Appendix G, Review of Watershed Planning and Department of Ecology Documents for WRIAs in Eastern Washington

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WIND-WHITE SALMON, WRIAS 29A AND 29B

Background

Wind-White Salmon River Basin (WRIAs 29a and b) encompass several watersheds flowing south from headwaters in the Mount Adams range to the Columbia River within the Columbia River Gorge in south-central Washington (Figure G-1). In total, the watershed covers more than 900 square miles. The watershed has some dramatic features, including Mount Adams in the north of the watershed, and the Columbia Gorge in the south. The upper portions of the WRIA are primarily forested, with agricultural use in the lower, broader valleys. The watershed has been broken into two sections for watershed planning purposes: the Wind sub-basin in the western part of the basin became WRIA 29a and the White Salmon sub-basin in the east became WRIA 29b. The basins are covered together here, as many of the early planning documents covered both parts of the WRIA.

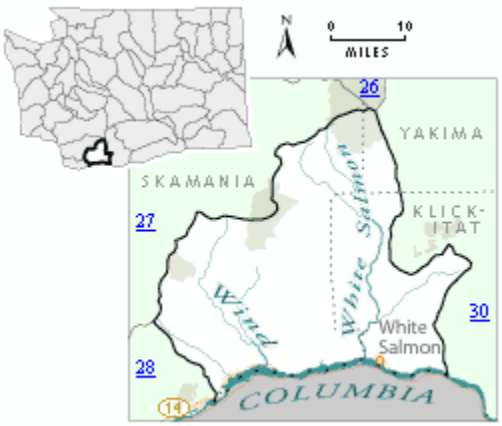

Figure G-1. Map of Wind and White Salmon (WRIAs 29a and 29b)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Much of the watershed was historically part of the lands used by the Yakama Tribe, ceded by Treaty in 1855. Some areas in the western part the Wind watershed were historically used by the Chehalis, Cowlitz, Klatsop, Chinook, Klickitat or other tribes, and were relinquished by Executive Order in 1864 (Department of Ecology, 2011).

Current Water Supply

Surface Water

The mean annual precipitation varies dramatically across WRIA 29, from less than 40 inches annually on the eastern edge, to over 100 inches annually on the western side (Envirovision, 2003). Precipitation is concentrated during the winter months, falling as rain in lower elevations and snow in higher elevations, including Mount Adams, which is in the northernmost part of the watershed. In many portions of the WRIA, rain-on-snow events cause rapid snow melt, resulting

in high peak flows. As a result, most streams in the WRIA experience high flows during the winter, though this is not uniformly the case (Envirovision, 2003). Melting snow ice may then cause additional (or higher) peak flows in the spring, with low flows in the summer. For example, the White Salmon Sub-basin has higher flows in the spring, and sustained summer flows, due to spring snowmelt and glacial influence. Several of the streams in WRIA 29 are regulated by dams, also shifting the timing of flows.

The Columbia River flows along the southern edge and Bonneville Dam is within WRIA 29.

Groundwater

The western part of the watershed is underlain by the far western edge of the Columbia River Basalt Group (CRBG) which extends throughout much of the Columbia Plateau. Because the geology is dominated by flood basalts, a significant amount of surface water percolates through the basalts and travels beneath the surface.

Current Out-Of-Stream Water Demand

There are rural residences and a few towns (Bingen, White Salmon, and Stevenson), but no urban centers. Increased population growth has occurred, mainly as a result of WRIA 29's proximity to the metropolitan Portland/Vancouver area. This means that municipal and domestic demands are smaller than in more populous areas of eastern Washington.

While the watershed is not a major agricultural producer compared to some areas of eastern Washington, agricultural uses are more prevalent in the broader valleys and include fruit orchards (particularly pears), pasture and forage land, as well as specialty row crops (Envirovision, 2003). Rural residential land uses typically include residences with hobby farms.

Surface water supplies most of the water allocated for use in WRIA 29 (Envirovision 2003). Comparisons of consumptive water allocations with existing streamflow records indicate that even in a low-flow year there is generally enough water to support existing consumptive allocations (Evirovision, 2003).

Current Instream Water Demand

WRIA 29 has large non-consumptive water rights for fisheries (Evirovision, 2003). The WRIA also 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, low amounts of large woody debris, high water temperatures, fine sediment, and reduced quantities of spawning gravels, limit the extent and quality of salmon habitat in at least the western portion of the WRIA (Sound Resolutions et al., 2005).

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Hydropower is generated both on the mainstem at Bonneville Dam, and on tributary streams.

The Columbia River Gorge and the forestland in the WRIA both draw visitors to the area, and recreational water usage is thus also important to economic activity in the area. This is particularly true as the proximity of Portland (OR) and Vancouver have resulted in increased tourism visits (Evirovision, 2003).

Instream Flows

No instream flow rules have been adopted in any streams in WRIA 29. Although several studies have been conducted relevant to the instream flow process (detailed in Sound Resolutions, 2005), a lack of information makes it difficult to determine whether there are adequate flows for fish.

Conversations with Ecology indicate that the WRIA 29a planning group, in consultation with Ecology, is working on instream flow recommendations. Instream flow work began in the summer of 2006 and will continue through the biennium to June 2009. This planning group is using a combination of operating funds and capital grant funds to have new gages installed in the watershed to support instream flow recommendations. Some information about progress towards recommendations may be available in the *Wind River Instream Flow Study 2007, Final Report*.

References

Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Evirovision Corp. In association with WPN and M Yinger and Associates. 2003. Wind/White Salmon Watershed (WRIA29) Level 1 Technical Assessment. Prepared for the WRIA 29 Planning Unit. Stevenson, WA, Skamania County.

Sound Resolutions, Cascadia Consulting Group, and Advanced Planning Solutions. 2005. Watershed Management Plan for Western Water Resource Inventory Area 29 (Western WRIA 29).

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KLICKITAT BASIN, WRIA 30

Background

The Klickitat Watershed (WRIA 30) extends across 1422 square miles in Klickitat and Yakima Counties. The Columbia River runs east-west along the southern length of the watershed, at the Washington-Oregon border. The Klickitat drains a significant portion of the watershed, including Mount Adams and the eastern flanks of the Cascades, as well as the Simcoe Mountains (drained by the Little Klickitat River). The watershed also contains some small tributaries that drain directly to the Columbia River.

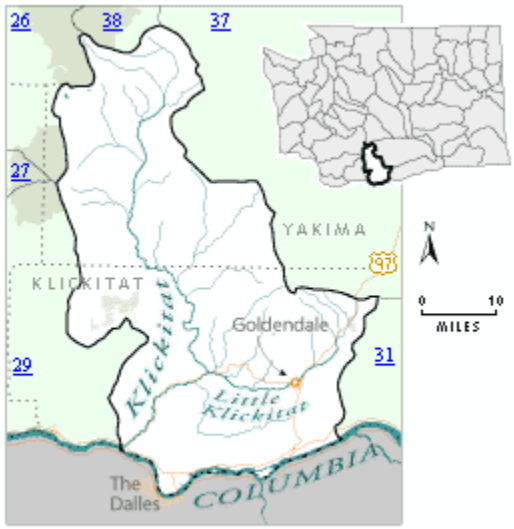

Figure G-2. Map of Klickitat Basin (WRIA 30)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The watershed has traditionally relied on agricultural crops, livestock, and timber production as its primary economic sectors (Watershed Professionals Network and Aspect Consulting, 2005a). The majority of the watershed is forested, while shrublands cover much of the rest of the watershed.

The northern part of the watershed is in the Yakama Indian Reservation, and the southern part of the watershed comprises lands historically ceded by the Yakama Nation (Ecology, 2011).

Current Water Supply

Surface Water

Precipitation generally increases with elevation and from east to west, from as little as 9 inches per year in the eastern end of the basin, to as high as 105 inches per year on Mount Adams. Streams in the upper sub-basins and in the Klickitat River mainstem are likely to have a snowmelt-dominated hydrograph, with the highest flows occurring in the late spring months.

Mid elevation ranges have highest flows occurring during relatively warm winter storms, driven by rain-on snow events. The lowest elevations have mostly rainfall with very little snow; thus highest flows occur in response to high intensity rainfall events (WPN and Aspect, 2005b). Many of the small tributaries that drain directly to the Columbia River are dry during the summer months (WPN and Aspect, 2005a).

The Columbia River runs east-west along the southern length of the watershed, at the Washington-Oregon border.

Groundwater

A portion of the Columbia Plateau regional aquifer system underlies WRIA 30, and groundwater within WRIA 30 occurs both within the basalt bedrock units and in the surficial alluvium. The Wanapum Basalt is the largest source of groundwater supplies, particularly for large irrigation and municipal withdrawals across the mid and southern portions of the WRIA (WPN and Aspect, 2005a). A few wells, mostly deep wells used for irrigation in the southern portion of the watershed, access the deeper Grand Ronde Basalt. Two known alluvial areas, in the Swale Creek Valley and the Camas Prairie area, provide substantial amounts of shallow groundwater for use.

Groundwater recharge within WRIA 30 occurs primarily through the infiltration of precipitation, and secondarily as seepage from the surface waters and from anthropogenic effects (return flows from irrigation and septic systems) (WPN and Aspect, 2005a). The USGS has estimated that recharge for the current land use is nearly 60% greater than under pre-development land uses, mostly due to irrigation return flows (as cited in WPN and Aspect, 2005a). Most groundwater discharge ultimately discharges to surface waters within the watershed (though some enters and exits through deep flow systems).

Current Out-Of-Stream Water Demand

Agricultural production includes both irrigated and non-irrigated lands, with significant crops including wheat, hay, alfalfa, barley, triticale, forage grasses, and orchards (including grapes, cherries, applies, and other fruit). The number of irrigated acres “has declined over the last decade.” The portion of irrigation use that is drawn from groundwater is uncertain in some areas, creating uncertainty about what sources water use is drawing upon (WPN and Aspect, 2005a).

77% of the water allocated within the watershed through permits and certificates is for irrigation use (WPN and Aspect, 2005b). Water rights for municipal, domestic, commercial/industrial, heat exchange, and railways uses account for an additional 22%. Water rights for stock watering, fire protection, fish propagation, and wildlife propagation make up less than 1% of the total. The overwhelming majority of claims are for irrigation (WPN and Aspect, 2005b).

Manufacturing, aggregate mining, and wholesale and retail trade also help support the local economy (WPN and Aspect, 2005a). The population of Klickitat County grew 18% (to 19,547 people) between 1990 and 2000, but the Washington State Department of Financial Management has estimated no growth since that time. As calculated by the planning group, residential and non-residential water use comprised only 8% of the total water used in the WRIA at the time watershed planning was carried out (WPN and Aspect, 2005b). The watershed planning process concluded that residential use would continue to be nominal relative to irrigation use "for the foreseeable future" (WPN and Aspect, 2005b).

Current Instream Water Demand

Currently, there are three stocks of Chinook salmon (spring, tule, upriver bright), Coho salmon, two stocks of steelhead (summer, winter), bull trout, rainbow/redband trout, and mountain white fish in the Klickitat watershed, as well as several non-salmonid fish species (WPN and Aspect, 2005a). Winter and summer steelhead and bull trout are listed under the Endangered Species Act as threatened.

Twelve races of four species of anadromous salmonids are found in the Columbia River within the WRIA waters, including those passing through to upstream watersheds (WPN and Aspect, 2005a; see table below). Natural migration barriers limit the distribution of fish within the watershed (WPN and Aspect, 2005a). For example, the Klickitat River flows through a canyon with steep walls, a narrow floor, and waterfalls that were historically impassable or only marginally passable. Several culverts also partially or completely block fish passage.

Instream Flows

There are currently no instream flows set within the Klickitat. The planning group chose not to address this element within their watershed plan, and Ecology currently has no plans to set instream flows within WRIA 30 (WPN and Aspect, 2005a). There is relatively little restriction of water users needed in order to ensure water supplies for more senior water rights holders (Darrell Monroe, Department of Ecology, personal communication).

References

Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Watershed Professionals Network and Aspect Consulting. 2005a. Klickitat Basin (WRIA 30) Watershed Management Plan. Klickitat County Natural Resources Department, Goldendale, WA.

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Watershed Professionals Network and Aspect Consulting. 2005b. WRIA 30 Phase II Watershed Assessment. Klickitat County Planning Department, Goldendale, WA.

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ROCK-GLADE BASIN, WRIA 31

Background

The Rock-Glade Watershed (WRIA 31) encompasses approximately 1,594 square miles (1,020,230 acres) located in south central Washington. The Columbia River runs east-west along the southern length of the watershed. "The WRIA includes portions of Benton, Klickitat, and Yakima Counties, extending from Kennewick on the east, approaching the John Day Dam on the west, and north to the Horse Heaven Hills.

Figure G-3. Map of Rock-Glade Basin (WRIA 31)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The majority of the watershed is on lands that were ceded by the Yakama Tribes, while the eastern portion of the watershed is on lands that were ceded by the Walla Walla (Department of Ecology, 2011).

Current Water Supply

Surface Water

Mean annual precipitation decreases from west to east across the WRIA, from around 24 inches along the northwestern corner to less than 8 inches near Kennewick on the east end of the WRIA (WRIA 31 Planning Unit, 2008). The majority of precipitation occurs between October and April, with some precipitation occurring as snow, particularly at higher elevations. Only a small portion of the watershed is snow dominated. Rather, high runoff times (and peak flows) tend to be dominated by rain on snow events, or rain events, depending on the elevation (Aspect Consulting, 2004). Streamflow data are very limited, however, the available data indicate that all WRIA 31 streams are ephemeral (lack dry season flow) except in localized spring-fed reaches (Aspect Consulting, 2004). Irrigation return flows supply dry season flows in some streams (e.g., Glade Creek) (Aspect Consulting, 2004, p. ES-2).

For WRIA 31 as a whole, Columbia River surface water is a larger supply source than all groundwater sources combined.

Groundwater

The Columbia River Basalt group underlies all of WRIA 31 and is the watershed's principal source for groundwater (Aspect Consulting, 2004). As a result of return flows from irrigation water supplied from the Columbia River, groundwater recharge is estimated to be about double what it is estimated to have been under pre-development conditions (Aspect Consulting, 2004). This recharge increase occurs primarily in the main areas of irrigated agriculture. In one area of WRIA 31, the Glade/Fourmile Creeks sub-basin, there is a sizeable negative net recharge (-23,000 acre-feet/year), indicating that annual pumping withdrawal exceeds annual recharge with return flow" (Aspect Consulting, 2004) Otherwise, groundwater recharge is neutral or positive.

Current Out-Of-Stream Water Demand

Agriculture, both dryland and irrigated, is the predominant economy within WRIA 31. Ranching is significant in the western part of the watershed (WRIA 31 Planning Unit, 2008). It is also the predominant user of water. Excluding the McNary Dam hydroelectric water right, the overwhelming majority of water rights list irrigation as the primary use (89% of current annual water appropriations) (Aspect Consulting, 2004 p. 3-34).

Much of the out of stream water demand is supplied from the Columbia River, accounting for 84% of total annual appropriations (excluding the McNary Dam hydroelectric water right). The WRIA also includes a number of interruptible water rights that draw from the Columbia River mainstem. "Excluding the McNary Dam hydroelectric water right, approximately 10 percent of the appropriated annual volume of Columbia River water for WRIA 31 is "interruptible" under WAC 173-563. Groundwater withdrawals accounted for an additional 16% of annual appropriated water (Aspect Consulting, 2004).

The total population of WRIA 31 is approximately 67,600 persons (2000 census), with approximately 97% (65,300) of those residing near Kennewick (WRIA 31 Planning Unit, 2008).

The estimated total annual water use in WRIA 31 is approximately 640,000 acre-feet/year (WRIA 31 Planning Unit, 2008). Of this total, an estimated 71 percent is supplied from the Columbia River, 18 percent from the Yakima River (Kennewick and Columbia Irrigation Districts), and 11 percent from groundwater sources. Irrigation represents 97 percent of all water use in WRIA 31, with residential and non-residential uses accounting for roughly 1 and 2 percent, respectively. The majority of estimated water use is within the Glade/Fourmile and Kennewick sub-basins (77 and 20 percent by volume), with the Rock Creek and Wood/Alder Creeks sub-basins comprising only 1 and 2 percent of the total volume, respectively.

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Current Instream Water Demand

Three species of anadromous salmon, fall Chinook (*Onchorynchus tschawytscha*), Coho *(Onchorynchus kisutch)*, and summer steelhead (*Onchorynchus mykiss*), are found in the Rock Glade water resource area. Summer steelhead has been identified as indigenous to the sub-basin. The remaining anadromous use is believed to be a result of straying mid-Columbia stocks, or is use associated with upriver migration of adults or downriver migration of juveniles (Berg et al. 2001, as cited by Aspect Consulting, 2004). Pacific lamprey (*Entosphenus tridentatus*), suckers (*Catostomus spp)*, dace (*Rhinicchthys spp*), and other non-game fish species have also been observed in WRIA 31 (Berg et al. 2001; Paul Wagner, personal communication, July 21, 2004; Carl Dugger, personal communication July 2004, all as cited by Aspect Consulting, 2004).

McNary dam is a major hydroelectric dam on the Columbia, within WRIA 31, operated as part of the Federal Columbia River Power System (FCRPS).

Instream Flows

There are no instream flows currently adopted in WRIA 31. The planning group (which is in phase 4, implementation), chose not to address this optional element of watershed planning). Ecology currently has no plans to set instream flows for any streams in this watershed.

References

Aspect Consulting. 2004. Level 1 Watershed Assessment WRIA 31 (Rock-Glade Watershed). Prepared for WRIA 31 Planning Unit. Washington Department of Ecology Project No. 030009-001-01.

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WALLA WALLA, WRIA 32

Background

The Walla Walla River Watershed occupies 1,758 square miles in southeastern Washington and northeastern Oregon. WRIA 32, encompassing the Washington State portion of the basin (plus a small amount of area near Burbank that drains directly to the Columbia River), covers 1,278 square miles of that area (EES, 2002). The Walla Walla watershed extends to the Columbia River on the west, the Snake River basin on the north, and the Blue Mountains on the east. Roughly three quarters of the WRIA is in Walla Walla County, while the remainder is in Columbia County.

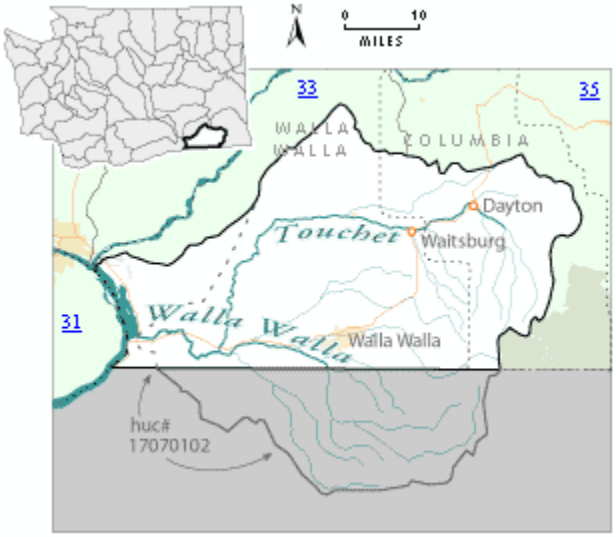

Figure G-4. Map of Walla Walla (WRIA 32)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

All of WRIA 32 is on land that was ceded by the Walla Walla under the Walla Walla Treaty of Camp Stevens in 1855 (Department of Ecology, 2011).

