to temperature increase since at least 30% of their riparian areas were in early seral (successional) vegetation stages²³ (Envirovision, 2003). However, these temperatures may be less of an issue since natural barriers limit fish passage into these reaches. In Moss Creek, stream temperatures are especially cold; in the summer and fall of 2000, no temperatures were recorded above 6 degrees C (43 degrees F). Cold water from Moss Creek and other headwater streams provides thermo-regulation in the downstream reaches (Jim Byrne, WDFW, personal communication, May 24, 2004).

Based on the limited available data, Envirovision’s *Level 1 Water Quantity and Quality Assessment* did not identify other water-quality issues (Envirovision, 2003).

²³ The early seral vegetation stage is characterized by shrubs and hardwood trees – such as alder – which start growing in natural succession soon after a disturbance such as fire, logging, or a landslide.

5.2.3. HABITAT

Natural barriers limit use of the Little White Salmon River sub-basin by anadromous fish species, as several waterfalls limit the upstream passage of fish. The first falls occur at river mile 2, and six other waterfalls that restrict fish passage are located in the sub-basin (Envirovision, 2003). Even below the falls, anadromous fish production is minimal, as the construction of the Bonneville Dam flooded the lower river and created Drano Lake (LCFRB, 2004). Although the creation of Drano Lake limited spawning in the area, the lake is now an important thermal refugia for migrating fish.

Aside from the presence of waterfalls, the habitat of the Little White Salmon River sub-basin has not been characterized in great detail. Based on a survey of several reaches, the Lower Columbia Fish Recovery Board reports that habitat diversity conditions are generally good and that there are no major water-quality concerns. However, they also report that there is little large woody debris (LWD) as streams surveyed contained only 6.1 to 14.5 pieces per mile and that some major impacts to channel stability, including bar development and channel widening, have occurred (LCFRB, 2004). In addition, the riparian zone has been impacted by human activity: 39% of the sub-basin falls outside the “range of natural conditions” for riparian function (USFS, 1995). Sedimentation is rated as “moderately impaired” in the lower portion of the watershed upstream of Drano Lake.

Finally, Skamania County has identified Eurasian watermilfoil as an invasive aquatic species affecting Drano Lake at the mouth of the Little White Salmon River. Milfoil affects both recreational and salmon/trout characteristic uses (Pfauth and Sytsma, 2004).

Fish Species Supported

Runs of hatchery-produced spring chinook, Bright fall chinook and coho salmon are supported in the sub-basin. These fish are produced at two USFWS hatcheries located within the sub-basin: the Little White Salmon River National Fish Hatchery and the Willard National Fish Hatchery (LCFRB, 2004). The Washington Department of Fish and Wildlife lists steelhead (winter and summer), spring chinook, rainbow trout, and bull trout as priority fish species in the Little White Salmon River sub-basin (WRIA 29 Habitat Committee, 2003). Pacific lamprey may also be present; this is a culturally important species for tribes and is a potential candidate for listing under the Endangered Species Act (Lee Carlson, Yakama Nation, comments submitted September 1, 2004).

5.3. ISSUES

The Planning Unit has identified the following key issues to be addressed in the Little White Salmon River sub-basin.

- LWS-1. Few water-quality data exist in the Little White Salmon River sub-basin.** Water-quality data that do exist in the Little White Salmon River indicate potential issues with water quality including temperature, turbidity, and suspended sediment. In general, however, few data exist to confirm these findings or monitor progress.²⁴ For example, only a few isolated

²⁴ An important exception to note is that both hatcheries have collected turbidity and temperature data over many years.

incidents of high temperatures have been recorded. More data are needed to allow for ongoing monitoring and documentation of trends.

- LWS-2. Sedimentation is a concern in the Little White Salmon River sub-basin.** The U.S. Fish and Wildlife Service has identified turbidity and suspended sediments as long-term problems in the Little White Salmon River sub-basin (Envirovision, 2003). According to the US Forest Service, stream-bank cutting in the mainstem and a slope failure in Lusk Creek are primary sources of this sediment. However, it was noted that suspended sediment levels appear to have improved somewhat in the 1990s, for unknown reasons. Still, further assessment or remediation efforts may be needed to address turbidity.

5.4. OPTIONS AND RECOMMENDATIONS

This section presents one option to address a specific issue of the Little White Salmon River sub-basin. This option was assembled by the Planning Unit for consideration; inclusion of it in this section does not necessarily indicate its endorsement or recommendation by the Planning Unit. Other, Western WRIA-wide options may also address issues identified in this sub-basin; these options are discussed under section 2.4, beginning on page 23.

5.4.1. ASSESS THE SEVERITY OF THE TURBIDITY AND TOTAL SUSPENDED SEDIMENT PROBLEM IN THE LITTLE WHITE SALMON RIVER SUB-BASIN AND DEVELOP A PLAN TO ADDRESS IT

Description of Option

Although turbidity and sedimentation have been a concern in the Little White Salmon River sub-basin, the situation improved somewhat in the 1990s for unknown reasons. A further assessment of turbidity and suspended sediment in the sub-basin could identify whether turbidity and sedimentation are still a problem and whether new actions are necessary.

Issue addressed: Sedimentation is a concern in the Little White Salmon River sub-basin (LWS-2).

Recommendation

The Planning Unit recommends an assessment of the severity of the turbidity and total suspended sediment in the Little White Salmon River sub-basin and preparation of a plan, if warranted, to address any problems (Chapter 7, Recommendation #13).

OTHER OPTIONS

Please note that several Western WRIA-wide options address issues identified in the Little White Salmon River sub-basin. In particular, for each Little White Salmon River sub-basin issue, the following table shows the most relevant Western WRIA-wide option or options. Please note this table is not intended to be entirely comprehensive; given the interrelated nature of the many issues, other Western WRIA-wide options not listed here may also help address the issues identified.