Current Water Supply

Surface Water

The Walla Walla basin receives most of its surface water supply from spring snowmelt in the Blue Mountains which border the east of the basin and from base flows fed by groundwater during the dry season (EES, 2002). The lower areas of the basin receive little direct precipitation, particularly during the summer (EES, 2002).

Groundwater

Groundwater resources in the WRIA include two primary aquifers: the gravel aquifer, consisting of unconsolidated sediments lying above a clay unit in the central lowland part of the basin

(covering approximately 190 square miles), and the underlying basalt aquifer, which covers 2500 square miles including portions of the basin in Oregon, and which is part of the much larger Columbia River Basalt Group (CRBG) (EES, 2002). Groundwater resources provide very significant amounts of water to consumptive water users in WRIA 32, supplying approximately 60% of total water rights (EES, 2002).

Groundwater flows are also in continuity with surface waters in some areas. For example, analysis by EES (1995, as cited by WALLA WALLA WATERSHED PLANNING UNIT, 2005) has indicated that withdrawals from the gravel aquifer have had a measureable impact on surface flows in the Walla Walla Basin. Discharge from the basalt aquifer is the major factor supplying summer flows in Mill Creek and the Walla Walla River.

Aquifer storage and recovery is a key part of the City of Walla Walla's water supply system, with an average of 286 million gallons of treated water stored each year during times of surplus, and withdrawn during times of surface water shortage. They are also carrying out shallow aquifer recharge projects.

Current Out-Of-Stream Water Demand

Agriculture is the predominant water user in WRIA 32. Approximately 75% of the land use in WRIA 32 is devoted to agriculture, including both irrigated and non-irrigated crops. Agriculture also forms an important base of the economy in this WRIA. Major crops include spring wheat, winter wheat, and barley. Hay, grapes, onions, potatoes, orchard fruits, and multiple pea varieties are also produced (WRIA 32 watershed plan). A significant amount of farmland in the watershed, including 12% of cropland acreage in the Touchet sub-basin in 2005, has been enrolled in the Conservation Reserve Program (CRP) leading to habitat improvements and reduced sediment loads to streams (Walla Walla Watershed Planning Unit, 2005).

In 2005, estimated agricultural use was 92, 500 ac-ft per year, though the watershed plan notes a lack of usage data to validate this estimation, which was made using crop acreage and average irrigation requirements by crop. Approximately half of this amount (46,300) was provided through surface water, with half provided by groundwater (Walla Walla Watershed Planning Unit, 2005).

Needs for residents, businesses, and industry come mostly from the towns of Walla Walla and College Place. The population of Walla Walla County has increased significantly in recent years, both in urbanized areas of the City of Walla Walla, and in rural areas. The population of the Columbia County portion of the WRIA was not expected to increase significantly (Walla Walla Watershed Planning Unit, 2005). In 2005, an estimated 9.67 mgd of surface water was used for residential, commercial, and industrial purposes to serve a population of 43,349. Almost all of this was purveyed by the City of Walla Walla. In 2005, residential, commercial,

and industrial *groundwater* use was estimated to be 7.31 mgd (Walla Walla Watershed Planning Unit, 2005).

By 2020, forecast *surface* water use for residential, commercial, and industrial use was 10.99 mgd, for an estimated 53,320 people. By 2020, residential, commercial, and industrial *groundwater* use was forecast to be 8.41 mgd, based on a population of 74,911 (Walla Walla Watershed Planning Unit, 2005). By 2042, the watershed planning unit forecast that there would be 70,128 ac-ft per year of out-of-stream demands from surface water, comprising 46,268 ac-ft per year of agricultural use, and 23,860 ac-ft per year of municipal water demand. Increases in demand are primarily projected to results from increases in usage for residential populations, with slight increases from commercial and industrial uses (Walla Walla Watershed Planning Unit, 2005).

Current Instream Water Demand

The waters of the Walla Walla provide habitat for many fish species, including two that have been listed under the Endangered Species Act (ESA), the summer steelhead (*Onchorhyhchus* mykiss) and the bull trout (*Savelinus* confluentus). Habitat and water quality concerns, while important for supporting fish populations (as well as for other reasons) were not the focus of the 2030 water forecast, though the WDFW assessment provides an integrated assessment at the sub-watershed level for some basins (EES, 2005). The waters resources of WRIA 32 also meet the Confederated Tribes of the Umatilla Indian Reservation's treaty fishing rights (EES, 2005). And streams and lakes offer both recreational opportunities and natural beauty for citizens and visitors to the Basin.

Instream Flows

The original WRIA 32 instream flows were established on December 14, 1977 (Chapter 173-532 WAC). There is a set of existing, active water rights conditioned to these flows. Flows were amended on September 5, 2007, as a result of the work of the watershed planning group, local stakeholders, and the Department of Ecology (Table G-1). The amendments include changes to instream flows, stream closures for some surface waters and the shallow gravel aquifer, and limits on use and mitigation requirements for future permit-exempt groundwater withdrawals. The amendments also allow the use of high flows for water storage projects that improve stream flows for salmon production. No water rights were conditioned to these newer instream flows as of 2011.

Table G-1. Current instream flows for WRIA 32 (Washington Administrative Code, 2007).

	Mill Creek	Walla Walla River	North Fork Touchet River	Touchet River
	MP 1 (Mill Creek at Kooskooskie)	MP 5a (Walla Walla River at Detour Rd), Department Gage No. 32A100	MP 6a (North Fork Touchet above Dayton), Department Gage No. 32E050	MP 11 (Touchet River at Bolles), Department Gage No. 32B100
January	110	250	95	150
February	125	250	95	150
March	150	350	125	200
April	150	350	125	200
May	125	250	125	200
June	100		95	125
July	53		65	74
August	41		53	48
September	41		51	56
October	48		63	82
November	100		95	150
December	110	250	95	150

Cells in yellow are closed (either completely closed if yellow but otherwise blank, or closed with the flows noted)

References

Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Economic and Engineering Services, Inc. 2002. Walla Walla watershed WRIA 32 level 1 assessment. In cooperation with Fountainhead, Martin Consulting Services, and Mike Barber, PhD.

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THE LOWER SNAKE, WRIA 33

Background

The Lower Snake watershed encompasses a sparsely populated area of central Washington, extending along the lower portion of the Snake, and extending to the point where the Snake enters the Columbia River near Pasco. Most of the watershed is in either Franklin or Walla Walla County, with a small portion in the east extending into Columbia County.

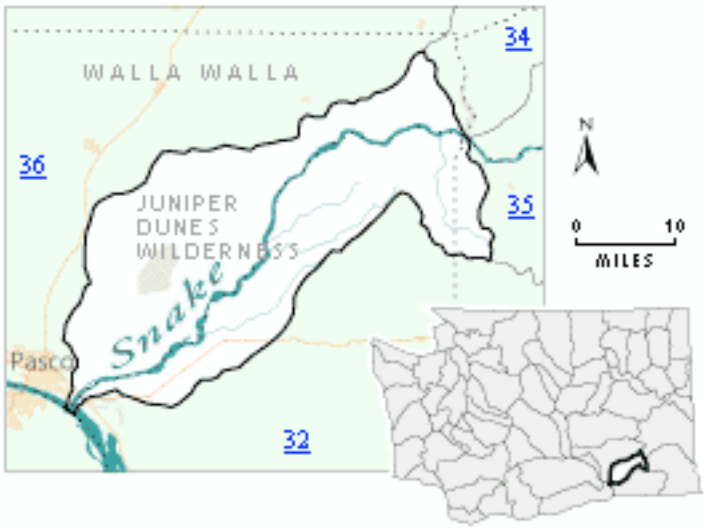

Figure G-5. Map of the Lower Snake (WRIA 33).
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The majority of the land area in the watershed is the Juniper Dunes wilderness area and other extremely steep terrain. The northern part of the watershed (north of the Snake) was historically part of the lands ceded by the Yakima. The area south of the Snake was ceded by the Walla Walla (Ecology, 2011).

The area is not currently engaged in watershed planning and there are few documents available on this watershed from the Department of Ecology.

Current Water Supply

Surface Water

There is little precipitation in this part of Washington, but the flows in the Snake River are dominated by water entering from outside the watershed. The Snake River is the largest tributary to the Columbia River. It flows into the state from Idaho, flowing through WRIAs 35 (Middle Snake) and 33 (Lower Snake) to join the Columbia River near Pasco WA. In its entirety, the drainage basin for the Snake River encompasses 108,000 square miles in parts of six states (Wyoming, Idaho, Nevada, Utah, Oregon, and Washington). Thus, flows on the Snake are

influenced by the precipitation and temperature of this wider drainage basin, as well as by the operations of dams upstream of WRIA 33, within and outside of Washington State. Some areas of the WRIA are served by the federal Columbia Basin Project. The extent of the Columbia Basin Project can be seen in Figure G-6.

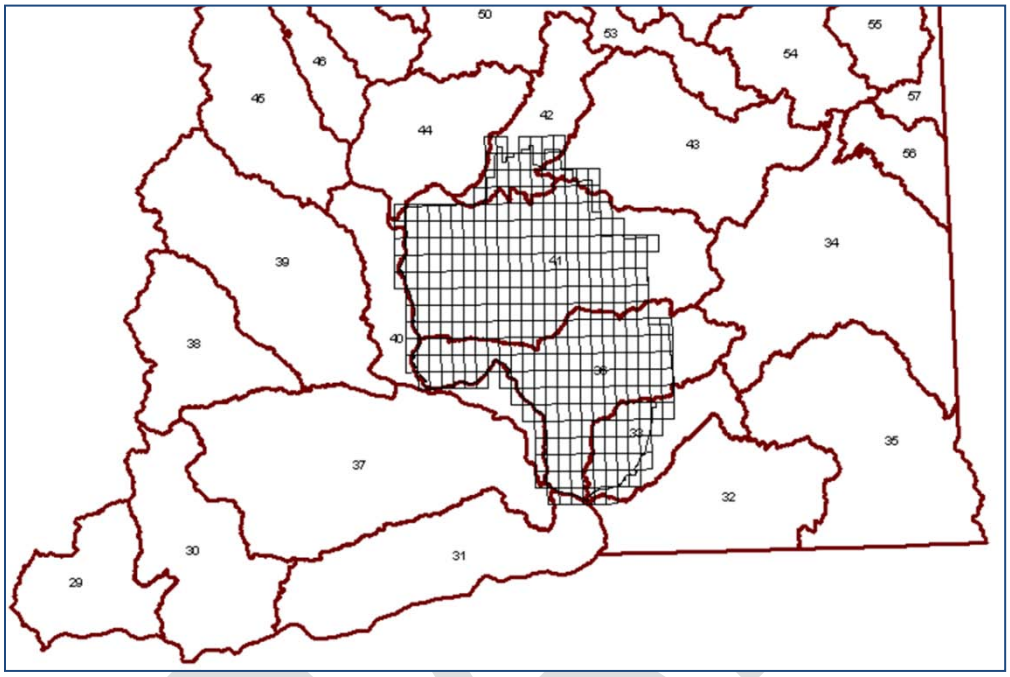

Figure G-6. Map showing the extent of the Columbia Basin project by WRIA.

Tributary streams within WRIA 33 may be mostly transient, though there is little documentation of this.

Groundwater

The Lower Snake is underlain by the Columbia River Basalt Group, which extends throughout much of eastern Washington.

Current Out-Of-Stream Water Demand

Most of the population in this watershed lives near where the Snake River runs into the Columbia River. There is a small amount of dryland agriculture in one area of the watershed, and a number of irrigated fields close to the mouth of the watershed (Chad Kruger, Washington State University Center for Sustaining Agriculture and Natural Resources, personal communication).

Current Instream Water Demand

Hydroelectric water demands are significant in WRIA 33. There are two hydroelectric projects on the Lower Snake River: Lower Monumental, and Ice Harbor Dams. These dams are flow-through rather than storage pools.

Instream Flows

There are no instream flows adopted in WAC for WRIA 33. WRIA 33 is not working under the Watershed Planning Act; there are no proposed instream flows for WRIA 33. According to a 2010 report to the Legislature, Ecology (2010) does not plan to propose instream flows.

References

Department of Ecology. 2010. 2009 Report to the Legislature: Watershed plan implementation statutory changes, progress report on setting instream flows, and reclaimed water in adopted plans. Olympia, WA: Department of Ecology Publication No. 09-11-033. 30 pp.

Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

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THE PALOUSE, WRIA 34

Background

The Palouse River extends from the mountains northeast of Moscow, Idaho, into Washington State, emptying into the Snake River at the Whitman/Franklin County line. The Palouse River and its tributaries drain over 2.1 million acres, most of which is in Washington, with about 17% in Idaho. While the Idaho portion of the watershed is outside of the Washington WRIA boundaries, individuals in the Palouse River Watershed have included the Idaho portion of the watershed in their planning process. The Washington portion of the watershed is mostly in Whitman County, with portions of Adams County, Lincoln County, and Spokane County. Major land uses in the Palouse include dryland agriculture (67% of the land area), rangeland (26%, mostly in the western portion), and a smaller amount of forested area (6%) (HDR/EES, 2007).

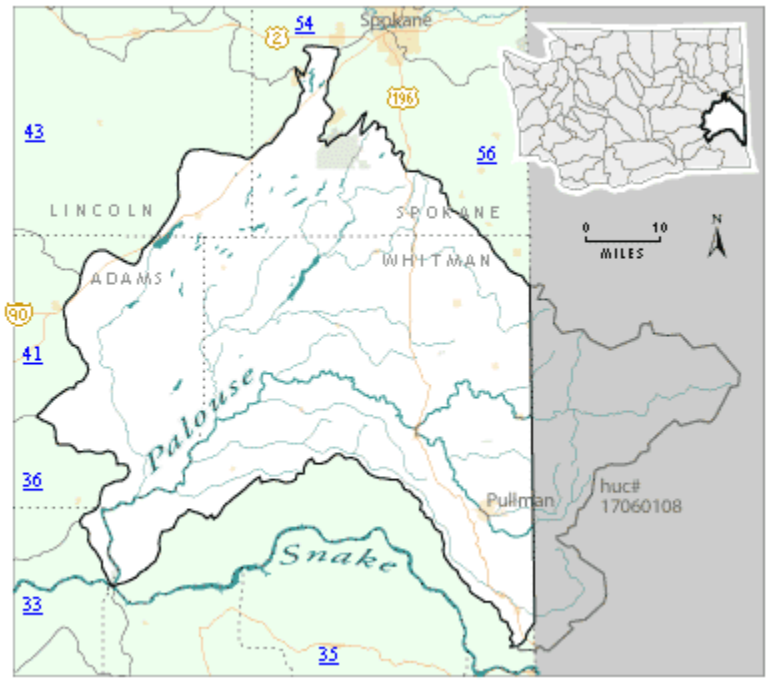

Figure G-7. Map of the Palouse (WRIA 34)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Most land in the Palouse were historically used by the Coeur d'Alene, Southern Spokane, and other bands, relinquished through Executive Order (as opposed to through a treaty). Some lands in the southwest corner of WRIA 34 were in the lands historically used by the Yakama or Nez Perce, and were ceded by treaty (Ecology, 2011).

Current Water Supply

Surface Water

The mountains in the eastern portion of the WRIA 34 receive as much as 50 inches of precipitation annually, with the majority (60-70%) falling as snow during the winter months. The western portion of the WRIA is drier, and may receive only 10 inches of annual precipitation. The Palouse River has no major man-made impediments, and flows freely.

Groundwater

Groundwater provides most of the basin's consumptive water supply, with groundwater pumped from two basalt aquifer systems. Municipal drinking water is mostly drawn from the deeper Grand Ronde aquifer, while the shallow Wanapum (Priest Rapids and Rosa) aquifer is the primary water source for rural residents, particularly in the eastern basin. Ground water declines have been recorded for the Grande Ronde aquifer, as much as 1-2 feet per year in some areas (Hashmi, 1995).

Current Out-Of-Stream Water Demand

Moscow, ID, and Pullman, WA are the two most important population centers in WRIA 34. Each has more than 10,000 inhabitants.

Irrigation is limited to supplemental irrigation of hay, pasture, and some grains on lands adjacent to surface waters, occupying less than 1% of the basin (HDR/EES, 2007).

Current Instream Water Demand

There is no significant hydroelectric generation in WRIA 34.

The Palouse River does not support anadromous salmonids, and does not provide critical habitat for fish species listed under the Endangered Species Act. The Palouse Falls, a natural barrier approximately 6 miles upstream of the Palouse River's confluence with the Snake River, prevents fish migration.

Instream Flows

WRIA 34 does not currently have instream flows adopted in WAC. As of 2011, the planning group had completed recommendations for minimum instream flows, allocation limits, and a reservation for new permit exempt wells for the North Fork Palouse River. The group will also be seeking funds for assessing the in-stream habitat of additional streams (Steve Robischon, WRIA 34 Planning Unit, personal communication).

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References

Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Golder Associates and Dally Environmental. 2009. WRIA 34 – Palouse Watershed Detailed Implementation Plan. Prepared for the WRIA 34 Planning Unit. Pullman, WA, Palouse Conservation District.

HDR/EES. In Association with Golder Associates. 2007. Palouse Watershed Plan. Prepared for the WRIA 34 Planning Unit. Pullman, WA, Palouse Conservation District.

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THE MIDDLE SNAKE, WRIA 35

Background

The Middle Snake River Watershed (WRIA 35) occupies approximately 2,250 square miles in southeastern Washington. It is bordered to the east by Idaho, and to the south by Oregon. The watershed encompasses portions of Whitman and Columbia and all of Asotin and Garfield Counties within Washington. Land use is approximately 50% rangeland, 33% agriculture, 15% forestland, and 1% urban.

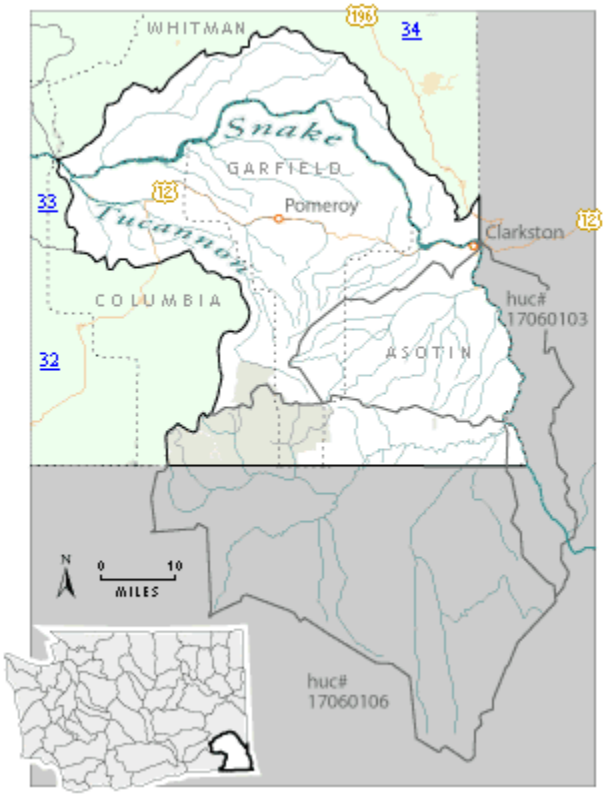

Figure G-8. Map of the Middle Snake Watershed (WRIA 35).
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Some lands within WRIA 35 (Asotin Creek and Tucannon River Valleys) are within the ceded lands of the Nez Perce tribe and the Confederated Tribes of the Umatilla. Both tribes retain fishing rights in their "usual and accustomed places" within the boundaries of their original 13.4 million acre reservation, including the mainstem Columbia River (Ecology 2011; MSRWPU, 2005).