**Table 9. Summary of Issues and Options in the
Little White Salmon River Sub-basin**

Little White Salmon River Sub-basin Issue	Little White Salmon River Sub-basin Options	Most relevant Western WRIA-Wide Options <i>Others may also apply</i>
LWS-1. Few water-quality data exist in the Little White Salmon River sub-basin.	None	2.4.1, 2.4.2, 2.4.4, 2.4.5
LWS-2. Sedimentation is a concern in the Little White Salmon River sub-basin.	5.4.1	2.4.6, 2.4.24, 2.4.33, 2.4.42, 2.4.43

6. Western Tributaries to the Columbia River

6.1. DESCRIPTION/LOCATION/CHARACTERISTICS

Numerous smaller tributaries to the Columbia River lie within Western WRIA 29 but not within any of the sub-basins described above. These tributaries generally begin in numerous springs. Collectively, these small drainages occupy 66.7 square miles, and they will be considered a sub-basin even though they do not technically form their own basin or watershed. Although this sub-basin represents only a small portion of the area of Western WRIA 29, it contains the majority of the population (approximately 3,000 people) and includes the majority of both Stevenson and Carson. However, these communities withdraw their water supply from within one of the other sub-basins. In addition, wastewater from the Stevenson wastewater treatment plant (the only one in Western WRIA 29) discharges directly to the Columbia River and therefore does not directly affect the water quality of Western WRIA 29 streams. The population of this sub-basin is projected to increase greatly over the next 15 years (Envirovision, 2003). Nearly all of the sub-basin lies within the Columbia River Gorge National Scenic Area.

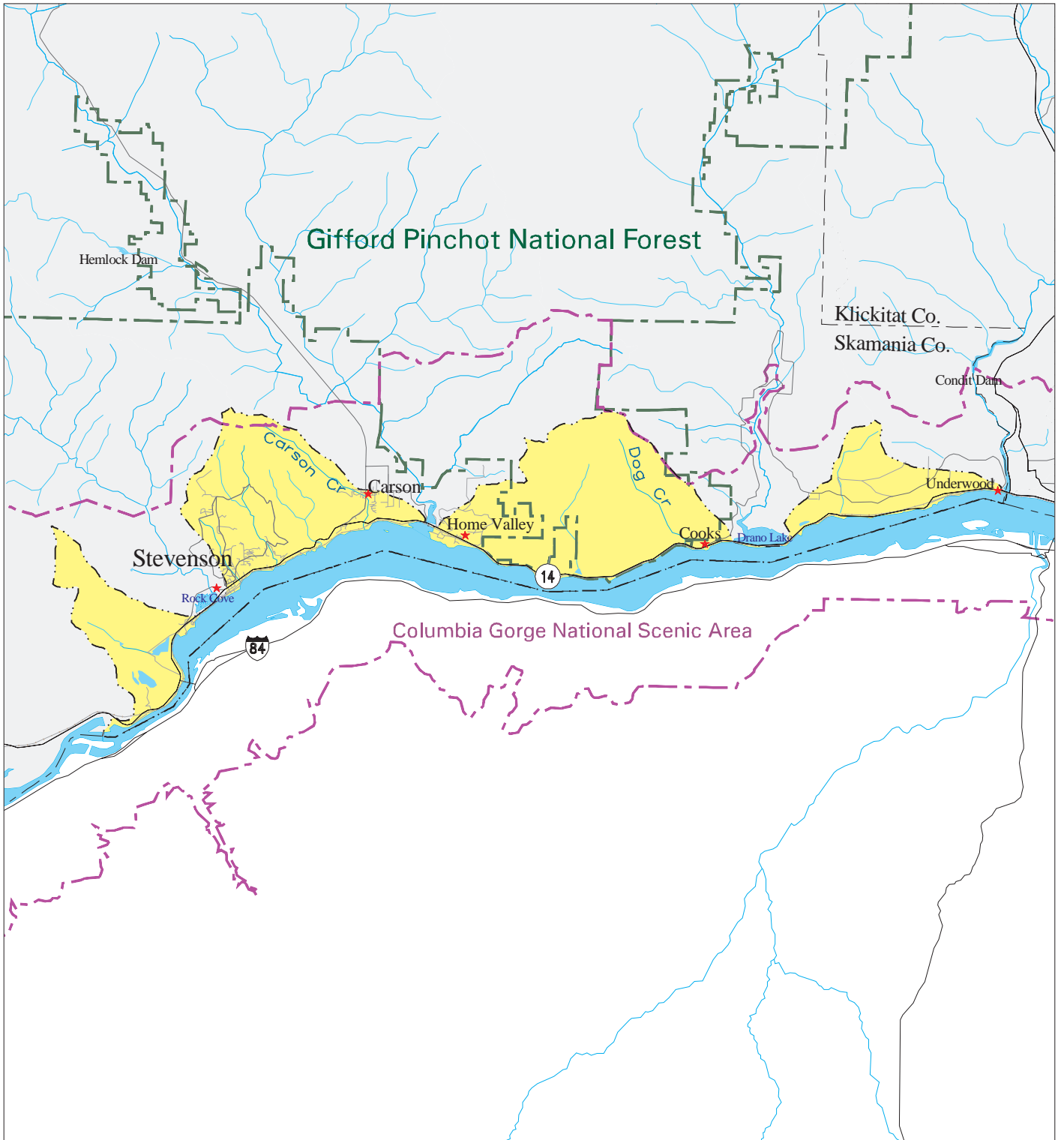
6.2. EXISTING CONDITIONS

This section summarizes the existing conditions of the Western Tributaries to the Columbia River sub-basin in terms of water quantity, water quality, and habitat. Unless otherwise noted, information presented in this section was summarized from Envirovision's *Level 1 Water Quantity and Quality Technical Assessment* (2003).

6.2.1. WATER QUANTITY

Almost no streamflow records are available in this sub-basin. The only identified flow measurements available were collected in February 2004 as part of the Lower Wind River Aquifer Recharge Study (Yinger, 2004). Flow measurements of 10 springs that discharge along the Columbia in the area near the Wind River ranged from 0.53 to 9.6 cfs, with a total calculated flow for the 10 springs of almost 27 cfs, a substantial flow. These measured flows, however, are in no way indicative of what might be expected at the other small drainages that comprise this sub-basin. The flow is very much related to geology and no streamflow records are available for any of the other drainages (Joy Michaud, Envirovision, personal communication, June 1, 2004).

Information regarding water rights is available from the Department of Ecology's Water Rights Tracking System (WRTS). The *Level 1 Water Quantity and Quality Technical Assessment* (Envirovision, 2003) does summarize the water rights in the Tributaries to the Columbia sub-basin, but it does not provide sufficient detail to allow for a discussion of which of those water rights are in the western portion of the sub-basin.

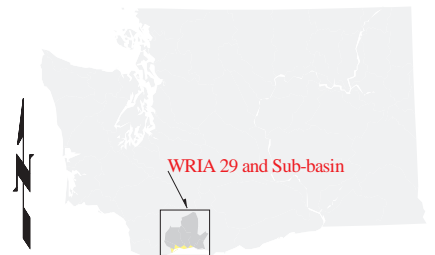
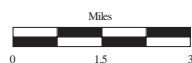


Tributaries of the Columbia Sub-basin



GIS Technical Services
04/21/06
wria29-3

-  US/State Highways
-  Secondary Roads
-  Local Paved Roads
-  Railroads
-  Rivers/Streams
-  Intermittent
-  Columbia Gorge Natl. Scenic Area
-  Gifford Pinchot National Forest
-  County
-  Outside Planning Area
-  Population Center



6.2.2. WATER QUALITY

Almost no water-quality data are available for any of these small drainages. A few water-quality measurements were made during the Lower Wind River Aquifer Recharge Study (Yinger, 2004). The measurements were made in five springs located near the base of the Wind River sub-basin. Total coliform levels were found to be quite high in these springs. These results, in comparison to well data in the area, supported the contention that discharge from on-site septic systems associated with the lower Wind River is affecting water quality in these springs (Joy Michaud, Envirovision, personal communication, June 1, 2004).

6.2.3. HABITAT

No information exists that is specific to this sub-basin (WRIA 29 Habitat Committee, 2003).

6.3. ISSUES

The Planning Unit has identified the following key issue to be addressed in the Western Tributaries to the Columbia River sub-basin.

- T-1. No streamflow or water-quality data exist for the small drainages in the Western Tributaries to the Columbia sub-basin.** The Western Tributaries to the Columbia River sub-basin houses the majority of Western WRIA 29's population, but represents a relatively small portion of the land area of Western WRIA 29. While this relative concentration of development suggests possible impacts on water quantity and quality, little data are available to help assess any such impacts.
- T-2. Growth in the Western Tributaries to the Columbia sub-basin could affect habitat, water quality, and water demand.** Growth will occur primarily within city limits or designated National Scenic Area Urban Areas located in the Western Tributaries to the Columbia sub-basin. This growth will bring with it the increased possibility of stormwater and other water-quality impacts.

6.4. OPTIONS AND RECOMMENDATIONS

This section presents an option to address an issue particular to the Western Tributaries to the Columbia sub-basin. This option was identified by the Planning Unit for consideration. Other, Western WRIA-wide options may also address issues identified in this sub-basin; these options are discussed under section 2.4, beginning on page 23.

6.4.1. IMPROVE FISH PASSAGE WHERE IMPEDED BY DEVELOPMENT STRUCTURES

Description of Option

Structures such as dams, weirs, culverts, bridges, and other low-water crossings can restrict fish passage and limit the recovery of salmon.²⁵ Such barriers prevent fish from reaching habitat suitable for spawning, rearing, or hiding from predators, forcing them to use less suitable habitats and exposing them to predation risks. The Planning Unit could encourage stakeholders, including the Washington State Department of Transportation, landowners, railroads, and volunteer groups to improve fish passage throughout the watershed, and encourage them to undertake public education on the importance of fish passage. Some such work on forested lands may be required under Washington's Forests and Fish Rule (Washington Forest Protection Association, 2004).

Issue addressed: Growth in the Western Tributaries to the Columbia sub-basin could affect habitat, water quality, and water demand (T-2).

Recommendation

The Planning Unit recommends interested habitat groups work with local stakeholders to improve fish passage where it is impeded by development structures (Chapter 7, Recommendation #32).

OTHER OPTIONS

Please note that several WRIA-wide options address issues identified in the Western Tributaries to the Columbia River sub-basin. In particular, for each sub-basin issue, the following table shows the most relevant WRIA-wide option or options. Please note this table is not intended to be entirely comprehensive; given the interrelated nature of the many issues, other WRIA-wide options not listed here may also help address the issues identified.

Table 10. Summary of Issues and Options in the Western Tributaries to the Columbia River Sub-basin

Western Tributaries to the Columbia River Sub-basin Issue	Sub-basin Options	Most relevant WRIA-Wide Options <i>Others may also apply</i>
T-1. No streamflow or water-quality data exist for the small drainages in the Western Tributaries to the Columbia sub-basin.	None	2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.7, 2.4.40
T-2. Growth in the Western Tributaries to the Columbia sub-basin could affect habitat, water quality, and water demand.	6.4.1	2.4.14, 2.4.15, 2.4.17, 2.4.18, 2.4.24, 2.4.45

²⁵ See Option 2.4.14 on page 30 for an option specific to culverts.