Current Water Supply

Surface Water

Primary surface water resources in WRIA 35 include the Snake River, the Tucannon River, and Asotin Creek, as well as other tributaries. The drainage basin for the Snake River encompasses 108,000 square miles in parts of six states (Wyoming, Idaho, Nevada, Utah, Oregon, and Washington). Thus, flows on the Snake are influenced by the precipitation and temperature of this wider drainage basin, as well as by the operations of dams outside of Washington State. Much of the precipitation within the Middle Snake occurs as snowfall during the winter in the Blue Mountains that occupy the southern part of the watershed. This snow provides flows for tributaries to the Snake within WRIA 35 as it melts, with peak periods in the spring through early summer. The northern majority of the WRIA is semiarid, and summer thunderstorms provide only small and temporary impacts on stream flows.

Groundwater

Groundwater exists primarily within the underlying Columbia River Basalt Group, which underlies the entire WRIA and extends throughout much of the Columbia Plateau. Groundwater discharge to streams is significant in WRIA 35, ranging from approximately 30% in the winter months to over 90% of flows in the summer. (MSRWPU, 2005)

Current Out-Of-Stream Water Demand

The Cities of Clarkston, Starbuck, Pomeroy, and Asotin are within WRIA 35. Population is currently 25,000, and expected to reach 33,000 by 2020, relatively little growth given the extent of the geographic area. The population of the City of Clarkston, which represents the major industrial, commercial, and residential water demands in the watershed, will likely be influenced by growth in the neighboring city of Lewiston (Idaho) (HDR, 2007).

Water use for agricultural irrigation is relatively limited in WRIA 35 compared to other parts of the Columbia River Basin, though some irrigated lands exist in the lower valleys (MSRWPU, 2005). Cattle ranching and non-irrigated farming in the uplands are also important parts of agriculture in this WRIA.

Current Instream Water Demand

Hydroelectric needs are significant in WRIA 33. There are two hydroelectric projects on the Lower Snake River: Lower Granite and Little Goose.. These dams are flow-through dams, meaning that they have limited additional storage capacity.

The Middle Snake planning area includes federally listed Endangered Species, including fall Chinook, spring/summer Chinook, steelhead and bull trout. The mainstem of the Snake River

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above Asotin, Washington, has some of the best spawning habitat for fall Chinook on the mainstem of the Snake River (HDR, 2007).

Instream Flows

The WRIA 35 watershed plan did address instream flow and noted potential concern about groundwater in the Clarkston area (HDR, 2007). The planning unit made final recommendations to focused set instream flows for three locations on Tucannon River (at the mouth, MP1, Territorial Road, and MP3 Marengo) and one location on Asotin Creek based on habitat needs for steelhead, Chinook, and bull trout (Appendix C, HDR, 2007). These recommendations are outlined in Table G-2.

Table G-2. Recommended instream flows for WRIA 35.

	Asotin Creek	Tucannon River Mouth	Tucannon River at Territorial Rd	Tucannon River at Marengo
	RM .02, MP-12, Mouth of Asotin Creek, Bridge on HWY 129 to N. and S. Forks	MP-1a, Tucannon River at Mouth to Territorial	MP-1b, Tucannon River from Territorial Rd to Marengo	MP 3, Tucannon River from Marengo to headwaters
January	63	110	110	110
February	93	110	110	110
March	131	110	110	110
April	173	110	110	110
May	176	110	110	110
June	92	110	110	110
June		75	85	
July	54	75	85	94
July	42	65	75	
August	35	65	65	77
September	37	65	75	86
September		75		
October	40	78	80	99
October		84		
November	43	95	95	100
November	46			
December	50	95	95	110

The group is currently gathering flow and habitat data on several other streams in the watershed (Brad Johnson, WRIA 35 Planning Unit, personal communication). They expect Ecology and the Department of Fish and Wildlife to collaborate in completing a final watershed-wide stream management recommendation for rule-making in 2012. These instream flows were determined on the basis of habitat needs for Chinook, steelhead and Bull trout.

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References

HDR. 2007. WRIA 35 Watershed Plan. Clarkston, WA, Asotin County Public Utility District.

Middle Snake River Watershed Planning Unit. 2005. Middle Snake River Watershed Phase 2 Level 1 Technical Assessment. Clarkston, WA, Asotin County Public Utility District.

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ESQUATZEL COULEE, WRIA 36

Background

The Esquatzel Coulee watershed, WRIA 36, covers a large area east of the Columbia River and north of Pasco, stretching across parts of Adams, Grant, and Franklin Counties. The watershed is not involved in watershed planning, and few documents that pertain directly to WRIA 36 were available from the Department of Ecology.

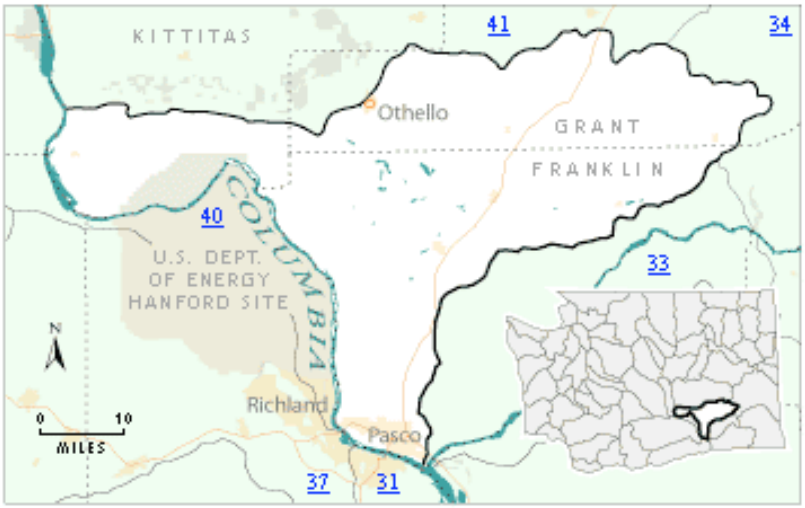

Figure G-9. Map of Esquatzel Coulee (WRIA 36)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

All lands in WRIA 36 are within areas that were ceded by the Yakama Tribes under the Yakima Treaty of Camp Stevens in 1855 (Department of Ecology, 2011).

Current Water Supply

Surface Water

The massive federal Columbia Basin Project with its three irrigation districts operates in WRIA 36. This project and the water it provides have turned the central Columbia River Basin into one of the most productive agricultural areas in the country.

Groundwater

Groundwater in WRIA 36 is found within part of the Columbia River Basalt aquifer system. As irrigation water has been used in WRIA 36, some of the introduced water has seeped into the ground, raising groundwater levels over naturally-occurring levels in some areas (DOE, 2011). Groundwater levels are declining in some areas, raising concerns that groundwater use is not sustainable.

Groundwater rights are no longer being issued in most of the watershed. WRIA 36 includes two groundwater management sub areas. Area 508-14 of the Columbia Basin Groundwater Management Area covers parts of Franklin, Grant, Lincoln and Adams Counties. This groundwater area has specific policies for granting new groundwater permits (described further in DOE, 2011 and in WAC 508-14), and is also working to address issues with nitrate in the groundwater.

Groundwater levels in the Odessa Groundwater Management subarea are declining, and groundwater is not available for new uses (DOE, 2011).

Current Out-Of-Stream Water Demand

Irrigated agriculture is significant in the Esquatzel Coulee watershed, relying mostly on surface waters (Frans and Helsel, 2005). The extent of the Columbia Basin Project can be seen in Figure G-10.

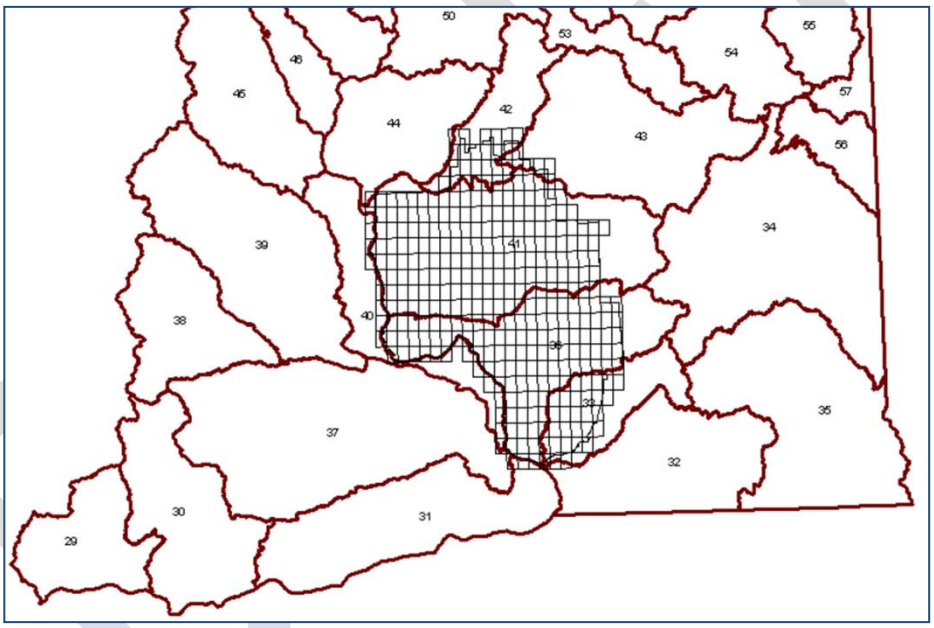

Figure G-10. Map showing the extent of the Columbia Basin project by WRIA.

Groundwater provides a majority of potable water for residents. The city of Connell is located in the middle of the watershed.

Current Instream Water Demand

On the western edge of the watershed, Priest Rapids dam is a major hydroelectric dam on the Columbia River.

No independent description of demands for fish was found for WRIA 36.

Instream Flows

There are currently no instream flows defined in WAC for WRIA 36. There are no proposed instream flows for WRIA 36, and as of late 2009, Ecology (2010) does not plan to propose instream flows for this watershed.

References

Department of Ecology. 2010. 2009 Report to the Legislature: Watershed plan implementation statutory changes, progress report on setting instream flows, and reclaimed water in adopted plans. Olympia, WA: Department of Ecology Publication No. 09-11-033. 30 pp.

Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Department of Ecology. 2011. Focus on Esquatzel Coulee Watershed. Publication No. 11-11-074. Spokane, WA, Department of Ecology Eastern Regional Office.

Frans, L and Helsel, D.R. Prepared in cooperation with the Columbia Basin Groundwater Management Area. 2005. Evaluating regional trends in ground-water nitrate concentrations of the Columbia Basin Groundwater Management Area, Washington. U.S.G.S. Scientific Investigations Report 2005-5078. U.S. Geological Survey, U.S. Department of the Interior. Tacoma, WA, U.S.G.S.

GWMA Project Office. 2001. GWMA Plan. Adopted by the Boards of County Commissioners of Adams, Franklin, and Grant Counties in 2001 and the Lincoln County Boards of County Commissioners in August 2005. Othello, WA, GWMA Project Office.

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THE YAKIMA BASIN, WRIAS 37, 38, AND 39

Lower Yakima, Naches, and Upper Yakima

Background

The Yakima River Basin covers about 6,200 square miles in south-central Washington. This large basin encompasses three WRIAs, the Lower Yakima (WRIA 37), the Naches (WRIA 38), and the Upper Yakima (WRIA 39). These three watersheds engaged in the watershed planning process together; therefore WRIA-level results of the statewide forecast are also presented together. About half the population lives in rural areas, while the other half lives in urban areas. Major cities include Ellensburg, Yakima, and Richland.

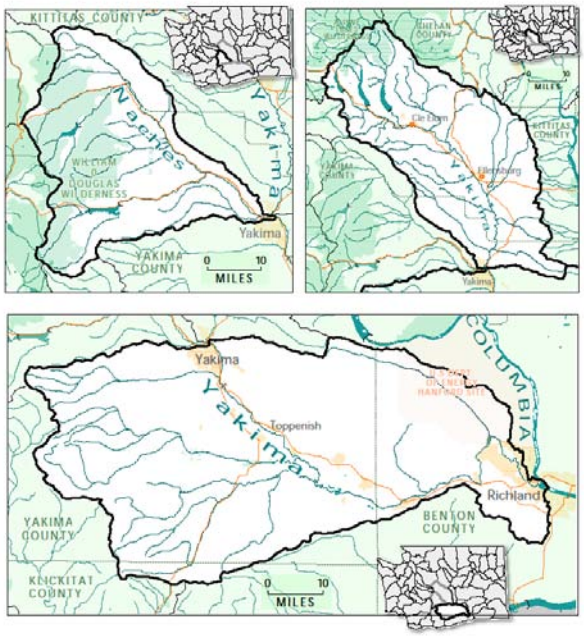

Figure G-11. Map of the Yakima Basin (WRIAs 37, 38 and 39)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The Yakima River Basin includes almost all of Yakima County, more than 80% of Kittitas County, and about half of Benton County, as well as a small amount of land in Klickitat County. The Yakama Nation Reservation covers approximately 23 percent of the Basin (with additional Reservation lands outside the Yakima River Basin). Most of the rest of the watershed is within the area ceded by the Yakama in 1855, while a small portion of the watershed (near the Yakima River confluence with the Columbia) is within the area ceded by the Walla Walla in 1855 (Department of Ecology, 2011).

Existing land cover in the Yakima Basin is approximately 50% non forested rangeland, 29% forested, 21% agricultural, and less than 1% urban developed land. Agricultural activity

provides the basis of the economy, along with related food processing industries. Timber production and related industries is also part of the Yakima Basin economy (Tri-County Water Resource Agency, 2003).

Yakima is a well-studied basin. This review does not comprehensively cover all available documents, but rather focuses on the major documents associated with the watershed planning process.

Current Water Supply

Surface Water

The headwaters of the basin are on the upper eastern slope of the Cascade Mountains, and have a mean annual precipitation of more than 120 inches. This contrasts sharply with the lower portions of the basin; less than 6 inches of rain fall per year in the area where the Yakima River meets the Columbia. Most precipitation falls during the winter months as snow in the mountains.

Surface water is stored in a system of six reservoirs operated by the U.S. Bureau of Reclamation: Bumping Reservoir, Kachess Reservior, Clear Lake (used primarily for recreation), Keechelus Reservoir, Rimrock Reservoir (at Tieton Dam), and Cle Elum Reservoir. Together, these reservoirs store about 1.07 million acre feet, with about 78% in the upper arm of the Yakima River, and 22% in the Naches River. These reservoirs do not include much carryover storage, and therefore need to be replenished each year in the winter and spring in order to be able to provide a full water supply during the irrigation season (Tri-County Water Resource Agency, 2003).

In the lower part of the Basin, return flows are an important part of water supply, and may be more important than release of water from reservoirs for meeting water demand (Vaccaro, 2011). About 45% of the irrigation water used in the upper portions of the basin return to the river system as surface-water inflows and groundwater discharge, with varying time-lags (Bureau of Reclamation, 1999, as cited by Vaccaro, 2011). During low flow periods, these return flows can account for about 75 percent of the streamflow below the gaging station near Parker.

Groundwater

The central, eastern, and southwestern parts of the Yakima River Basin overlie the basalt lava flows of the Columbia River Basalt Group (CRBG). Meanwhile, the lowlands are underlain by unconsolidated and weakly consolidated valley fill that in places is more than 1,000 ft thick (Drost et al., 1990, as cited by Vaccaro, 2011). Each of these provides a portion of groundwater supply. In a recent study, the USGS (2011) confirmed that river aquifer exchanges involve mostly streams and shallow groundwater. They found that net gains from groundwater to streamflow were much more vigorous than losses in the reaches that they studied, including in reaches that are potentially important areas for salmonids. In most perennial streams in the

basin, streamflow during most of the year is dominated by groundwater that has discharged to the stream channel.

The deep groundwater system, on the other hand, seems to contribute little to surface water streamflow (Vaccaro, 2011).

Current Out-Of-Stream Water Demand

Irrigated agriculture is the principal economic activity in the Yakima River basin. About 70% of surface water diversions for major irrigation entities in the Basin are provided through the USBR's Yakima Project (Vaccaro, 2011). Supplemental groundwater rights are used in many areas of the basin for agriculture (Tri-County Water Resources Agency, 2003).

Municipal demand is also significant, and much of these needs are met by groundwater. There are currently more than 20,000 wells in the basin (Vaccaro, 2011), including both shallow domestic wells, and deeper public supply wells. Population growth has been quite significant, and the watershed planning unit projections suggest that it will remain that way.

In a water balance for the basin, the USGS estimated that 17% of annual streamflow was used consumptively (mostly evapotranspiration by irrigated crops), while 55% of precipitation was consumed by evapotranspiration under natural conditions (Vaccaro, 2011, pp 4-5).

Current Instream Water Demand

The Yakima River Basin provides habitat for fish species that have been listed under the federal Endangered Species Act, and sustains non-listed fish and wildlife as well (Tri-County Water Resource Agency, 2003). Releases from several reservoirs provide instream flows during the winter to support the incubation of salmon eggs.

Legally enforceable instream flow criteria exist for two lower Yakima River mainstem control points, at Sunnyside and Prosser Diversion Dams (USBR, 2011).

Instream Flows

The U.S. Bureau of Reclamation (Reclamation) manages water delivered by USBR on the mainstem Yakima and Naches Rivers, including on tributary streams which have federal storage facilities. Tributary streams which do not have federal storage, and groundwater rights, are not managed by Reclamation and have separate water rights under the State of Washington. In addition, even in areas served by Reclamation's Yakima Project, individual land owners may have state water rights that are used in combination with water they obtain through the Yakima Project (Tri-County Water Resource Agency, 2003).

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The framework by which the Bureau of Reclamation operates the Yakima Project is the 1945 consent decree. This decree established three classes of rights: non-proratable, proratable, and junior. Non-proratable water rights holders, with priority dates before May 1905, receive their full allocation of water. Proratable water rights holders, with priority dates of May 1905, may receive only a percentage of the water that is allocated to them, based on the Total Water Supply Available (TWSA), a calculation of the current available storage in reservoirs, forecasted estimates of unregulated flow, return flows, and other sources. Junior water rights holders may be completely turned off in cases when TWSA is not enough to meet the demands of non-proratable and proratable users.

Historically, water pro-rationing has occurred relatively frequently, including (up through 2008), 1973, 1977, 1979, 1987-1988, 1992-1994, 2001, and 2005 (Tri-County Water Resource Agency, 2003). Many proratable users have groundwater rights that allow them to pump supplemental water in years that their surface water rights are subject to pro-rationing.

The major management point for the Bureau of Reclamation is the streamflow gaging station on the Yakima River near Parker, just below the Sunnyside and Wapato Main canal diversions.

Flow targets at this point reduce the amount of total water supply available for other purposes (Tri-County Water Resource Agency, 2003). Water levels are also managed to meet defined instream flow targets at Prosser diversion dam. Since 1995, the basin has also chanced operations, lowering reservoir releases from Keechelus and Cle Elum Reservoirs in mid-September to encourage spawning Chinook salmon to lay their eggs lower in the channel. Meanwhile, releases from the Naches arm are increased to meet demands, in an operational procedure called “flip-flop.”

Flows in these basins are not managed through the Washington State instream flow program, though the BOR does manage to meet instream flows as described above. Ecology anticipates no state-level instream flow activities at this time (Department of Ecology, 2012).

The Yakima River Basin Water Enhancement Project (YRBWEP) is also important to management of water in the Basin (Tri-County Water Resource Agency, 2003). This project, authorized by federal legislation, has a variety of purposes, including:

- To protect, mitigate, and enhance fish and wildlife
- To improve the reliability of water supply for irrigation
- To improve the efficiency of water delivery and use
- To realize at least 110,000 acre feet of water savings per year for fish and wildlife, and at least 55,000 acre feet of water savings per year for irrigation, by year 2002,
- To encourage voluntary transactions among public and private entities which result in water conservation measures, practices, and facilities, and
- To provide for the implementation of certain projects by the Yakama Indian Nation.

References

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Department of Ecology. 2012. Watershed management updates by WRIA: Yakima River Basin (WRIA 37/38/39) Accessed February 7, 2012. http://www.ecy.wa.gov/programs/eap/wrias/Planning/37-38-39.html.

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ALKALI-SQUILCHUCK AND SQUILCHUCK-STEMILT BASIN, WRIAS 40 AND 40A

Background

The Squilchuck-Stemilt Watershed, WRIA 40a, comprises over 49,000 acres (76.6 square miles). Nearly half of the watershed is above 3000 feet elevation. The Squilchuck and Semilt Creeks are the two primary tributaries to the Columbia River in the watershed. The watershed is dominated by commercial agriculture and forestry with tree fruit (mainly cherries) the predominant agricultural crop. Residences lie mainly within the lower elevations near the Columbia River. Industrial land use is mainly in the Malaga sub-basin near the Columbia, while recreational use takes place in upper elevations. (CCNRD, 2007) Mission Ridge Ski Area brings 100,000 visitors to the area annually (USFS 1998 as cited in CCNRD, 2007).

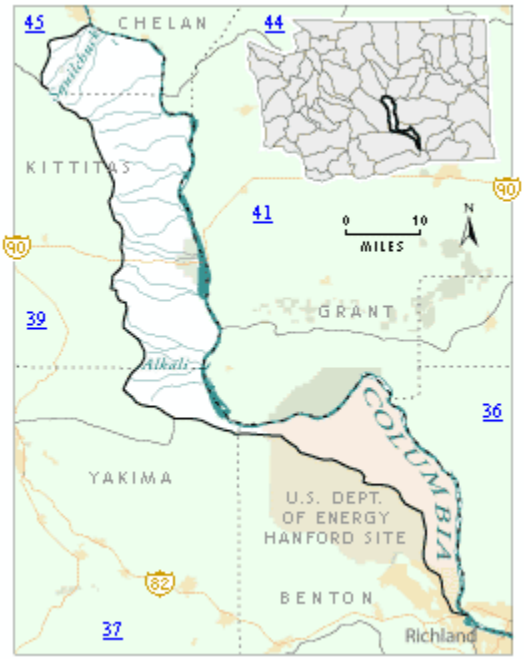

Figure G-12. Map of Alkali-Squilchuck and Squilchuck-Stemilt Basin (WRIAs 40 and 40a) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

There was very little information available about WRIA 40 (which has not been planning). However, there is very little demand of supply in the DOD portions of WRIA 40 (Michael Barber, personal communication).

WRIA 40a is within the area ceded by the Yakama Nation in 1855, and the Yakama Nation reserves fishing rights in WRIA 40a (CCNRD, 2007 p.13). Some areas of WRIA 40 are within the area ceded by the Yakama Nation, while others are within the area ceded by the Walla Walla (Department of Ecology, 2011).

Current Water Supply

Precipitation accounts for the vast majority of the water input to WRIA 40a, with most of this falling as snow above 3000 feet (RH2, 2007). Average annual precipitation ranges from 8 inches in lower elevations to 32 inches in the highest elevations (CCNRD, 2007). Because of this, roughly 65 percent of the annual water flow in the Stemilt and Squilchuck rivers comes from snowmelt between April and July (RH2, 2007).Because summer streamflow is low and groundwater is limited by geologic conditions, water is diverted to reservoirs and pumped from the Columbia River to meet demand.

The watershed contains 27 active reservoirs with a combined capacity of 3,300 acre-feet (AF) (and 8 inactive reservoirs, 135 AF) (CCNRD, 2007 p. 14; RH2 Engineering, 2007). A significant amount of water is lost due to seepage from reservoirs, surface evaporation, leakage in ditches and pipelines, and inefficient irrigation of orchards (CCNRD, 2007). Altogether, estimated loss of stored water is 20 percent of the total estimate for irrigation (19,430 AF/Y).

Groundwater has not been extensively studied, but is generally limited (CCNRD, 2007).

Current Out-Of-Stream Water Demand

Most of the crop cover is comprised of orchards (mostly cherry), with some row crops and some grass or alfalfa (183 acres). Existing irrigation water use is efficient, and industrial and commercial water use is minor. Domestic water returns contribute to groundwater and base flow; domestic consumption is also a minor part of the water balance (CCNRD, 2007). Current allocated water rights are estimated to be 50 percent greater than what is physically available. (CCNRD, 2007 p.13)

Current Instream Water Demand

WRIA 40a opted out of quality components of watershed planning, and there was little available information about instream water demands for fish.

Instream Flows

Washington has not adopted minimum instream flows within WRIA 40a (CCNRD, 2007 p.14).

References

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LOWER CRAB, WRIA 41

Background

The Lower Crab Watershed includes the portion of Crab Creek from Ephrata to its confluence with the Columbia River, covering parts of Grant, Adams, and Lincoln Counties. Surface water resources in the watershed are dominated by the Columbia Basin Project, operated by the Bureau of Reclamation to deliver irrigation water from the Grand Coulee Dam.

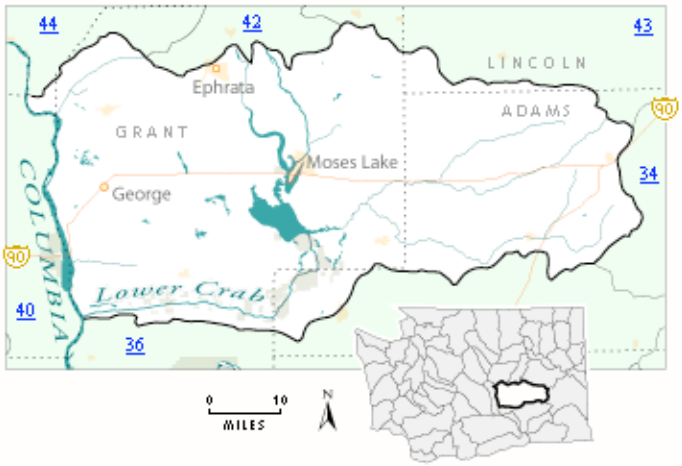

Figure G-13. Map of Lower Crab (WRIA 41) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The western and southern portions of the watershed were part of the historical lands of the Yakama, ceded by treaty in 1855 (Department of Ecology, 2011). The northeast area of the watershed is part of the historical lands of the Coeur d'Alene, Southern Spokane, and other bands, relinquished by Executive Order in 1873 (Department of Ecology, 2011).

Current Water Supply

Surface Water

The federal Columbia Basin Project is operated over many areas of this watershed for multiple purposes including irrigation, power production, flood control, municipal water supply, recreation, and fish and wildlife benefits (DOE, 2009). The extent of the Columbia Basin Project can be seen in Figure G-14. Potholes Reservoir and the network of irrigation canals associated with the Columbia Basin Project are important to water supply, particularly in terms of meeting needs for agricultural irrigation.

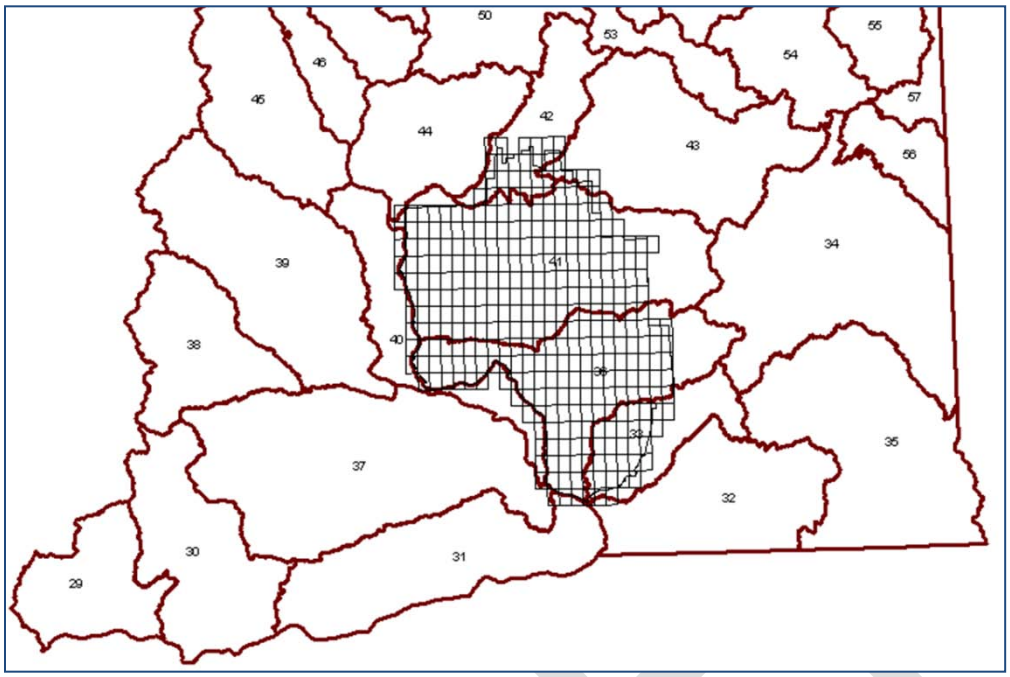

Figure G-14. Map showing the extent of the Columbia Basin project by WRIA.

Moses Lake, which existed historically (though flows are altered because of the Columbia Basin Project) occupies the middle of the Lower Crab watershed, while Rock Ford Creek and Lower Crab Creek are also important surface water features. Most tributaries creeks and streams in this watershed are seasonal in nature (DOE, 2011).

Annual precipitation occurs mostly in the winter and ranges from 7 inches per year in the Beverly area to over 10 inches in higher elevations (DOE, 2011).

Groundwater

WRIA 41 is underlain by groundwater resources, comprising commingled naturally occurring, and artificially recharged groundwater (DOE, 2009). Groundwater resources are concentrated within the boundaries of the Columbia Basin Project, with limited availability of groundwater from bedrock outside the boundaries of the Project (DOE, 2011). Many areas are experiencing groundwater declines, leading to concerns that they may not be able to support current levels of use (DOE, 2011).

Ground water in the Lower Crab is managed under three distinct subareas, Quincy Basin, Odessa, and the Columbia Basin Project Area. Each of these has its own regulatory framework. The Quincy Basin Subarea is primarily located in the northwest part of the Lower Crab Watershed. This area has both older state water rights, and the unique “Quincy Basin” water permits for artificially stored groundwater (groundwater stored as a result of the federal Columbia Basin Project).

The Odessa Subarea is located in the far eastern portion of WRIA 41. Much of this area has not been developed with surface area supplies, and thus is dependent on groundwater (DOE, 2011). Groundwater levels in the Odessa Subarea are declining in many places, and new options for water supply for current users are currently under study. There is growing concern over the cumulative impacts of water demand, including a large number of permit-exempt wells (DOE, 2009).

The 508-14 Columbia Basin Groundwater Management Subarea is located in the southwest part of the watershed, and is managed under WAC 508-14. This area includes both naturally occurring groundwater, and artificially stored groundwater resulting from the Columbia Basin Project.

Current Out-Of-Stream Water Demand

Agricultural uses of water include lands irrigated by surface water from the Columbia Basin Project canal system and by groundwater (Frans and Helsel, 2005). Three large irrigation districts operate in WRIA 41 (DOE, 2009). Water supply demands for municipal and industrial uses have also been growing (DOE, 2009).

Current Instream Water Demand

The Columbia Basin Project, which operates in WRIA 41, includes significant hydropower generation. Moses Lake and Potholes Reservoir are significant recreational fishing destinations, supporting the local tourism and wildlife economy of the watershed.

Instream Flows

There are currently no instream flows defined in WAC for WRIA 41. There are no proposed instream flows for WRIA 41, and as of late 2009, Ecology (2010) does not plan to propose instream flows for this watershed.

References

Department of Ecology. 2009. Focus on the Lower Crab Watershed. Department of Ecology, Publication No. 09-11-007. Spokane, WA. Department of Ecology, Eastern Regional Office.

Department of Ecology. 2010. 2009 Report to the Legislature: Watershed plan implementation statutory changes, progress report on setting instream flows, and reclaimed water in adopted plans. Olympia, WA. Department of Ecology Publication No. 09-11-033. 30 pp.

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GRAND COULEE, WRIA 42

Background

Grand Coulee Watershed is located at the northern end of the Columbia Basin Project, and includes Banks Lake and Billy Clapp Lake. These two reservoirs are supplied by water diverted from the Columbia River, and serve as control reservoirs for the Columbia Basin Project.

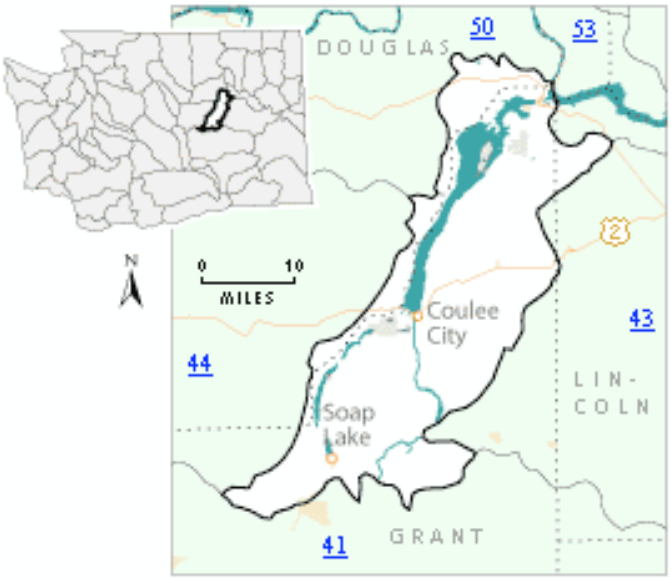

Figure G-15. Map of Grand Coulee (WRIA 42) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The western half of the watershed is within the area that was historically ceded by the Yakama by Treaty in 1855 (Department of Ecology, 2011b). The eastern part of the watershed is part of the historical lands of the Coeur d'Alene, Southern Spokane, and other bands. This land was relinquished by Executive Order in 1873 (Department of Ecology, 2011).

Current Water Supply

Surface Water

Regional rainfall averages only 7 to 15 inches per year (GWMA Project Office, 2001). Water features of Grand Coulee are dominated by Banks Lake and other features associated with the federal Columbia Basin Project. The extent of this project can be seen in Figure G-16.

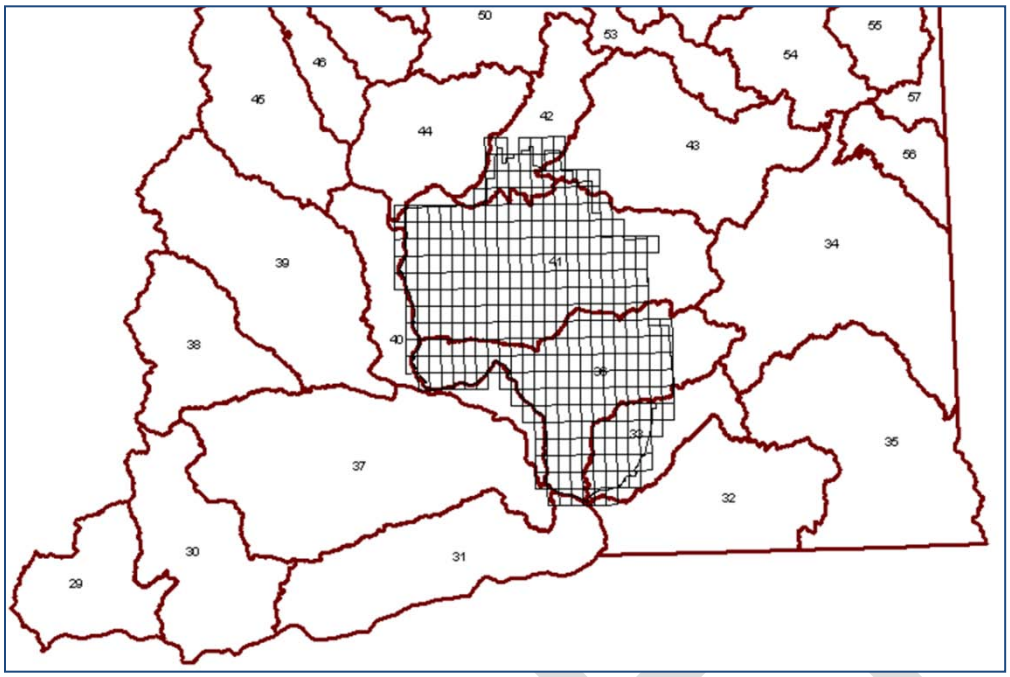

Figure G-16. Map showing the extent of the Columbia Basin project by WRIA.

Most streams in the regional are seasonal and flow during winter runoff events.

Groundwater

WRIA 42 is underlain by portions of the regional Columbia Plateau aquifer system. Recharge of the aquifers may occur from losing reaches of the Columbia River or its tributaries though in a more general sense these features a generally regarded as discharge features (GWMA Project Office, 2001). Upper aquifers likely also receive significant amounts of artificial recharge associated with the Columbia Basin Project and irrigation of agricultural lands. Groundwater resources are thus concentrated within the boundaries of the Columbia Basin Project, with limited availability of groundwater from bedrock outside the boundaries of the Project (Department of Ecology, 2011a).

WRIA 42 includes the Quincy Subarea and small portion of Odessa Subarea. Each of these has its own regulatory framework. The Quincy Basin Subarea covers the southern part of WRIA 42. This area has both older state water rights, and the unique "Quincy Basin" water permits for artificially stored groundwater (groundwater stored as a result of the federal Columbia Basin Project).

A small amount of the Odessa Subarea is located within the southeastern part of Grand Coulee. Groundwater levels in the Odessa Subarea are declining in many places, and new options for water supply are currently under study. Use of groundwater under the permit-exemption is still available.

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Current Out-Of-Stream Water Demand

The Columbia Basin Project canal system provides water for much of the agricultural irrigation that occurs in WRIA 42. Outside of this area, much of the agriculture of this WRIA is dryland agriculture or rangeland. Municipal demands in this watershed have also been increasing (Department of Ecology, 2011a).