7. Summary of Recommendations

Based on consideration of the issues and options discussed in this plan, the Western WRIA 29 Planning Unit assembled the following list of recommendations. Each of these recommendations was first mentioned in one of the previous chapters 2 through 6. This chapter provides a summary and discussion of the Planning Unit's recommendations for Western WRIA 29's water resources.

7.1. TOP PRIORITY PLANNING UNIT RECOMMENDATIONS

The Planning Unit agrees that gathering additional water quantity and water quality data across Western WRIA 29 is the highest priority need in the watershed. The Planning Unit believes it is difficult to develop clear and specific plan recommendations when, in many parts of the watershed, such data has either not been collected, or has not been collected over a long period of time using consistent, comparable methodologies. Therefore, the Planning Unit's highest priority recommendation is to establish comprehensive monitoring and evaluation throughout the watershed. However nothing in this recommendation should be construed as to obligate any Planning Unit member to an action for which there is no designated funding.

Recommendation #1 Implementation of the groundwater and surface water monitoring strategies, pertinent to Western WRIA 29, developed in the Level 2 Assessment (Options 2.4.1 and 2.4.2)

7.2. RECOMMENDATIONS TO GATHER ADDITIONAL DATA

The Planning Unit agrees that the need for additional data and information, above and beyond water quantity and quality monitoring and evaluation, is a very high priority. The Planning Unit believes it is difficult to develop clear and specific plan recommendations when, in many parts of the watershed, data and information regarding water quality, water quantity, habitat conditions and other factors has not been collected or needs improvement. However, the Planning Unit recognizes that there is not adequate funding to conduct all of the desired monitoring or studies. Nothing in these recommendations should be construed as obligating any Planning Unit member to an action for which there is no designated funding.

Desired monitoring, studies or other data gathering efforts include:

Recommendation #2 Hydrogeologic studies to gather information on hydraulic continuity and aquifer recharge (Option 2.4.3)

Recommendation #3 Expanded efforts to assess fecal coliform in areas of concern, including enhanced water-quality sampling and analyses to determine the sources of fecal coliform (Option 2.4.4)

Recommendation #4 Studies to determine causes of high stream temperatures (Option 2.4.5)

Recommendation #5 Identification of sources of excess sediment inputs in Western WRIA 29 rivers (Option 2.4.6)

- Recommendation #6** Continued research to improve septic system operation (Option 2.4.8)
- Recommendation #7** Studies to determine the status and trends of important species in addition to those listed under the Endangered Species Act (2.4.9)
- Recommendation #8** Hydrographs for Rock Creek and its tributaries by synthesizing or extrapolating data from stream gauges on other similar streams (to be conducted by qualified experts, such as the Washington Department of Fish and Wildlife or the US Forest Service), and that data collection begin to develop an actual hydrograph (Option 3.4.1)
- Recommendation #9** Further assessments of any high temperatures in the Rock Creek sub-basin, including an identification of causes, with funding to be pursued by interested habitat groups and agencies (Option 3.4.2)
- Recommendation #10** Water-quality monitoring to assess if there are any impacts from the golf course and the old Skamania County landfill, by the City of Stevenson, in cooperation with the owners (Option 3.4.4)
- Recommendation #11** Hydrographs for Bear and Panther Creeks and other Wind River tributaries, by synthesizing or extrapolating data from stream gauges on other similar streams (to be conducted by qualified experts, such as the Washington Department of Fish and Wildlife or the US Forest Service), and that data collection begin to develop an actual hydrograph (Option 4.4.1)
- Recommendation #12** Ongoing temperature monitoring in the Wind River sub-basin in accordance with the TMDL and expanded monitoring in additional tributaries (Option 4.4.2)
- Recommendation #13** An assessment of the severity of the turbidity and total suspended sediment levels in the Little White Salmon River sub-basin and preparation of a plan, if warranted, to address any problems (Option 5.4.1)

7.3. RECOMMENDATIONS CONCERNING PUBLIC EDUCATION AND OUTREACH

The Planning Unit recognizes that voluntary, cooperative efforts to enhance the watershed are more appropriate for the local community than mandatory or enforcement options. Therefore, the Planning Unit places a high priority on efforts to raise awareness of watershed issues, and to educate and encourage citizens to take appropriate actions. However, the Planning Unit recognizes that these efforts require significant funding.

The Planning Unit intends to seek appropriate funding to conduct some or all of the desired public education and outreach activities. However, nothing in this recommendation should be construed as obligating any Planning Unit member to an action for which there is no designated funding.

Desired public education and outreach activities include:

- Recommendation #14** Education and outreach on water conservation and water quality as well as to promote a general understanding of the watershed (Option 2.4.10)

- Recommendation #15** Education and outreach on the benefits of water metering (Option 2.4.11)
- Recommendation #16** Education and technical assistance for public and private landowners on responsible land stewardship, including proper use and effects of pesticides and fertilizers and proper management of animal waste, particularly from livestock (Option 2.4.12)
- Recommendation #17** Education and outreach on the proper care of sewer and septic systems, including ongoing maintenance, the identification of problems, and the associated implications and solutions (Option 2.4.13 and Option 2.4.20)
- Recommendation #18** Pursuit of funding to identify and rectify problems associated with roads, including erosion control, sedimentation, road decommissioning, and problem culverts; in addition, education and outreach to private landowners to encourage them to address problem culverts, and providing them with financial assistance if available (Option 2.4.14)