Current Instream Water Demand

The Columbia Basin Project, which operates in WRIA 42, includes significant hydropower generation. Banks Lake is an important recreational fishing and boating destination, supporting the local recreation and tourism industry in this area.

Instream Flows

There are currently no instream flows defined in WAC for WRIA 42. There are no proposed instream flows for WRIA 42, and as of late 2009, Ecology (2010) does not plan to propose instream flows for this watershed.

References

Department of Ecology. 2011a. Focus on water availability: Grand Coulee Watershed, WRIA 42. Department of Ecology Publication No. 11-11-046. August. Spokane, WA. Department of Ecology.

Department of Ecology. 2011b. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Department of Ecology. 2010. 2009 Report to the Legislature: Watershed plan implementation statutory changes, progress report on setting instream flows, and reclaimed water in adopted plans. Olympia, WA. Department of Ecology Publication No. 09-11-033. 30 pp.

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UPPER CRAB-WILSON, WRIA 43

Background

Upper Crab Creek-Wilson Creek watershed, WRIA 43, covers more than 1.1 million acres upstream of Brook Lake. Most of the watershed is in Lincoln county, though small portions extend into Grant, Spokane, and Adams Counties. Most of the land area (87%) is dedicated to agriculture (grain, hay, fruit or grazed livestock) (WRIA 43 Watershed Planning Unit and St. Godard, 2006). There are no significant non-agriculture related industrial or commercial activities in the watershed.

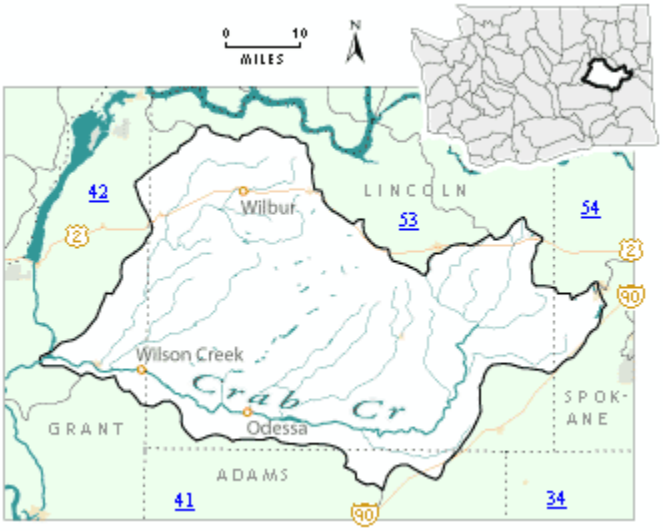

Figure G-17. Map of Upper Crab Creek-Wilson Creek Watershed (WRIA 43) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Most of the watershed is part of the historical lands of the Coeur d'Alene, Southern Spokane, and other bands. This land was relinquished by Executive Order in 1873 (Department of Ecology, 2011). A small area in the far western part of the watershed was part of the historical lands of the Yakama, ceded by treaty in 1855 (Department of Ecology, 2011).

Current Water Supply

Surface Water

WRIA 43 receives between 5 and 15 inches of precipitation annually, with higher amounts falling in the eastern (higher) portions of the watershed (WRIA 43 Watershed Planning Unit and St. Godard, 2006). Precipitation falls mostly between November and February as snow (Kennedy/Jenks, 2005). Streams are mostly ephemeral, flowing during winter and spring runoff periods. From June through November, stream flow is mostly or entirely supported by groundwater discharge (Kennedy/Jenks, 2005).

Long-term records indicate that stream flow as measured at Irby along Crab Creek appears to have decreased over the last 60 years, despite generally stable precipitation levels (Kennedy/Jenks, 2005).

Groundwater

Three groundwater aquifers underlie WRIA 43. The shallowest aquifer, which seems to be in direct hydraulic continuity with Crab Creek and its tributaries, includes the sedimentary zones in coulees along stream courses (Kennedy/Jenks, 2005). These sedimentary aquifers are also in hydraulic connection with two Columbia River Basalt Group (CRBG) aquifers, the shallower Wanapum and the deeper Grande Ronde. The basalt aquifers provide most of the potable and irrigation waters to wells in WRIA 43 (Kennedy/Jenks, 2005). The Wanapum has been incised by Crab Creek and its tributaries, and therefore likely provides water to streams at many locations throughout WRIA 43 (Kennedy/Jenks, 2005).

The watershed planning group notes that there is a lack of knowledge regarding the total amount of groundwater available in WRIA 43, about how the aquifers and surface waters are connected throughout the watershed, and about the relationship between groundwater, stream flows, and irrigation and domestic uses (WRIA 43 Watershed Planning Unit and St. Godard, 2006).

Current Out-Of-Stream Water Demand

Almost 94% of the water rights issued in the watershed have been issued for groundwater, with about 6% for surface waters, indicating the predominance of groundwater for supplying out-of-stream water uses in WRIA 43 (Kennedy/Jenks, 2005).

Approximately 99% of an estimated 327,000 acre feet of annual water use is for irrigation, with the remaining 1% for Group A and B water systems, domestic wells, and other exempt wells (Kennedy/Jenks, 2005). The watershed planning group projected that non-irrigation water use would increase to approximately 5,700 acre-feet per year by 2040, but did not make a projection for irrigation water use (Kennedy/Jenks, 2005).

All available surface waters in most years on Crab Creek are allocated, due to a 1943 water right for the "withdrawal of all the unappropriated public waters of Moses Lake, Crab Creek, Rocky Ford Creek, Lind Coulee, and tributaries thereto (WRIA 43 Watershed Planning Unit and St. Godard, 2006)." This permit, for natural storage in the Potholes Reservoir, estimates that approximately 180 AF of an annual 200,000 AF certificated will come from Crab Creek and Rocky Ford Creek.

Current Instream Water Demand

Native fish species in the watershed include rainbow trout, Columbia River interior redband trout, westslope cutthroat trout, and Yellowstone cutthroat trout (Kennedy/Jenks, 2005). Bull

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trout had not been reported in fish surveys in WRIA 43 as of 2006 (WRIA 43 Watershed Planning Unit and St. Godard, 2006). Non-native species include brook trout and brown trout, both of which contribute to the fisheries resources of WRIA 43 (Kennedy/Jenks, 2005).

Instream Flows

An instream flow study was completed as part of the watershed planning process, and minimum flows for two sites were submitted by the WRIA 43 Planning Unit to WDFW and Ecology (WRIA 43 Watershed Planning Unit and St. Godard, 2006). However, because of disagreements about the proposed flow numbers, the watershed plan did not include numerical instream flow recommendations (Department of Ecology, 2011).

References

Department of Ecology. 2011. Watershed management: Upper Crab, WRIA 43. Accessed July 8, 2011. http://www.ecy.wa.gov/programs/eap/WRIAs/Planning/43.html.

Kennedy/Jenks Consultants. 2005. Watershed assessment report: WRIA 43. In association with GeoEngineers, Inc and Water and Natural Resources Group. Prepared for Lincoln County. November 2005. Portland, OR: Kennedy/Jenks Consultants.

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MOSES COULEE AND FOSTER CREEK, WRIAS 44 AND 50

Background

WRIAs 44 (Moses Coulee) and 50 (Foster Creek) cover 2,043 square miles of the Columbia Plateau, including portions of Grant, Douglas, and Okanogan Counties. The Columbia River borders the two WRIAs on the north and west.

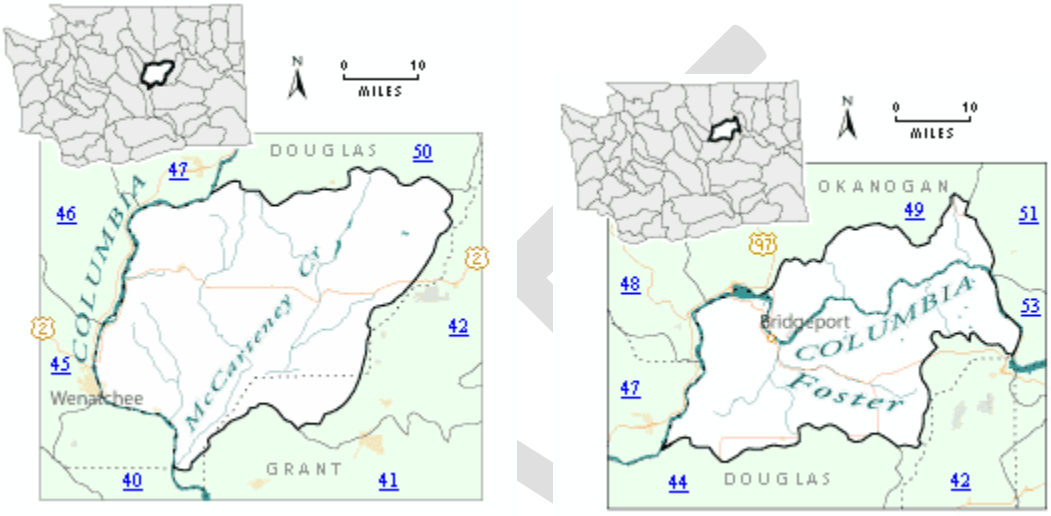

Figure G-18. Map of Moses Coulee (WRIA 44) and Foster Creek (WRIA 50) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The northern portion of WRIA 50 is part of the reservation of the Colville Confederated Tribes. The middle portion of WRIA 50 was historically part of the historical lands of the Coeur d'Alene, Southern Spokane, and other bands. This land was relinquished by Executive Order in 1873 (Department of Ecology, 2011). The southern portion of WRIA 50 and all of WRIA 44 are within the area that was historically part of the historical lands of the Yakama, ceded by treaty in 1855 (Department of Ecology, 2011).

Current Water Supply

Surface Water

The two WRIAs have a semi-arid climate, receiving an average of 8 to 12 inches of precipitation annually (Bartu and Andonaegui, 2001, as cited by PGG, 2003). Most streams in these two WRIAs are seasonal flood channels. Some streams are fed by perennial or intermittent springs. Many streams in WRIAs 44 and 50 loose water to the underlying aquifer as they enter the Columbia River basin (PGG, 2003). Low summer streamflows are often below the surface of alluvial fans near the Columbia River, leaving dry streambeds (PGG, 2003).

The watershed planning group estimated that the majority, 85%, of the water used in the WRIA for irrigation and domestic use occurs along the Columbia River, and thus comes from water outside the WRIA.

Groundwater

WRIAs 44 and 50 are underlain by the aquifers of the Columbia Basin regional aquifer system, including both the Grand Ronde Basalt and the Wanapum Basalt. In many areas, including surrounding the Columbia River mainstem, there are also shallow unconsolidated deposits. Generally, water flows easily between the Columbia River and the surrounding alluvium. Based on this, it is likely that most of the groundwater pumped from the alluvial aquifer and within a short distance of the Columbia River originates from the Columbia.

Current Out-Of-Stream Water Demand

Almost half the land within the two WRIAs is used for non-irrigated cropping (primarily wheat), and another quarter is used as rangeland (Pacific Groundwater Group, 2003). Only 5% of the land in the WRIA is used for irrigated agriculture, mostly for hard and soft fruit and forage crops (PGG, 2003). These irrigated lands are mostly located along the Columbia River mainstem, adjacent upland areas, and in Moses Coulee Basin.

These WRIAs have little population, and domestic demand is primarily concentrated near the Columbia River. The watershed planning unit notes some conversion of irrigated agricultural lands to residential or commercial/industrial use, because of low crop values and the proximity to Wenatchee. There is “high demand” for additional rights from the Columbia River, and “some demand” for additional water rights inside WRIAs 44 and 50, though the planning group says this demand is likely to increase in the future (Foster Creek Conservation District, 2004).

Current Instream Water Demand

Chinook salmon spawn and rear in the Columbia River and larger tributaries, while steelhead and Coho are found in both the mainstem and in smaller tributaries (PGG, 2003). Anadromous fish use has been confirmed as recently as 2001 for two creeks in WRIAs 44 and 50 (Foster Creek and Rock Island Creek) (PGG, 2003). In general, topography and landforms limit potential available fish habitat for spawning and rearing in the two WRIAs (PGG, 2003). The high plateau of the Columbia Basin breaks off sharply near the canyon walls of the Columbia, creating very steep cascading stream reaches through inter-gorge canyons, and extensive alluvial floodplains at the mouths of streams as the channel gradient flattens near the Columbia River.

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Instream Flows

Flow recommendations were submitted for 2 locations with the final WRIA 44/50 watershed plan in 2004 (Table G-3). According to the Ecology website, the group was planning to consider another 3 instream flow recommendations (Department of Ecology, 2012).

Table G-3. Recommended instream flows for WRIA 44/50 (Foster Creek Conservation District, 2004).

	Foster Creek	Douglas Creek
	Bridgeport irrigation diversion dam RM 1/03	RM 1.3 USGS Gage station No. 4635
January	5.0	13.0
February	5.0	15.0
March	5.3	15.0
April	9.5	13.3
May	6.3	13.0
June	4.2	13.0
July	2.8	12.0
August	1.3	12.0
September	1.5	12.0
October	2.7	12.0
November	3.9	13.0
December	5.0	13.0

References

Department of Ecology. 2012. Watershed management: Moses Coulee/Foster Creek, WRIAs 44/50. Accessed February 9, 2012. http://www.ecy.wa.gov/programs/eap/WRIAs/Planning/44-50.html.

Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Foster Creek Conservation District. 2004. Watershed management plan, Moses Coulee and Foster Creek Watersheds WRIA 44 & 50. Prepared for Foster Creek Conservation District. Waterville, WA, Foster Creek Conservation District.

Pacific Groundwater Group. 2003. With Montgomery Water Group, Inc., and R2 Resource Consultants. WRIA 44/50 Final Phase 2 Basin Assessment. Prepared for Foster Creek Conservation District. Waterville, WA, Foster Creek Conservation District.

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WENATCHEE BASIN, WRIA 45

Background

The Wenatchee Watershed (WRIA 45) encompasses about 1,370 square miles, most of which drain into the Wenatchee River, though some areas drain directly into the Columbia River. The watershed includes Cashmere, Leavenworth and Wenatchee, agricultural land primarily in fruit production, and private and public timber lands (WRIA 45 Planning Unit, 2006). Federal and State lands comprise over 80% of the land in the WRIA (WRIA 45 Planning Unit, 2006).

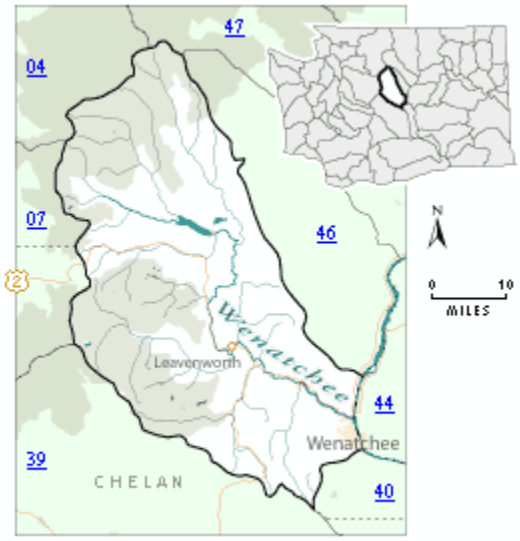

Figure G-19. Map of Wenatchee Basin (WRIA 45)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Though there is no tribal land in WRIA 45, the Yakama Nation has reserved rights to fish and hunt over the entire watershed (WRIA 45 Planning Unit, 2006).

Current Water Supply

Surface Water

Most of the precipitation in WRIA 45 falls in the winter as snow. Annual precipitation varies widely, from over 150 inches at the Cascade Crest to 8 inches in Wenatchee (WRIA 45 Planning Unit, 2006). As snowpack melts in the spring and early summer, it provides most of the peak streamflow. Groundwater (replenished by snowmelt) provides a relatively low base flow the rest of the year as it slowly discharges to streams and rivers.

The lack of dams in WRIA 45 means that it is difficult to redistribute water supplies from times when there is more water (late winter/spring) to times when there is little water (summer/early fall).

Groundwater

There is no continuous regional aquifer that characterizes the entire Wenatchee watershed, and the amount of groundwater available in WRIA 45 has not yet been comprehensively estimated (Golder, 2005a, as cited in WRIA 45 Planning Unit, 2006). Aquifers in many of the smaller drainages are in direct connection with the surface water, in which case the surface water supply and groundwater generally respond together (Montgomery Wafer Group et al., 1995).

Current Out-Of-Stream Water Demand

The largest water demand occurs in the lower, drier watershed near Wenatchee (WRIA 45 Planning Unit, 2006), is highest during the period when streamflows are lowest (July-Oct), and is driven by needs for fruit production, fire protection, increased tourism needs, domestic use, and aquatic habitat. Irrigated agriculture, mostly tree fruit, is an important part of the local economy, generating approximately $100 million in gross sales annually (WRIA 45 Planning Unit, 2006). Irrigation systems provide most water to meet agricultural needs.

Municipal and domestic use in the WRIA consists of both year-round and seasonal (summer) use. The Lake Wenatchee, Upper Wenatchee, Nason, and Chiwawa Sub-watershed have all been estimated to have part-time populations double that of full time populations (WRIA 45 Planning Unit, 2006, p. 12).

Current Instream Water Demand

Demands for instream water are important in WRIA 45. Although there are no hydroelectric dams in WRIA 45, core populations of sockeye salmon, steelhead, bull trout, and both spring and summer Chinook salmon in the upper Wenatchee are relatively strong compared to other populations in the Columbia Sub-basin, despite human-caused reductions in habitat quantity and quality (Andonaegui, 2001). WRIA 45 salmonid habitat is thus important to the entire Columbia River region (WRIA 45 Planning Unit, 2006). The Yakima Nation has a special interest in fish populations, as their treaty fishing rights in WRIA 45 include the right to have water in streams to ensure that fish survive (WRIA 45 Planning Unit, 2006). Three species of fish have been federally listed in Wenatchee River watershed (WRIA 45 Planning Unit, 2006):

- The Upper Columbia River population of Chinook salmon (*Oncorhynchus tshawytscha*) is listed as endangered.
- The Upper Columbia River population of steelhead trout (*Oncorhynchus mykiss*) is listed as endangered.
- The Upper Columbia River population of bull trout (*Salvelinus confluentus*) is listed as threatened.

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Instream Flows

WRIA 45 has a significant management aimed at ensuring instream flows are met. Instream flows were specified in 1983 at five points: Wenatchee River at Plain, Icicle Creek near Leavenworth, Wenatchee River at Peshastin, Mission Creek near Cashmere, and Wenatchee River at Monitor (Department of Ecology, 2007). In addition, Peshastin Creek was closed from 1983 until 2008 to further appropriation between June 15th and October 15th. Roughly 46 permits and certificates (mostly issued between 1983 and 1995) are conditioned to instream flows that were set in 1983 (Department of Ecology, 2007).

In addition, if a cumulative negative effect on instream flows is determined to exist from single domestic water users, all uses of water outside the house could be limited for these users; such a move would potentially impact all those who have constructed wells since the instream flows were established, an estimated 80-90 households per year (Department of Ecology, 2007).[1] Actual streamflow in the Wenatchee River at Monitor and Plain and on Mission Creek were less than instream flows established by the 1983 rule approximately half the time during low flow months (WRIA 45 Planning Unit, 2006). Over the 23 years between 1983-2005, the Washington State Department of Ecology regulated junior water right holders nine times (Department of Ecology, 2007).