7.4. POLICY AND PLANNING RECOMMENDATIONS

- Recommendation #19** The Planning Unit recommends that water purveyors consider providing municipal water users with incentives to conserve water (Option 2.4.15).
- Recommendation #20** The Planning Unit recommends that the state allow the use of small amounts of captured rainwater (Option 2.4.16).
- Recommendation #21** The Planning Unit recommends that Skamania County consider adopting a stormwater plan or ordinance (Option 2.4.17).
- Recommendation #22** The Planning Unit recommends growing communities consider establishing community septic/sewer systems (Option 2.4.18).
- Recommendation #23** The Planning Unit recommends that appropriate organizations within the watershed pursue funding in partnership with landowners, community councils, and other groups to establish incentives for sewer or septic system upgrade or repair (Option 2.4.19 and Option 2.4.21).
- Recommendation #24** The Planning Unit supports preparation of an action plan to upgrade failing and out-of-compliance septic systems in Western WRIA 29, particularly in the Carson area (Option 2.4.20).
- Recommendation #25** The Planning Unit recommends that Skamania County consider adopting an ordinance to require septic inspection or certification upon the sale or transfer of property (Option 2.4.22).
- Recommendation #26** The Planning Unit encourages the State to implement a performance-based effluent treatment standard for on-site sewage treatment systems (Option 2.4.23).
- Recommendation #27** The Planning Unit recommends that federal, state, and county agencies coordinate and communicate with each other as well as with private landowners to improve road maintenance where needed (Option 2.4.24).

Recommendation #28 The Planning Unit supports continued special and routine air quality monitoring and regulatory programs to detect and prevent adverse impacts on water quality (Option 2.4.25).

Recommendation #29 The Planning Unit recommends that it engage in a process to determine and recommend minimum instream flows to the Department of Ecology if funding is provided. If funding for instream flow studies is not available, the Planning Unit is interested in participating with the Department of Ecology while the agency develops instream flows. During the instream flow process, the Planning Unit will consider the PUD's requested reservation for the Carson Water System and a reservation for the City of Stevenson (Option 2.4.7 and Option 2.4.26).

Recommendation #30 The Planning Unit recommends that regional climate change projections developed by the University of Washington's Climate Impacts Group or other qualified scientists be considered when making water resource planning decisions in Western WRIA 29; the Planning Unit also recommends that water suppliers consider developing adaptive capacity to prepare for the possibility of lower summer flows in the future (Option 2.4.27).

Recommendation #31 Pending results of further temperature assessments, a plan to address high stream temperatures in Rock Creek, to be developed by interested habitat groups and agencies (Option 3.4.3)

Recommendation #32 The Planning Unit recommends interested habitat groups work with local stakeholders to improve fish passage where it is impeded by development structures (Option 6.4.1).

7.5. OTHER RECOMMENDATIONS

Recommendation #33 The Planning Unit recommends that Planning Unit members provide the list of desired studies and monitoring activities to appropriate research organizations in the region for consideration as research projects (Option 2.4.28).

Recommendation #34 The Planning Unit recommends that Skamania County consider developing GIS capability (Option 2.4.29).

Recommendation #35 The Planning Unit supports efforts by the Department of Ecology to update its water right database by collecting new data and verifying existing data (Option 2.4.30).

Recommendation #36 The Planning Unit supports efforts by the Department of Ecology to make water right information more accessible to the public (Option 2.4.31).

Recommendation #37 The Planning Unit recommends local agencies and irrigators pursue partnerships and find opportunities to increase water conservation in irrigation and water transport, where feasible and practical (Option 2.4.32).

Recommendation #38 The Planning Unit recommends that watershed residents and appropriate agencies work in partnership to pursue funding to implement projects to improve habitat, reduce water temperatures, and increase stream shading where needed; the Planning Unit also recommends that local

jurisdictions and Skamania County implement programs that would encourage landowners to limit development and forest cover removal in riparian areas (Option 2.4.33).

Recommendation #39 The Planning Unit recommends that all Planning Unit members, local agencies, and organizations encourage cooperative, voluntary corrective actions to reduce fecal coliform, including education and outreach on sources of fecal coliform, preparation of farm plans, and other waste management efforts (Option 2.4.34).

Recommendation #40 The Planning Unit recommends that the Department of Ecology improve their compliance monitoring and enforcement of illegal water withdrawals (Option 2.4.35).

Recommendation #41 The Planning Unit recommends that local government agencies and other local experts review the characteristic uses assigned to Western WRIA 29 water bodies and recommend any revisions to Ecology (Option 2.4.36).

Recommendation #42 The Planning Unit supports implementation of *Skamania County's Integrated Aquatic Vegetation Management Plan* (Pfauth and Sytsma, 2004) and encourages the County to continue seeking supplemental funding sources to do so; the Planning Unit also encourages federal and state agencies to fund milfoil control projects in Western WRIA 29; the Planning Unit encourages continued research on milfoil and management techniques and encourages the State to undertake a Columbia basin-wide effort to control milfoil and educate water users about it, its effects, and its control (Option 2.4.37 and Option 4.4.8).

Recommendation #43 The Planning Unit recommends that the state Department of Natural Resources conduct additional verification of the accuracy of the stream-typing model and maps in Western WRIA 29 and work with the local community to validate its findings with ground-truthing (Option 2.4.38).

Recommendation #44 The Planning Unit recommends appropriate agencies and local landowners pursue funding and partnerships to develop strategies and implement best management practices to minimize susceptibility to wildfires (Option 2.4.39).

Recommendation #45 The Planning Unit recommends that sub-basins within WRIA 29 be prioritized for installation and maintenance of permanent continuously-recording stream gauges on the Wind River, Rock Creek or Little White Salmon River, and the Western Tributaries of the Columbia River; the Planning Unit also encourages the Department of Ecology and the US Geological Survey to maintain existing stream gauges over the long term (Option 2.4.40).