In December 2007, a rule change was adopted to revise instream flow levels for existing monitoring points, set instream flow requirements for two new points (Chiwawa River near Plain, Nason Creek near the mouth, and Peshastin Creek at Green Bridge Road), and set maximum allocations above the instream flows for the Wenatchee River and its tributaries (Table G-4). (Department of Ecology, 2007). In addition, 4 cfs were reserved for uninterruptible water rights to serve domestic, municipal and stock water uses over 20 years of planned growth, and the Chumstick and Mission Creek sub-basins were closed temporarily to complete studies prior to allocating new water. Lastly, the seasonal closure which had been in effect in Peshastin Creek was replaced with a combination of instream flows and maximum allocation limits (Department of Ecology, 2007). These actions were taken to incorporate changing needs due to aquatic resources protection and out-of-stream water use (WRIA 45 Planning Unit, 2006). The full text of the current instream resources protection program for WRIA 45 is available in Chapter 173-545 of the Washington Administrative Code (WAC).

[1] Estimated for the 1995-2006 period.

Table G-4. Current instream flows for WRIA 45 (WAC, 2007).

		Wenatchee R. at Plain	Icicle Cr. near Leavenworth	Wenatchee R. at Peshastin	Nason Cr. near Mouth	Wenatchee R. at Monitor	Peshastin Cr. at Green Bridge Rd.	Chumstick Cr. at North Road
		Control Station No. 12-4570.00	Control Station No. 12-4585.00	Control Station No. 12-4590.00	Control Station No. ECY 45J070	Control Station No. 12-4625.00	Control Station No. ECY 45F070	Control Station No. TBD
January	1	550	267	1933	120	1867	53	TBD
	15	550	267	1933	120	1867	53	
February	1	550	267	1933	120	1867	53	TBD
	15	550	566	2800	160	2400	120	
March	1	550	518	2800	160	2400	120	TBD
	15	700	518	2800	160	2400	120	
April	1	910	650	2800	160	2400	120	TBD
	15	1150	650	2800	160	2400	120	
May	1	1500	650	2800	160	2400	120	TBD
	15	2000	650	2800	160	2400	120	
June	1	2500	650	2800	160	2400	120	TBD
	15	2000	550	1933	210	1600	110	
July	1	1500	550	1933	210	1600	110	TBD
	15	1200	550	1933	210	1600	110	
August	1	880	400	1933	180	1600	80	TBD
	15	700	343	1400	180	900	80	
September	1	660	275	1311	165	900	80	TBD
	15	620	275	1311	165	1338	80	
October	1	580	267	1932	120	1723	53	TBD
	15	520	267	2672	120	2427	53	
November	1	550	267	2900	120	2800	53	TBD
	15	550	267	2900	120	2800	53	
December	1	550	267	1933	120	1867	53	TBD
	15	550	267	1933	120	1867	53	

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ENTIAT BASIN, WRIA 46

Background

The Entiat Watershed (WRIA 46) comprises about 478 square miles that include the Entiat and Mad River watersheds, as well as some minor Columbia River tributaries. The watershed includes the City of Entiat, agriculture (primarily tree fruit production), livestock production and grazing, timber harvest, residential housing and recreation (Chelan County Conservation District, 2004). Over 90% of the land in the Entiat WRIA is publically owned, largely by the U.S. Forest Service. The remaining privately owned land is located within one mile of the mainstem of the Entiat River (CCCD, 2004).

Figure G-20. Map of Entiat Basin (WRIA 46). (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The Yakama Nation, under the 1855 Treaty with the Yakima, maintains hunting and gathering rights in the WRIA (CCCD, 2004).

Current Water Supply

Surface Water

Annual precipitation varies widely from 90 inches per year near the Cascade crest to less than 10 inches per year near the Columbia River. Most precipitation falls as snow in the upper portions of the watershed, with 75% falling between October and March. Cumulative snow depths range from less than 24 to almost 400 inches. Surface flows in the Entiat River are determined by a combination of snowmelt/precipitation and groundwater discharge, as the river is underlain by a shallow alluvial aquifer. This unconfined aquifer is highly connected to the river. Snowmelt results in high stream flows in late spring and early summer and low flows in late summer, fall, and throughout winter.

Groundwater

Aquifer storage is derived primarily from precipitation and potentially from irrigation return flows, but is largely dependent on surface water exchange with the Entiat River. The amount of water stored by the aquifer is cyclical, with the most water being stored just after peak snowmelt, and the least in the late winter just prior to the onset of snowmelt.

Current Out-Of-Stream Water Demand

Irrigated agriculture is an important part of the local economy, with water for irrigation used April through October and peaking in July. Tree fruit is the most important in terms of water use (and economic impacts), with pasture and turf also demanding significant amounts of water (CCCD, 2004). Orchards in the watershed are generally operated by local residents who depend on orchard profits as their primary source of income (CCCD, 2004). A recent study estimates 1427 acres of irrigated orchards lie within the watershed, mostly along the mainstem of the Entiat River Of this total, an estimated 537 acres are irrigated from areas in hydraulic continuity with the Columbia River (CCCD, 2004).

High density development due to population growth and vacation home construction is an ongoing concern in this WRIA because of possible impacts to water quality.

Current Instream Water Demand

The Rocky Reach Dam (hydroelectric) which spans the Columbia River creates Lake Entiat bordering WRIA 46 on the southeastern edge. Otherwise, the WRIA does not have significant demand from hydroelectric dams.

Instream demands are also important in this watershed, with important anadromous fish stocks including Chinook and steelhead (CCCD, 2004).

Instream Flows

In 2003, the EWPU developed legal minimum instream flows for WRIA at three locations: the Upper Entiat River, the Lower Entiat River, and the Mad River (Chelan County Conservation District, 2004). The legal minimum instream flows included a reserve of 5 cfs, negotiated based on the Planning Unit's estimated future water demands and evaluation of the potential impact of additional withdrawals on aquatic resources and existing beneficial uses (CCCD, 2004).

These original WRIA 46 instream flows were filed on August 3, 2005 and effective on September 3, 2005 (Chapter 173-546-040). There are currently no water rights conditioned to these instream flows (Table G-5). The flows were based on instream flow recommendations of the Entiat watershed planning unit, a group composed of a broad base of water use interests, and also by Chelan County officials. Water rights established after the priority date of the instream flows, and not covered under the reservation, are expressly subject to these instream flows.

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Table G-5. Current instream flows for WRIA 46 (WAC, 2005).

		USGS Gauge #12452990	USGS Gauge #12452800	USGS Gauge #12452890
		Lower Entiat, nr. Entiat, RM 1.4	Upper Entiat, nr. Ardenvoir, RM 18	Mad River at Ardenvoir, RM 0.35
January	1-30	185	175	32
February	1-29	185	175	32
March	1-15	185	175	32
	16-31	250	285	68
April	1-15	250	325	100
	16-30	350	375	100
May	1-15	474	375	100
	16-31	720	375	100
June	1-15	898	325	100
	16-30	617	325	100
July	1-15	359	275	68
	16-31	268	275	68
August	1-15	185	275	68
	16-31	185	275	51
September	1-30	185	175	32
October	1-31	185	175	32
November	1-30	185	175	32
December	1-31	185	175	32

The EWPU also developed three biologically-based (non-regulatory) flow regimes, or "Planning Unit" flows, for subbasin monitoring and management manage of conservation efforts for Chinook and steelhead at these three locations. These flows are detailed in the watershed plan (CCCD, 2004).

Actual flows in the late summer tend to be higher than the minimum instream flows specified by law, so that water use is generally not interrupted (CCCD, 2004).

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LAKE CHELAN, WRIA 47

Background

WRIA 47 occupies 1,044 square miles, most of which is made up of Lake Chelan and its tributary sub-basins, with a small amount of land (10%) that drains directly to the Columbia River (RH2, 2009). Most of the land in the watershed is under Federal management, primarily by the Forest Service and National Park Service. Almost three quarters of the basin's area is above an elevation of 3,000 feet, with glacially carved valleys surrounded by high ridges and steep cliffs (RH2, 2009). Chelan is the largest community, with other smaller communities mainly concentrated near the shores of Lake Chelan.

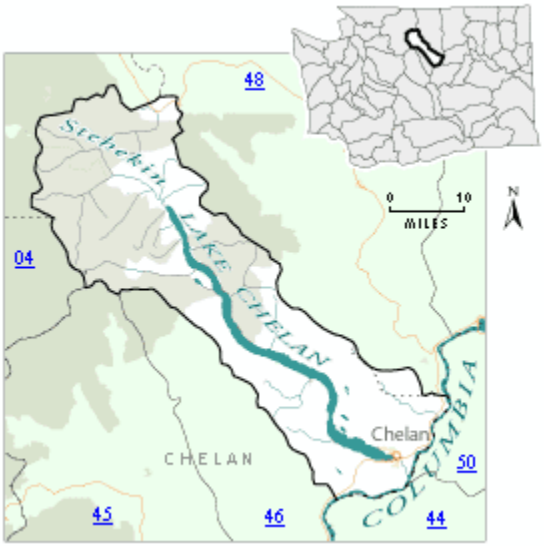

Figure G-21. Map of Lake Chelan (WRIA 47) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Current Water Supply

Surface Water

Except for limited pumping from the Columbia River to nearby areas, precipitation provides most of the total water input to WRIA 47. The climate is moist to semi-arid, with higher rainfall near the crest of the Cascade mountains reaching 150 inches, while only 11 inches falls in the City of Chelan (Beck, 1991, as cited by RH2, 2009). As in other watersheds in this portion of the Basin, most precipitation falls as snow above 3,000 feet from October through April (RH2, 2009). Melting snow provides peak runoff for most tributary streams to Lake Chelan from May to July, with low flows from September through February (RH2, 2009).

Lake Chelan is a dominating feature of surface water resources in WRIA 47, with a total gross storage capacity of 15.8 million acre feet (MAF) and a useable storage capacity of 677,400 AF

between elevations 1,079 and 1,100 above mean sea level (amsl) (RH2, 2009). The reservoir receives water from the Stehekin River, Railroad Creek, and other small tributaries, and water flows to the Columbia River from Lake Chelan via the Chelan Falls Power Plant or the Chelan River. The reservoir serves various needs, including power, recreation, irrigation, potable water supply, historic and cultural preservation, fisheries, wildlife, and habitat (RH2, 2009). Lake levels and flows are managed by the Chelan County PUD under the conditions of its Federal Energy Regulatory Committee (FERC) license.

Groundwater

Glacial flood groundwater units provide the most significant source of groundwater to the watershed, providing domestic, irrigation, and municipal water (RH2, 2009). Some of these units (including those that provide water to wells for the Chelan Falls Water System, Chelan PUD), and some private irrigation wells, are in hydraulic continuity with the Columbia River (RH2, 2009). Surficial aquifers also provide groundwater in some areas of WRIA 47. Relatively minor quantities of groundwater are also found within bedrock units (RH2, 2009).

Current Out-Of-Stream Water Demand

Municipal uses include significant seasonal residential use, as well as year-round uses (RH2, 2009). Growth for commercial and industrial rights is forecast at the same pace as residential growth. Population growth is estimated to be 30% from 2008 to 2025, with water to meet this coming from municipal supplies derived from Lake Chelan storage and private domestic wells (under inchoate rights or current water rights applications) (RH2, 2009).

Irrigated agriculture in the district includes apples and cherries, which are expanding in the district, as well as wine grapes, which are becoming more prevalent (RH2, 2009). Some irrigated lands within WRIA 47 are being converted to development, which may free up some water for other uses. The watershed plan forecasts that an additional 2,000 acres of irrigable lands is estimated to be outside the irrigation district boundary, and would require 5,000 AF or irrigation supply, likely either from Lake Chelan or from the Columbia River (RH2, 2009, p 49).

Current Instream Water Demand

Power generation is a very important land use in WRIA 47. Recreation is also important, with significant seasonal use of the Lake Chelan and the surrounding areas.

Instream Flows

Chelan does not have instream flows codified in Washington Administrative Code. The WRIA 47 Planning Unit chose not to pursue instream flow elements of watershed planning because they considered these issues essentially completed during previous efforts (RH2, 2009). As of late

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2009, Ecology did not have immediate plans to pursue instream flow rule-making in this watershed (Department of Ecology, 2010).

References

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METHOW, WRIA 48

Background

The Methow basin drains 1,805 square miles, extending from the crest of the Cascade Mountains (9000 feet above sea level), to the confluence with the Columbia River (775 feet above sea level). Approximately 14% of the land within the WRIA is privately owned, with the rest being federal or state land. Seventy five percent of the Basin is forested (Ely, 2003). Most of the population is concentrated in the Methow River valley between the towns of Mazama and Pateros (where the Methow River enters the Columbia River). Twisp and Winthrop are the largest towns.

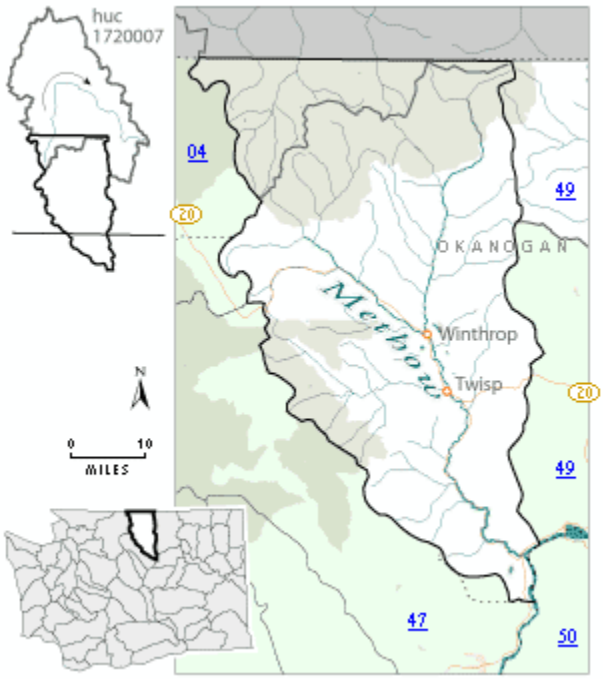

Figure G-22. Map of Methow River basin (WRIA 48)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Current Water Supply

Surface Water

The Methow River drainages have wide variations in temperature and precipitation, ranging in precipitation from 180 inches annually at the highest mountains, to only 8 in valley bottoms (Methow Watershed Planning Unit, 2005). Most snow (and thus spring runoff from snowmelt) originates near the Cascade Crest (Ely 2003). Flows are altered from historical flows, in that streamflow is augmented from inflow from groundwater that has been artificially enhanced by seepage from unlined irrigation canals and irrigation practices (Ely, 2003). Meanwhile, it has

been suggested that other human alterations to the basin (including road and dike construction, conversion of riparian habitat to agriculture and residential development, and water diversions) exacerbate limiting conditions that occur during low flow periods (Washington Conservation Commission, 2000, as cited by Ely, 2003).

Management practices on the 86% of land that is owned at the federal or state level also has a significant potential impact on surface water flows (Methow Watershed Planning Unit, 2005).

Groundwater

Aquifer units cover more than 45 square miles of the basin (Ely, 2003). The Methow and Twisp Rivers are major sources of recharge to the aquifer, particularly during high-flow periods. As noted above, unlined irrigation canals have provided groundwater recharge above the levels that were seen prior to their development.

Current Out-Of-Stream Water Demand

Currently, about 17,000 acres of agricultural land are under irrigation (compared to 20,240 acres between 1940 and 1968). Most of this land (77%) is planted to alfalfa (Methow Watershed Planning Unit, 2005). The remaining acreage is a mix of small orchards, and pasture or turf. Irrigation canals used for agricultural irrigation range from unlined to completely constructed of pipe (Ely, 2003).

Many of the residences in the Methow Basin are seasonal.

Current Instream Water Demand

Three species of fish in the Methow River Basin have been listed under the Endangered Species Act: Upper Columbia River steelhead, including the Methow River Run (listed as endangered); bull trout in the Methow River (listed as threatened); and Upper Columbia River spring-run Chinook salmon, including the Methow River Run (listed as endangered) (Ely, 2003). During the 1950s, roughly 60% of Spring Chinook Salmon were of Methow origin (Methow Watershed Planning Unit, 2005). The WRIA is still important to salmonid population health; the reach of the Methow between Weeman Bridge and Winthrop (fed by an upwelling of groundwater) consistently produces the highest density of Chinook salmon redds in the basin (Methow Planning Unit, 2005).

Instream Flows

Instream flows were adopted for the Methow River in December 1976 (Table G-6). The rule established a reservation of 2 cfs of water in each of seven stream management reaches, for future single domestic and stock water uses. Recent work by the Methow Watershed Planning Unit has estimated quantities of water currently remaining in the reservation for each reach, accounting for existing developed residential parcels subject to the rule. It has also estimated

quantities of water that would be utilized in each reach under two future development scenarios (Aspect Consulting, 2011).

Table G-6. Current instream flows for WRIA 48.

		Lower Methow	Middle Methow	Upper Methow	Methow Headwaters	Early Winters Creek	Chewack River	Twisp River
		Methow R. nr. Pateros, affecting Methow River confluence with Wells Pool to confluence with Twisp River	Methow R. nr. Twisp, affecting Methow River from confluence with Twisp River to confluence with Chewack River	Methow R. nr. Winthrop, affecting Methow River from confluence with Chewack River to confluence with Little Boulder Creek and including Little Boulder Creek.	Methow R. at Little Boulder Cr, affecting Methow River from confluence with Little Boulder Creek to headwaters.	Early Winters Cr. near Mazama, affecting Early Winters Creek from confluence with Methow River to headwaters.	Chewack R. nr. Boulder Creek, affecting Chewack River confluence with Methow River to headwaters.	Twisp R. nr. Twisp, affecting Twisp River from confluence with Methow River to headwaters.
January	1	350	260	120	42	10	56	34
	15	350	260	120	42	10	56	34
February	1	350	260	120	42	10	56	34
	15	350	260	120	42	10	56	34
March	1	350	260	120	42	10	56	34
	15	350	260	120	42	10	56	34
April	1	590	430	199	64	14	90	60
	15	860	650	300	90	23	140	100
May	1	1300	1000	480	130	32	215	170
	15	1940	1500	690	430	108	290	300
June	1	2220	1500	790	1160	290	320	440
	15	2220	1500	790	1160	290	320	440
July	1	2150	1500	694	500	125	292	390
	15	800	500	240	180	45	110	130
August	1	480	325	153	75	20	70	58
	15	300	220	100	32	8	47	27
September	1	300	220	100	32	8	47	27
	15	300	220	100	32	8	47	27
October	1	360	260	122	45	11	56	35
	15	425	320	150	60	15	68	45
November	1	425	320	150	60	15	68	45
	15	425	320	150	60	15	68	45
December	1	390	290	135	51	12	62	39
	15	350	260	120	42	10	56	34

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There have not yet been amendments to the original WRIA 48 instream flows. However, the Methow Watershed council planning group and the Department of Ecology have agreed to revisit the rule, after the gaining new information and clarifying specific proposed rule changes (Department of Ecology, 2012).

To protect habitat for naturally producing salmonid populations, the National Marine Fisheries Service (NMFS) set minimum instream flow requirements for three tributaries to the Methow River, the Chewuch River, Early Winters Creek, and Wolf Creek (Ely, 2003). The Chewuch River has flow requirements that vary for each 15-day period between April 1 and October 16. The minimum instream flow for Early Winters Creek is 35 cfs. Wonf Creek has a minimum of 8 cfs (National Marine Fisheries Service, as cited by Ely, 2003). When flows in these streams decrease to the minimums set by the NMFS, selected irrigation canals are shut down (Ely, 2003).

References

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OKANOGAN, WRIA 49

Background

The Okanogan Basin covers about 6,300 square miles within British Columbia and 2,600 square miles in the State of Washington (Ecology, 1995). On the Canadian side of the border, the Okanogan is one of British Columbia's most densely populated and most quickly growing regions (Entrix, 2006). Meanwhile, on the U.S. side of the border, Okanogan County has only 38,000 residents. Osoyoos Lake is an international water body located on the Okanogan River, with its upper portion in Canada, and lower portion (including the structure that controls lake outflow) in the United States.

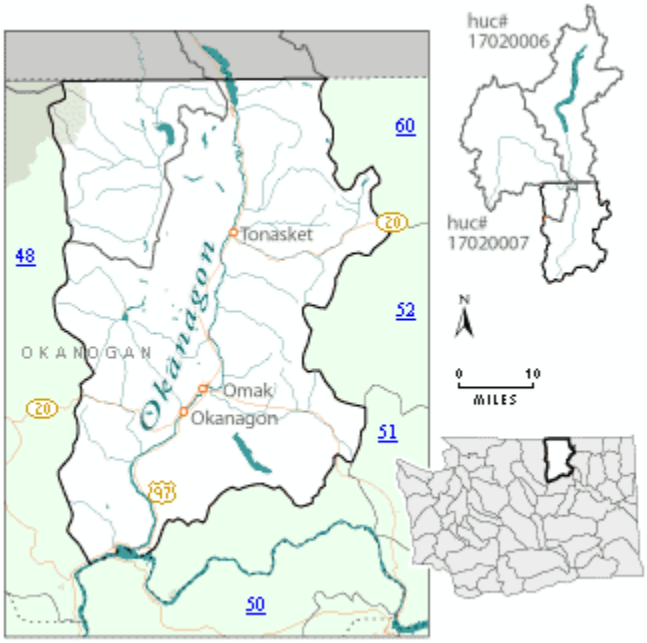

Figure G-23. Map of Okanogan (WRIA 49) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

On the U.S. side, approximately 47% of the basin is covered by forest lands (Okanogan Watershed Planning Unit, 2009).

Some of the land in the basin (in the southeast) is part of the reservation of the Colville Confederated Tribes. The rest of the watershed was historically part of reservations, with the western half of the watershed forming part of the Moses Reservation, and the northeast part of the watershed forming part of the second Columbia (Colville) Reservation (Department of Ecology, 2011).

Current Water Supply

Surface Water

The Okanogan River has its headwaters in British Columbia, and flows through three lakes (Okanogan, Skaha, and Vaseaux) before entering the U.S. at Lake Osoyoos, created by a dam of the Okanogan River at the U.S.-Canada border. Lake Osoyoos is a major water feature of the Washington State portion of the Basin. The Similkameen River, a major tributary that enters the Okanogan River below the dam, is a second major feature, with a flow that is on average more than 4.4 times the flow of the Okanogan (Entrix, 2006). The Similkameen thus provides a majority of watershed level water supply.

The Okanogan River Valley is semiarid in the lower valleys, and sub-humid in the mountains. Mean annual precipitation ranges from 11 inches per year at lower elevations, to approximately 30 inches at higher elevations, and more than 60 inches in the upper elevations of the Pasayte and Ashnola sub-watersheds (Entrix, 2006; Okanogan Watershed Planning Unit, 2009). At higher elevations, up to 40 inches of snow can accumulate by spring. In general, peak discharges in WRIA 49 occur during April through July, when streams contribute about 70 to 80 percent of their average annual discharge (Entrix, 2006). These peak flows result primarily from rain on snow events and snowmelt. Low flows occur from August to October, reflecting both low summer rainfalls, and depleted groundwater storage (Entrix, 2006).

Groundwater

Groundwater, stored mostly in unconsolidated sediments of stream valleys, contribute to streamflow and provide the primary water storage in WRIA 49 (Entrix, 2006). Groundwater is recharged from rainfall and snowmelt, as well as by irrigation infiltration in some locations of the watershed, especially Pogue Flats and the Duckwater Groundwater Basin (Entrix, 2006).

Current Out-Of-Stream Water Demand

Assessments carried out on behalf of the Okanogan Watershed Planning Unit suggest that several sub-basins in WRIA 49 may be over-appropriated in both surface and groundwater (Entrix, 2006).

The Okanogan Watershed Planning Unit has noted (2006) that many towns face annual water needs that exceed their current annual water rights. Brewster has already fully used its existing water right of 1,205 AF per year, and Oroville, Riverside, Okanogan, and Tonasket are all projected to need additional annual water rights by 2026. The City of Oroville has applied for additional water rights (which have not yet been acted upon by Ecology), and due to annexation and growth, is also concerned about not being able to meet new demands for water from within its existing water rights.

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Agricultural lands in the Okanogan are used for row crops, field crops, orchards, hay/pasture, and summer fallow (Okanogan Watershed Planning Unit, 2006). Of these, irrigated crops include irrigated hayland (mostly alfalfa), irrigated corn grown for silage, Sudan grass and triticale, and row crops (Okanogan Watershed Planning Unit, 2006). Agricultural water supply issues are not foreseen for the future, as it appears that farmland is being converted from production to other uses, reducing the overall future water demand (Entrix, 2006).

Current Instream Water Demand

No information on current instream water demands was found in watershed planning documents.

Instream Flows

Lake Osoyoos and Zosel Dam (the dam at its outlet) are regulated by the International Joint Commission (established under the 1909 boundary Waters Treaty to prevent and resolve disputes between the United States of America and Canada). Minimum instream flow targets on the U.S. side of the U.S. – Canada border have not been met for some years (Plan of Study for the Renewal of the International Joint Commission Osoyoos Lake, January 29, 2006, as cited by Entrix, 2006). Drought is frequently declared for this region, 12 times in the 24 years from 1986-2010 (Omak Chronicle, 2010).

State level instream flows were set on the mainstem Okanogan River in 1976 (Chapter 173-549 WAC) (Table G-7). There have not yet been amendments to these flows. There is a set of existing, active water rights conditioned to these flows.

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Table G-7. Current instream flows for WRIA 49.

		Okanogan River at Malott	Okanogan River near Tonasket	Upper Okanogan R. at Oroville	Similkameen River at Nighthawk
January	1	860	800	320	400
	15	830	800	320	400
February	1	820	800	320	400
	15	850	800	320	400
March	1	880	800	320	425
	15	900	800	320	450
April	1	925	910	330	510
	15	1100	1070	340	640
May	1	1750	1200	350	1100
	15	3800	3800	500	3400
June	1	3800	3800	500	3400
	15	3800	3800	500	3400
July	1	2100	2150	420	1900
	15	1200	1200	350	1070
August	1	800	840	320	690
	15	600	600	300	440
September	1	620	600	300	400
	15	700	600	300	400
October	1	750	730	330	450
	15	960	900	370	500
November	1	950	900	370	500
	15	950	900	320	500
December	1	930	900	320	500
	15	900	850	320	450

As part of the watershed planning process in WRIA 49, an instream flow focusing on the groundwater and surface water interchange in four main tributaries to the Okanogan River was completed (Okanogan Watershed Planning Unit, 2009).

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NESPELEM, WRIA 51

Background

Most of Nespelem watershed is within Okanogan County, though some eastern portions extend into Ferry County. The watershed is entirely within the reservation of the Colville Confederated Tribes (Department of Ecology, 2011b). Associated federally reserved rights are not yet quantified and so the legal availability of water in this watershed is undetermined (Department of Ecology, 2011a).

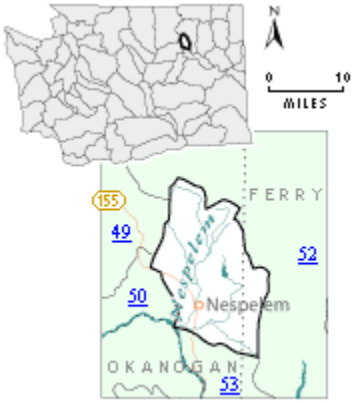

Figure G-24. Map of Nespelem (WRIA 41) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Nespelem is not working under the watershed planning process, and there are an extremely limited number of documents available from the Department of Ecology on this watershed.

Current Water Supply

Surface Water

The location of Nespelem watershed within eastern Washington suggests that this watershed generally receives less than 20 inches of rain per year, with most of this falling during the winter (Department of Ecology, 2011a).

Groundwater

No information on groundwater resources in this watershed was found.

Current Out-Of-Stream Water Demand

Agricultural activity in this watershed includes irrigated alfalfa hay, a few orchards, horse pastures, and livestock rangeland grazing for cow-calf production (Patrice Beckwith, personal communication).

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No information on municipal or domestic water demands in this watershed was found.

Current Instream Water Demand

No information on instream water demands in this watershed were found.

Instream Flows

There are no proposed instream flows for WRIA 51. As of 2010, Ecology have immediate plans to propose instream flows in the near future (Department of Ecology, 2010).

References

Department of Ecology. 2010. 2009 Report to the Legislature: Watershed plan implementation statutory changes, progress report on setting instream flows, and reclaimed water in adopted plans. Olympia, WA. Department of Ecology Publication No. 09-11-033. 30 pp.

Department of Ecology. 2011a. Focus on water availability: Nespelem Watershed, WRIA 51. August. Publication No. 11-11-055. Spokane, WA. Department of Ecology.

Department of Ecology. 2011b. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

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SANPOIL, WRIA 52

Background

Sanpoil watershed includes the Sanpoil River and its numerous tributary creeks and streams, except for Curlew Creek, which is outside the watershed (though it drains to the Sanpoil). Much of Sanpoil watershed is in Ferry County, while the northwest portion of the watershed is in Okanogan County.

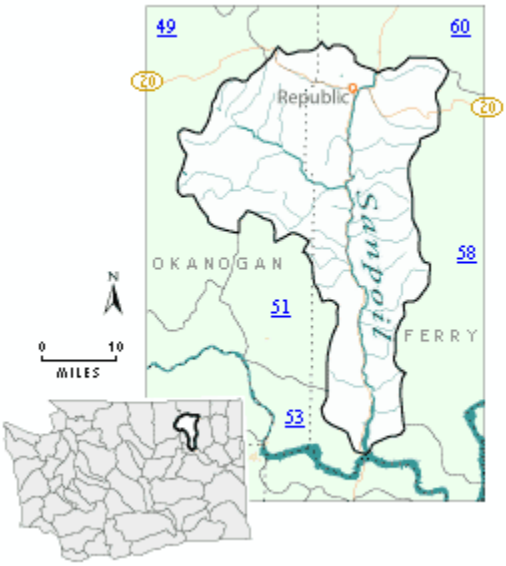

Figure G-25. Map of Sanpoil (WRIA 52)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The southern part of the watershed is within the reservation of the Colville Confederated Tribes, while the northern portion is within the area of that was the Second Columbia (Colville) Reservation (Department of Ecology, 2011b).

Sanpoil is not working under the watershed planning process, and there are very few documents available on this watershed. Most of these available documents address water quality issues and were not relevant to the forecasting effort.

Current Water Supply

Surface Water

Annual precipitation ranges from 11 inches per year near the Sanpoil's confluence with the Columbia River, to 30 inches in the higher elevation areas (Department of Ecology, 2011a). Most of the precipitation occurs during the winter months.

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Groundwater
Availability and yield of groundwater from bedrock in this WRIA is generally very limited, based on climate and geology (Department of Ecology, 2011a).

Current Out-Of-Stream Water Demand

Sanpoil watershed has limited irrigated agricultural land, though there is some irrigated alfalfa in the Swawila basin (Patrice Beckwith, personal communication). Some older irrigation systems are not in use. Agricultural production mainly includes dryland alfalfa grass, horse pastures, and livestock rangeland grazing for cow-calf production (Patrice Beckwith, personal communication).

No information on municipal or domestic water demands in this watershed was found.

Current Instream Water Demand

No information on instream water demands in this watershed was found.

Instream Flows

There are no proposed instream flows for WRIA 52. As of 2010, Ecology did not plan to propose instream flows in the near future (Department of Ecology, 2010).

Most surface water sources (and groundwater connected to these surface waters) in the watershed are limited through administrative restrictions known as Surface Water Source Limitations (SWSLs). Often, these restrictions require that new water uses stop during low flow periods (Department of Ecology, 2011a). In addition, Granite Creek and Long Lake are "closed" to new uses by SWSL (Department of Ecology, 2011).

References

Department of Ecology. 2010. 2009 Report to the Legislature: Watershed plan implementation statutory changes, progress report on setting instream flows, and reclaimed water in adopted plans. Olympia, WA: Department of Ecology Publication No. 09-11-033. 30 pp.

Department of Ecology. 2011a. Focus on water availability: Sanpoil Watershed, WRIA 52. August. Publication No. 11-11-056. Spokane, WA. Department of Ecology.

Department of Ecology. 2011b. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

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LOWER LAKE ROOSEVELT, WRIA 53

Background

The Lower Roosevelt WRIA covers approximately 510 square miles and extends mostly through northern Lincoln County, with small portions extending into northeastern Grant County, southern Ferry County, and southeastern Okanogan County. The watershed is bisected by the Columbia River, with most of the area north of the river (approximately 185.52 square miles) within the boundaries of the Colville Indian Reservation. Of the area south of the Columbia, most (84%) is privately owned.

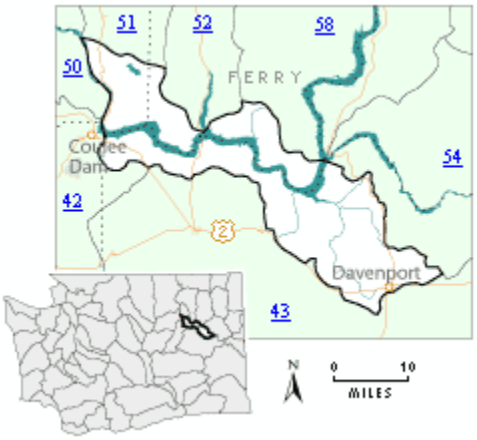

Figure G-26. Map of Lower Lake Roosevelt (WRIA 53) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Nearly half (44%) of the land is covered in shrub and grassland, while timber lands cover an additional quarter (28%) (St. Godard and Lindsey, 2009). Nine percent of the landscape is covered by water or wetlands, mostly associated with the Columbia River. Only 3% of the watershed is urban, and the watershed has one incorporated town, Davenport.

The area outside the Colville Confederated Tribes Reservation is part of the historical lands of the Coeur d'Alene, Southern Spokane, and other bands. This land was relinquished by Executive Order in 1873 (Department of Ecology, 2011).

Current Water Supply

Surface Water

The watershed is dominated by the Columbia River, which bisects the watershed in a westerly direction. Other surface water systems are fairly limited, and consist primarily of intermittent streams in canyons draining to the Columbia (St. Godard and Lindsey, 2009). There are also spring-fed streams, fed by groundwater discharge from the Columbia River Basalt Group (CRBG) aquifers (St. Godard and Lindsey, 2009).

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The climate is typical of northeast Washington, combining features typical of semi-arid climates and mountainous climates (St. Godard and Lindsey, 2009). Valleys are relatively drier, while and mountain ranges tend to capture available moisture as rain or snow. Average annual precipitation ranges from approximately 9 inches along the Columbia River to approximately 21 inches in the highlands of the Colville Indian Reservation (St. Godard and Lindsey, 2009).

Groundwater

Basalt flows of the Columbia River Basalt Group (CRBG) underlie most of the WRIA except the northern and eastern edges where pre-basalt basement rocks crop out at the surface (St. Godard and Lindsey, 2009). Potable groundwater in WRIA 53 is most commonly found in CRBG, but is also found in localized alluvial systems that have a high degree of hydrologic continuity with surface water, and a low yield system found within pre-basalt basement rocks (St. Godard and Lindsey, 2009).

Current Out-Of-Stream Water Demand

Agricultural use (both rangeland and farming) takes up approximately 74% of the land south of the Columbia River (St. Godard and Lindsey, 2009). However, the WRIA 53 watershed assessment carried out by St Godard and Lindsey (2009) estimated that only 2,000 acres of land south of the Columbia River were irrigable.

Population growth within the watershed has been slow, but Lincoln County expects some growth to occur in the future, primarily along the Columbia River (St. Godard and Lindsey, 2009).

Current Instream Water Demand

Grand Coulee Dam, at the lower end of Lake Roosevelt, is managed for power generation as well as flood control, irrigation, and other demands. There is no significant demand for hydropower generation outside of the mainstem Columbia River (St. Godard and Lindsey, 2009).

No information about instream demands for fish was found in watershed planning documents.

Instream Flows

The WRIA 53 watershed planning group is not addressing instream flows (St. Godard and Lindsey, 2009), and as of late 2009, Ecology (2010) did not have immediate plans to propose instream flows.

References

Department of Ecology. 2010. 2009 Report to the Legislature: Watershed plan implementation statutory changes, progress report on setting instream flows, and reclaimed water in adopted plans. Olympia, WA. Department of Ecology Publication No. 09-11-033. 30 pp.

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Department of Ecology. 2011. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

St Godard, G. and Lindsey, K. 2009. Water Resource Inventory Area 53, Lower Lake Roosevelt Watershed, Phase II, Level 1 hydrogeologic technical assessment. Prepared for the WRIA 53 Planning Unit.

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THE LOWER SPOKANE, WRIA 54

Background

WRIA 54, the Lower Spokane, extends along the Spokane River from the confluence with Hangman (Latah) Creek to the point where the Spokane empties into the Spokane arm of Lake Roosevelt. The Lower Spokane covers 883 square miles in three counties (Spokane, Stevens, and Lincoln), and includes the City of Airway Heights, parts of the Cities of Spokane and Medical Lake, and Fairchild Air Force Base.

Figure G-27. Map of the Lower Spokane (WRIA 54)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

WRIA 54 is part of the greater Spokane-Coeur d'Alene watershed, which includes parts of Idaho, as well as three other Washington WRIAs:

- Little Spokane River (WRIA 55, a major Spokane River tributary from the north)
- Hangman/Latah Creek (WRIA 56, a major Spokane River tributary from the south)
- Middle Spokane River (WRIA 57, from the Idaho border downstream to Latah Creek)

Approximately 25% of the land in the Lower Spokane is part of the Spokane Indian Reservation. Other areas of the WRIA were historically part of the Colville Indian Reservation, or were lands that were historically used by the Coeur d'Alene, Southern Spokane, or other bands, relinquished by Executive Order (Department of Ecology, 2011a).