Recommendation #46 The Planning Unit recommends the USFS and the Skamania Country PUD work together to reconcile the measurement methods, timing, and location of their two datasets regarding Bear Creek low-flows prior to beginning any instream flow process (Option 4.4.9).

7.6. RECOMMENDATIONS TO SUPPORT THE CONTINUATION OF EXISTING EFFORTS

The Planning Unit recognizes that many groups are already working to mitigate many of the issues identified in this plan. The Planning Unit supports these ongoing efforts and recommends that the work continue.

Recommendation #47 The Planning Unit supports efforts to control erosion and sedimentation (Option 2.4.42).

Recommendation #48 The Planning Unit incorporates by reference the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan's (LCFRB, 2005) habitat strategies, measures, and actions for the Wind River, the Little White Salmon River, and other Gorge tributaries within Skamania County in the Western WRIA 29 Watershed Management Plan. The Planning Unit also incorporates by reference the habitat protection and restoration activities coordinated through the Lower Columbia Fish Recovery Board as a key non-regulatory habitat component of the Western WRIA 29 Watershed Management Plan. Additionally, the Planning Unit incorporates by reference the tribal anadromous fish plan, WY-KAN-USH-MI WA-KISH-WIT, Spirit of the Salmon (Nez Perce et al, 1995), into the Western WRIA 29 Watershed Management Plan (Option 2.4.43).

Recommendation #49 The Planning Unit supports and encourages ongoing education on wildfire prevention, hazards, and preparedness (Option 2.4.44).

Recommendation #50 The Planning Unit supports and encourages local governments' efforts to plan for the impact of growth on water supply and water quality (Option 2.4.45).

Recommendation #51 The Planning Unit supports the City of Stevenson's efforts to address problems associated with Rock Creek Bridge (Option 3.4.5).

Recommendation #52 The Planning Unit supports the implementation of the Temperature TMDL in the Wind River Sub-basin (Option 4.4.3).

Recommendation #53 The Planning Unit supports continuation of riparian enhancement work in the WRIA (Option 4.4.4).

Recommendation #54 The Planning Unit supports continuation of instream enhancement work in the WRIA (Option 4.4.5).

Recommendation #55 The Planning Unit supports continuation of watershed management groups in the watershed (Option 4.4.6).

8. Plan Implementation

5 The Watershed Management Act (RCW 90.92) and its 2003 amendment identified four phases to watershed planning in Washington. This watershed plan represents the culmination of phases I, II, and III, and was approved by the Planning Unit on December 14, 2005. This approved Western WRIA 29 Watershed Plan must be forwarded to Skamania County for public hearings and adoption according to the process outlined in RCW 90.82.

10 Once adopted, the next logical step would be to implement the Western WRIA 29 Watershed Plan. Plan implementation is Phase IV of watershed planning; Phase IV was created in 2003 when the Legislature amended RCW 90.82. The law requires the implementation plan to contain strategies to provide sufficient water for a) production agriculture; b) commercial, industrial, and residential use; and c) instream flows (RCW 90.82.043(2)). The State provides funds to Planning Units in the first year after County adoption to create a detailed implementation plan. Subsequent funding is also available to implement the watershed plan and provide support to the Planning Unit.

15 Although Western WRIA 29 intends to assemble a detailed implementation plan, Table 11, below, provides an initial summary of the entities likely to be responsible for each of the Planning Unit's recommendations. This table will be updated during Phase IV. Please note that the text of the recommendations below is abbreviated to facilitate presentation in table format. The full text of each recommendation can be found in Chapter 7 (Summary of Recommendations), and background information about each recommendation can be found in the *Options and Recommendations* section of Chapters 2 through 6.

20 The Planning Unit believes it is important that all of the recommendations be integrated into an implementation plan that sets priorities and includes a schedule with identified performance measures. The Planning Unit intends to prepare this implementation plan in Phase IV of the watershed planning process. The Planning Unit also intends to hold an instream flow workshop, when and if funds become available from Ecology, to initiate the instream flow recommendations process.

25 In the following table, a **P** represents that the organization listed may have primary responsibility for the recommendation (more than one organization can have primary responsibility) and an **S** means that the organization may have secondary responsibility.

Table 11. Summary of Recommendations with Suggested Key Parties

P = Primary player
S = Secondary player

RECOMMENDATIONS	Planning Unit	Skamania County (Lead Agency)	Skamania County PUD	Yakama Nation	City of Stevenson	Washington State Department of Ecology	Underwood Conservation District	U.S. Forest Service	Timber interests	Other Government Members	Other Non-Government Members
Recommendations to Gather Additional Data											
#1 – Implement the Level 2 groundwater and surface water monitoring strategies		P	S	S	S	S	S	S	S	S	S
#2 – Conduct hydrogeologic studies on hydraulic continuity and aquifer recharge		P	S	S	S	S	S	S	S	S	S
#3 – Expand efforts to assess fecal coliform in areas of concern		P	S	S	S	S	S	S	S	S	S
#4 – Conduct studies to determine causes of high stream temperatures		P	S	S	S	S	S	S	S	S	S
#5 – Identify sources of excess sediment in rivers		P	S	S	S	S	S	S	S	S	S
#6 – Continue research to improve septic system operation		P	S	S	S	S	S	S	S	S	S
#7 – Encourage studies to determine effects on non-ESA-listed species		P		P		S	P	P		P	
#8 - Prepare hydrographs for Rock Creek and its tributaries by synthesizing or extrapolating data from stream gauges on other similar streams		S	S		P	S		P		P	
#9 – Conduct further temperature assessments in the Rock Creek sub-basin		S	S	P	P	S	S	S	S	S	P
#10 - Seek funding to conduct water-quality sampling to monitor potential impacts from the Golf Course and the old County landfill					P						

	Planning Unit	Skamania County (Lead Agency)	Skamania County PUD	Yakama Nation	City of Stevenson	Washington State Department of Ecology	Underwood Conservation District	U.S. Forest Service	Timber interests	Other Government Members	Other Non-Government Members
RECOMMENDATIONS											
#11 - Prepare hydrographs for Bear and Panther Creeks and other Wind River tributaries		P	S		S	S		P		P	
#12 – Conduct ongoing temperature monitoring in the Wind River sub-basin		P		P		S	P	P		P	
#13 – Assess turbidity and sedimentation in the Little White Salmon River sub-basin and develop a plan to address it		P	S	S	S	S	S	S	S	S	S
Recommendations concerning education and outreach											
#14 – Conduct education and outreach on water quantity, water quality, and the watershed in general		P	P	P	P	S	P	S	S	S	S
#15 – Conduct education and outreach on the benefits of water metering.		P	P	P	P	S	P	S	S	S	S
#16 – Conduct education and technical assistance to landowners on responsible land stewardship		P	S	P	P	S	P	S	S	S	S
#17 – Conduct education and outreach on proper care of sewer and septic systems		P	S	P	P	S	S				
#18 - Pursue funding to identify and rectify problems associated with roads		P	S	P	P	S	S	P	P	P	P
Recommendations Concerning Policy or Planning Efforts											
#19 - Consider providing municipal water users with incentives to conserve water		S	P	S	S	S	S				
#20 – Recommend that the State allow the use of small amounts of captured rainwater	P	S	S	S	S	S	S	S	S	S	S
#21 – Consider adopting a stormwater plan or ordinance		P									

RECOMMENDATIONS	Planning Unit	Skamania County (Lead Agency)	Skamania County PUD	Yakama Nation	City of Stevenson	Washington State Department of Ecology	Underwood Conservation District	U.S. Forest Service	Timber interests	Other Government Members	Other Non-Government Members
#22 – Consider establishing community septic/sewer systems		P	P	S	P	S				P	
#23 – Pursue funding to establish incentives for sewer or septic system upgrade and repair		P	S	S	P	S	S			S	S
#24 – Support preparation of an action plan to upgrade failing and out-of-compliance septic systems		P		P	P	S	S				
#25 - Consider adopting an ordinance to require septic inspection or certification upon the sale or transfer of property		P									
#26 - Encourage the State to implement a performance-based effluent treatment standard for on-site sewage treatment systems.	P	S	S	S	S	S	S	S	S	S	S
#27 - Coordinate and communicate to improve road maintenance where needed		P	S	P	P	S	S	P	P	P	P
# 28 - Support air quality monitoring and regulatory programs to detect and prevent adverse impacts on water quality	P										
#29 – Request funding from Ecology for an instream flow process	P	P	P	P	P						
#30 – Consider climate change projections when making water resource planning decisions and consider developing adaptive capacity		P	P	P	P	P	P	P	P	P	P
#31 – Develop a plan to address high temperatures in Rock Creek		S	S	P	P	S	S	P	S	P	P
#32 – Improve fish passage where it is impeded by development structures.		S	S	P	S	S	S	S	S	P	P

RECOMMENDATIONS	Planning Unit	Skamania County (Lead Agency)	Skamania County PUD	Yakama Nation	City of Stevenson	Washington State Department of Ecology	Underwood Conservation District	U.S. Forest Service	Timber interests	Other Government Members	Other Non-Government Members
Other recommendations											
#33 - Provide the list of desired studies and monitoring activities to research organizations in the region		P	P	P	P	P	P	P	P	P	P
#34 – Consider developing GIS capability		P									
#35 – Update the Department of Ecology’s water right database by collecting new data and verifying existing data						P					
#36 - Make water right information more accessible to the public						P					
#37 - Pursue partnerships and find opportunities to increase water conservation in irrigation and water transport		S		S			P			S	S
#38 - Pursue funding to implement projects to improve habitat and stream shading, such as stream-bank restoration		P	S	P	P	S	P	P	P	P	P
#39- Encourage cooperative, voluntary corrective actions to reduce fecal coliform		P	S	P	P	P	P			S	P
#40 - Improve compliance monitoring and enforcement of illegal water withdrawals.						P					
#41 - Review the characteristic uses assigned to WRIA 29 water bodies and recommend any revisions to Ecology		P	S	P	P	S	S	S	S	S	S
#42 - Implement the Integrated Aquatic Vegetation Management Plan in Skamania County		P									
#43 – Request that the DNR conduct additional verification of the accuracy of the stream-typing model and maps in Western WRIA 29	P	S	S	P	S	S	S	S	S	S	S

RECOMMENDATIONS	Planning Unit	Skamania County (Lead Agency)	Skamania County PUD	Yakama Nation	City of Stevenson	Washington State Department of Ecology	Underwood Conservation District	U.S. Forest Service	Timber interests	Other Government Members	Other Non-Government Members
#44 – Pursue funding and partnerships to develop strategies to minimize susceptibility to wildfires		S	S	S	S	S	S	P	P	S	S
#45 – Install new permanent gauges and maintain existing gauges		S		S	S	P	S	P		P	
#46 – Reconcile Bear Creek low flow measurements			P					P			
Recommendations to support the continuation of existing efforts											
#47 – Support efforts to assist in control of erosion and sedimentation	P										
#48 - Support habitat planning and restoration activities, including specific other plan	P										
#49 – Support and encourage ongoing education on wildfire prevention, hazards, and preparedness	P										
#50 – Support and encourage local government efforts to plan for the impact of growth on water supply and water quality	P										
#51 - Support the City of Stevenson’s process to address problems with Rock Creek bridge	P	P			P						
#52 – Support implementation of the temperature TMDL in the Wind River basin	P										
#53 – Support continuation of riparian enhancement work in the watershed	P										
#54 – Support continuation of instream enhancement work in the watershed	P										

RECOMMENDATIONS	Planning Unit	Skamania County (Lead Agency)	Skamania County PUD	Yakama Nation	City of Stevenson	Washington State Department of Ecology	Underwood Conservation District	U.S. Forest Service	Timber interests	Other Government Members	Other Non-Government Members
#55 – Support the continuation of watershed management groups in the watershed	P										

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10. Appendices

The following documents are considered to be appendices to this watershed plan.

- WRIA 29 Level 1 Water Quantity and Water Quality Technical Assessment
- WRIA 29 Level 1 Habitat Assessment
- WRIA 29 Level 1 Instream Flow Assessment
- WRIA 29 Surface Water Monitoring Strategy
- WRIA 29 Long-Term Groundwater Monitoring Strategy
- WRIA 29 Water Conservation Strategies
- Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan
- Stabler Area Water Quality and Quantity Study
- Lower Wind River Aquifer Recharge Study
- Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon – The Columbia River Anadromous Fish Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes – Volume II Subbasin Plans.

To request a CD-ROM containing the files please call the Skamania County Department of Planning and Community Development at (509) 427-3900 or e-mail planningdept@co.skamania.wa.us.

11. Definitions and Acronyms

alluvial – deposited by a stream

alluvium – sediment deposited by a stream

acre-foot – A unit for measuring the volume of water, is equal to the quantity of water required to cover 1 acre to a depth of 1 foot and is equal to 43,560 cubic feet or 325,851 gallons. The term is commonly used in measuring volumes of water used or stored.

aquifer – Layer of underground sand, gravel, or permeable rock that stores and/or transmits water, such as to wells and springs. An aquifer may be either *confined* or *unconfined*.

aquifer recharge – water added to an aquifer, such as rainfall that seeps into the ground

allocation – the designation of specific amounts of water for specific beneficial uses

anadromous – the behavior exhibited by some fish (such as many salmonids) that involves spawning and rearing of juveniles in fresh water, followed by a migration of juveniles to the ocean and eventual return of adults to their birth location to spawn and die

cfs – cubic feet per second. One cfs is equal to a volume of water one foot high and one foot wide flowing a distance of one foot in one second. One cfs is equal to 7.48 gallons of water flowing each second.

confined aquifer – an aquifer that is bound both above and below by layers of impermeable material and is under pressure so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer.

BPA – Bonneville Power Administration

DO – dissolved oxygen

Ecology – The Washington State Department of Ecology

EIS – Environmental Impact Statement. The purpose of an EIS is to provide information on potential environmental impacts that could result from a proposed action.

Endangered species – A species that is listed as endangered under the federal or state Endangered Species Act (or both). These species are considered in critical danger of extinction if protection measures are not taken. Take (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collector kill, harass, both, etc.) of such species is prohibited unless under an approved Habitat Conservation Plan or “Take” permit.

EPA – United States Environmental Protection Agency

ESA – Endangered Species Act

ESU – Evolutionarily Significant Unit (see below)

Eurasian Watermilfoil – A non-native, noxious, aquatic weed that proliferates in waterways with low flows; its roots are attached to the bottom but it grows to the surface to form a dense mat of vegetation

Evolutionarily Significant Unit – a distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout.

ft – feet

GIS – Geographic Information System

gpm – gallons per minute

hydraulic continuity – the connection between groundwater and surface water bodies

hydrograph – a graph that shows water flows over time for a specific location in a stream

IFIM – Instream Flow Incremental Methodology

instream flow – minimum flows that must be met in a stream to protect the resources and benefits that stream provides

LCFRB – Lower Columbia Fish Recovery Board

LFA – Limiting Factors Analysis

non point-source pollution – pollution from a source that cannot be specifically identified and pinpointed, such as run-off from fields or roads

percolate – to pass through, or permeate

permeability – the ability of a material to allow the passage of a liquid, such as water through rocks

pH – a measure of the relative acidity or alkalinity of water. Water with a pH of 7 is neutral; lower pH levels indicate increasing acidity, while pH levels higher than 7 indicate increasingly basic (alkaline) solutions.

point-source pollution – pollution from a source that can be specifically identified and pinpointed, such as an effluent discharge pipe from a factory

RCW – Revised Code of Washington

regulated – in the context of streamflow, regulated means that the flow is controlled by a dam or other structure

reservation – an allocation of water set aside for future domestic, stock watering, agricultural, commercial and industrial uses. For purposes of this chapter (WAC 173-546-030), the priority date of the reservation is senior to the instream flows set in WAC 173-546-050. Reservation is the same as reserved water in the Entiat WRIA management plan.

salmonid – fish species that are, or are related to, salmon, such as trout and steelhead

streamflow – the water discharge that occurs in a natural channel. A more general term than runoff, streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

suspended sediment – that portion of the sediment load suspended in the water column. Distinct from bedload, which is defined as the material rolling along the bed. Relative size of the suspended sediment is determined by flow characteristics, such as velocity.

TMDL – Total Maximum Daily Load: the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards.

Threatened species – A species that is listed as threatened under the federal or state Endangered Species Act. These species are considered in need of some protection in order to prevent extinction. Incidental take (or kill) of such species may be allowed under certain regulated situations

tributary – a smaller stream that flows into a larger stream

turbidity – a measurement of light refraction in water, an indicator of suspended sediment

UCD – Underwood Conservation District

unconfined aquifer – an aquifer that is not confined or under pressure, such that the water level is able to rise and fall

USFS – United States Forest Service

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Survey

WAC – Washington Administrative Code

WDFW – Washington State Department of Fish and Wildlife

WRIA – Water Resource Inventory Area