Current Water Supply

Surface Water

Average rainfall in WRIA 54 is 16 inches per year, approximately half of which falls as snow, peaking between October and the end of March (NOAA, 2006 as cited in WRIA 54 Planning

Unit, 2009). Most of the tributaries to the Spokane River in WRIA 45 have only seasonal surface flow (WRIA 54 Planning Unit, 2009). Management of the Post Falls Dam, upriver on the Spokane in Idaho, largely determines the overall water supply on the Spokane in WRIA 54, particularly over four to six months when flows are most actively managed (Little Spokane River and Middle Spokane River Planning Unit, 2005). In addition, the lower 30 miles of the Spokane River are made more lake-like than river-like by the operations of the Grand Coulee Dam, outside WRIA 54.

Groundwater

Groundwater is an important element of water supply in WRIA 54. It provides water directly to some users, and also provides base streamflow during the dry summer months as groundwater infiltrates into stream beds. Groundwater resources vary significantly across WRIA 54, and exist in both unconsolidated sediments, and, in some areas, in basalt aquifers, portions of the Columbia River Plateau regional aquifer system. The largest aquifer, the Spokane Valley-Rathdrun Prairie (SVRP) Aquifer, extends from the southeastern corner of WRIA 54 into other WRIAs (principally WRIAs 55 and 57) and Idaho. Altogether, it supplies water to more than 500,000 people for residential, commercial, industrial, and agricultural uses (Department of Ecology, 2009a). A recent study by the USGS (2007) concluded that withdrawal of water from this aquifer directly and quickly affects river flows, but also found that relatively high amounts of water could be withdrawn without negatively impacting the water table.

There is some evidence suggesting that groundwater may be over-allocated in some portions of WRIA 54. In the West Plains area (over the Wanapum Basalt Aquifer), water level declines have been observed in some wells, suggesting water withdrawal rates are not sustainable.

Current Out-Of-Stream Water Demand

WRIA 54 supports an extensive agricultural industry that is the largest consumptive water user, particularly in the region south of the Spokane River. Water needs for irrigated agriculture peak in the summer, when precipitation levels are low. Municipal demands are also significant, with 90% of the WRIA 54 population living in the urban area in and around the City of Spokane.

Current Instream Water Demand

The portion of the Spokane in WRIA 54 includes Nine Mile, Long Lake, and Little Falls Dams, all of which are hydroelectric dams.

The river system of WRIA 54 provides habitat for a variety of fish, of which rainbow trout and mountain whitefish are particularly important for management purposes (WRIA 54 Planning Unit, 2009).

Instream Flows

There is currently no Washington State instream flow set for the Spokane River or any other tributaries in WRIA 54. However, there is likely to be in the future.

The WRIA 54 planning group has completed an instream flow study of selected reaches of the Spokane River and toe-width measurements on Deep, Coulee, Spring, and Little Chamokane creeks. A stakeholder work group was formed in collaboration with WRIA 55/57 to develop integrated instream flow recommendations for the main stem of the Spokane River. The work group did not achieve consensus on minimum instream flows for the main stem Spokane River. However, they did agree upon control points to manage surface water and the Spokane Valley/Rathdrum Prairie aquifer (Department of Ecology, 2011b).

The State Caucus recommendations for minimum instream flows were used as the foundation for conditions in the Section 401 water quality certification of the Avista hydroelectric dam relicense. Further work that needs to be completed to develop instream flow recommendations within WRIA 54 includes: added stream flow and fish habitat data on the tributaries, hydrogeological studies, water supply and demand and build-out analysis to develop recommendations for groundwater management, and evaluation of a reservation for domestic exempt wells. The planning group and the State Caucus are considering management options for the lower river, which is more lake-like due to the three hydroelectric dams. (Department of Ecology, 2011b)

Chamokane Creek, in WRIA 54, has an established instream flow rule, set through a federal adjudication (WRIA 54 Planning Unit, 2009).

References

Department of Ecology. 2009a. Focus on Lower Spokane Watershed. Department of Ecology Publication No. 09-11-023. August 2009. Spokane, WA: Department of Ecology, Eastern Regional Office.

Department of Ecology. 2009b. Department of Ecology Publication No. 09-01-013. December 2009. Olympia, WA. Department of Ecology.

Department of Ecology. 2011a. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

Department of Ecology. 2011b. Watershed management updates by WRIA: Lower Spokane, WRIA 54. Accessed July 8, 2011. http://www.ecy.wa.gov/programs/eap/WRIAs/Planning/54.html.

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WRIA 54 Planning Unit. 2009. WRIA 54 (Lower Spokane) watershed plan. Spokane, WA. WRIA 54 Planning Unit. http://www.spokanecounty.org/wqmp/project54/ASP/Plan54.asp.

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LITTLE AND MIDDLE SPOKANE, WRIAS 55 AND 57

Background

WRIA 55 (Little Spokane) includes the drainage for the Little Spokane River from its headwaters to the point where it enters the Spokane River. WRIA 57 (Middle Spokane) includes parts of the drainage of the Spokane River within Washington up to the point where Hangman/Latah Creek (a major tributary) enters the river. The Little Spokane and Middle Spokane WRIAs are part of the larger Spokane-Coeur d'Alene watershed, which includes parts of Idaho, as well as two other Washington WRIAs:

- Lower Spokane River (WRIA 54, extending along the Spokane from the point where Hangman Creek enters the Spokane River to where the Spokane empties into the Spokane arm of Lake Roosevelt)
- Hangman/Latah Creek (WRIA 56, a major Spokane River tributary from the south)

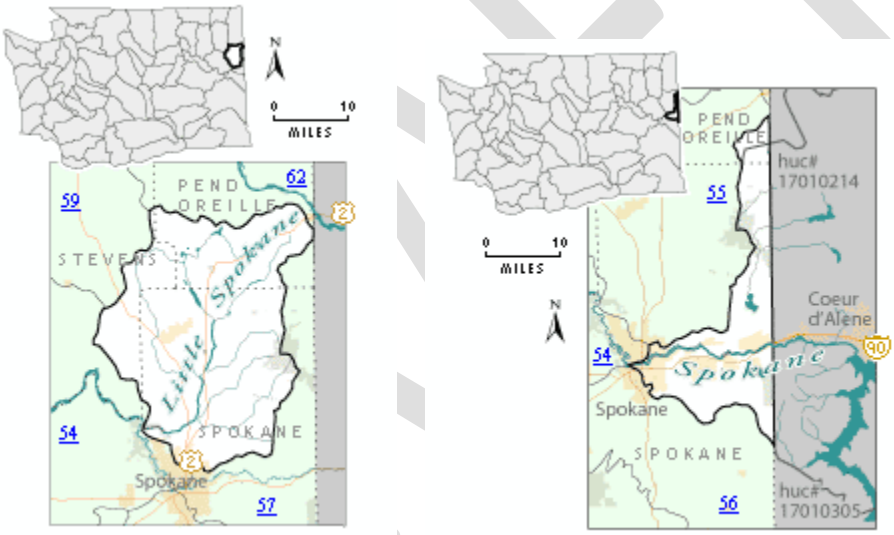

Figure G-28. Map of Little Spokane (WRIA 55) and Middle Spokane (WRIA 57) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The natural drainage of the Little Spokane River is almost entirely within Washington State, with only a small portion in Idaho. On the other hand, WRIA 57 contains less than 10% of the contributing natural drainage of the Spokane River Basin, with most of the drainage in Idaho (LSR&MSRPU, 2006). The majority of the two watersheds are in Spokane County, though WRIA 55 extends into Stevens County on the west, and both WRIA 55 and WRIA 57 extend north into Pend Oreille County. The City of Spokane falls within WRIA 57, and incorporated and unincorporated communities are found throughout both WRIAs.

Both WRIAs contain a significant amount of forest land (70% of land area in WRIA 55 and 60% in WRIA 57) (LSR&MSRPU, 2006). However, otherwise the basins have a different character. The Little Spokane also has a significant amount of agriculture (25%) and some urban development (5%), while the Middle Spokane has much more urban development (23%) and some agriculture (16%) (LSR&MSRPU, 2006).

No tribal land is in the watershed, but a large portion of WRIA 55 and a smaller portion of WRIA 57 are ancestral lands of the Spokane Tribe (LSR&MSRPU, 2006). All of WRIA 55, and part of WRIA 57 was historically part of the Colville Reservation (Department of Ecology, 2011a).

Current Water Supply

Surface Water

Annual precipitation in the Little and Middle Spokane watersheds ranges from about 15 inches per year in the lower elevations of the basin to over 45 inches in the mountainous areas (LSR&MSRPU, 2006). Most of this precipitation (about 70%) falls from October through March, and some (25-40%) falls as snow.

The Little Spokane has few artificial controls on its flow, and thus the hydrograph shows sharp responses to seasonal effects such as snow pack melt. The Little Spokane also gains water from the underlying aquifer.

The Spokane River, on the other hand, has numerous dams and impoundments, including (from upstream to downstream) Post Falls (in ID, upstream of WRIA 57), Upriver, Division Street/Upper Falls, and Monroe Street Dams. Additional dams on the Spokane are downstream from WRIA 57 (Nine Mile, Long Lake, and Little Falls). Of these, Post Falls Dam, at the outlet of Lake Coeur d'Alene, has the most significant impact on water supply within WRIA 57, essentially regulating flow in the Spokane River during four to six months of the year. Because of these dams, and the larger basin size, the Spokane River has smoother transitions to peak flows that the Little Spokane River. Interactions between the Spokane River and the underlying SVRP Aquifer are important for maintaining flows and water quality in the Spokane River.

Groundwater

The primary aquifers of WRIAs 55 and 57 are unconsolidated sediments, although Columbia River Basalt rocks underlie parts of the basins, and also provide groundwater in some areas. The Spokane Valley Rathdrum Prairie (SVRP) Aquifer, part of the unconsolidated aquifer, underlies the central portion of WRIA 57, the southern portion of WRIA 55, and extends into Idaho, and is one of the most productive aquifers in the country. It is the primary water source for more than 400,000 people living in Spokane County, WA and Kootenai County, Idaho (LSR&MSRPU, 2006). Movement of water in this aquifer from WRIA 57 to WRIA 55 links water in the two basins, despite the fact that surface waters are distinct.

Current Out-Of-Stream Water Demand

Land use changes in the future are expected to result in additional conversion of agricultural land to development in both WRIAs (LSR&MSRPU, 2006).

Somewhat unusually, many of the residents in both unincorporated and incorporated areas of WRIAs 55 and 57 are served by special purpose water and irrigation districts. The Planning Unit has estimated that about 40% of the population of 275,000 living in the planning area are served by water systems operated by cities, 50% by special water districts, and 10% by individual wells (LSR&MSRPU, 2006). In addition, almost half of the customers served by the City of Spokane are outside of the WRIA 55/57 boundaries, but almost all of the water for the City of Spokane comes from WRIAs 55/57 (LSR&MSRPU, 2006).

Current Instream Water Demand

WRIAs 55 and 57 includes Upriver, Upper Falls, and Monroe Street Dams, all of which are run-of-the-river hydroelectric projects.

The Little Spokane has rainbow trout and mountain whitefish. The WRIA 55 and 57 Planning Unit carried out an evaluation of current minimum instream flows on the Little Spokane (WRIA 55), and concluded that the existing minimum instream flows on the three control sites on the upper Little Spokane River (described below) provide relatively good habitat protection for most of the year for rainbow trout and mountain whitefish (LSR&MSRPU, 2006).

Instream Flows

There is not currently an instream flow rule for the Spokane River in WRIA 57. However, Ecology set a 2,000 cfs recommended minimum flow target for the Spokane River in 1999 (at the USGS gate 12422500, Spokane River at Spokane). This flow represents the 50% exceedence flow for the period prior to the installation of Post Falls Dam (1891-1906). The WRIAs 55/57 Watershed Planning Unit has emphasized that this target flow is met only 86% of the time, and only 55% of the time during the summer (LSR&MSRPU, 2006).

The original WRIA 55 instream flows were established on January 6, 1976 (Chapter 173-555 WAC) (Table G-8). There have not yet been amendments to the original WRIA 55 instream flows. There is a set of existing, active water rights conditioned to these flows. The minimum flows were set at the 80% exceedence level based on the historical record, and are set for four points (Elk, Chattaroy, Dartford, and Near Dartford (Rutter Parkway Bridge). A 1995 assessment of WRIA 55 noted that water flows in the Little Spokane River and its tributaries failed to meet instream flows 53 days per year on average between 1970 and 1991 (Dames and Moore and Cosmopolitan, 1995, as cited by Golder Associates, 2003).

Table G-8. Current instream flows for WRIA 55 (WAC, 1988).

		Elk	Chattaroy	Dartford	Confluence
January	1	40	86	150	400
	15	40	86	150	400
February	1	40	86	150	400
	15	43	104	170	420
March	1	46	122	190	435
	15	50	143	218	460
April	1	54	165	250	490
	15	52	143	218	460
May	1	49	124	192	440
	15	47	104	170	420
June	1	45	83	148	395
	15	43	69	130	385
July	1	41.5	57	115	375
	15	39.5	57	115	375
August	1	38	57	115	375
	15	38	57	115	375
September	1	38	57	115	375
	15	38	63	123	380
October	1	38	70	130	385
	15	39	77	140	390
November	1	40	86	150	400
	15	40	86	150	400
December	1	40	86	150	400
	15	40	86	150	400

A WRIA 54 and 55/57 instream flow work group collaborated on instream flow recommendations for the entire Spokane River, integrating the research from the recent studies with those completed in 2004 and during the Avista FERC relicensing process. The work group did not achieve consensus on minimum instream flows for the main stem Spokane River. However, they did agree upon control points to manage surface water and the Spokane Valley/Rathdrum Prairie aquifer.

The State Caucus recommendations for minimum instream flows were used as the foundation for conditions in the Section 401 water quality certification of the Avista hydroelectric dam relicense. The State Caucus is developing recommendations for spring spawning flows and delineating the boundary of the Spokane Valley/Rathdrum Prairie aquifer that would be associated with a future instream flow rule. (Department of Ecology, 2011b).

References

Department of Ecology. 2011a. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

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Department of Ecology. 2011b. Watershed management updates by WRIA: Little Spokane/Middle Spokane, WRIAs 55/57. Accessed July 8, 2011. http://www.ecy.wa.gov/programs/eap/wrias/Planning/55-57.html

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HANGMAN-LATAH CREEK, WRIA 56

Background

The Hangman Creek watershed (also known as Latah Creek), drains approximately 431,000 acres in Washington and Idaho, emptying into the Spokane River. The upper third of the Hangman Creek watershed is in Idaho, and thus activities in Idaho impact supply and demand in WRIA 56. Agriculture (mostly non-irrigated annual small grain production) is the most significant land use within the basin, accounting for 64% of land use, concentrated in the upper and middle portions of the watershed (The Hangman Creek Watershed Planning Unit, 2005). The lower reaches of WRIA 56 are moderately urbanized, with many small rural towns and two golf courses. Hangman Creek is part of the larger Spokane-Coeur d'Alene watershed, which includes parts of Idaho, as well as three other Washington WRIAs:

- Middle Spokane (WRIA 57, from the Idaho border downstream to Latah Creek)
- Little Spokane River (WRIA 55, a major Spokane River tributary from the north)
- Lower Spokane River (WRIA 54, extending along the Spokane from the point where Hangman Creek enters the Spokane River to where the Spokane empties into the Spokane arm of Lake Roosevelt)

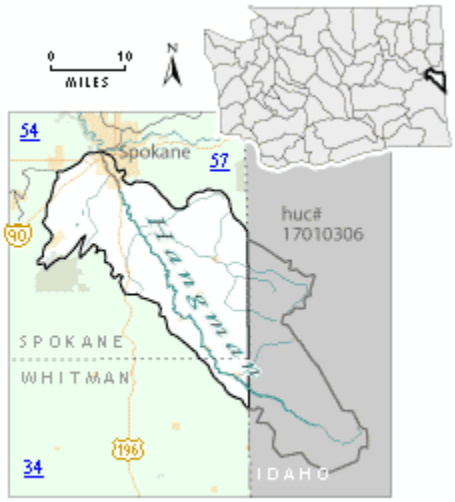

Figure G-29. Map of Hangman-Latah Creek (WRIA 56)
(used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Though there is no tribal land in WRIA 56, the watershed is considered to be ancestral ground of both the Spokane and Coeur d'Alene tribes, and the Coeur d'Alene Tribe owns more than 50,000 acres of timberland on the Idaho side of the border (The Hangman Creek Watershed Planning Unit, 2005).

Current Water Supply

Surface Water

The Hangman watershed receives low to moderate precipitation, ranging from less than 18 inches per year at the mouth of Hangman Creek to over 40 inches per year in the southeastern headwaters (WRIA 56 Planning Unit, 2009). Summers are arid, with most precipitation during the winter. The stream hydrograph is driven by rain on snow (and frozen ground) events, resulting in a flashy flow regime with flooding during the winter and spring and very low flows from July through October (WRIA 56 Planning Unit, 2005). Summer flows are generally in the range of 10-15 cfs, and daily average flows of less than one cfs have been recorded on numerous days at the USGS gage at the mouth of Hangman Creek, with flows upstream that are significantly less than this (The Hangman Creek Watershed Planning Unit, 2005).

The flashy nature of streamflows are exacerbated by the fact that there are no dams or structures regulating Hangman Creek, little natural water storage in the watershed, and groundwater supported baseflows are low (The Hangman Creek Watershed Planning Unit, 2005). In fact, seepage runs conducted by the Spokane County Conservation District showed that some reaches of Hangman Creek lose water to the groundwater system.

Groundwater

While groundwater supplies are less important for supporting surface water flows in Hangman-Latah Creek, they are an important component of water supply for WRIA 56. An unconfined aquifer exists in the lower portions of the watershed, below Rock Creek, while the main aquifer in the upper portions of the watershed is contained in the Columbia River Basalts (The Hangman Creek Watershed Planning Unit, 2005). Imbalances in sub-watershed level supply and demand could be leading to groundwater mining in some portions of the watershed; water right allocations from groundwater greatly exceed the estimated recharge rate in the California Creek and Marshall Creek sub-watersheds, while groundwater allocations in the lower Hangman Creek may adversely impact stream flows (WRIA 56 Planning Unit, 2009).

Current Out-Of-Stream Water Demand

Irrigated agriculture is a much smaller portion of the water budget in this WRIA than in many other WRIAs of the Columbia River Basin, though it still uses significant amounts of water. Most of this (an estimated 80% of use) comes from groundwater rather than surface water sources (Buchanan and Brown 2003, as cited in The Hangman Creek Watershed Planning Unit, 2005).

Though WRIA 56 is primarily rural in nature (with some urbanized and urbanizing areas) municipal uses (including commercial and industrial uses) are estimated to be the largest water users in WRIA 56. Domestic exempt wells had recently proliferated in WRIA 56 at the time of watershed planning (The Hangman Creek Watershed Planning Unit, 2005). At the time of

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watershed planning, populations are expected to be stable or slightly declining for most rural towns. In contrast, the southwest quadrant of the City of Spokane, which is within WRIA 56, was expected to absorb roughly 27,000 people between 1995 and 2010 (The Hangman Creek Watershed Planning Unit, 2005).

Current Instream Water Demand

There are no hydroelectric demands in WRIA 56.

While Hangman Creek historically had viable populations of native redband trout and healthy runs of salmon and steelhead, the primary species now found in the stream are adapted to warmer slower waters, and are considered undesirable as gamefish. Resident rainbow trout populations are severely depressed, though a primary management priority (The Hangman Creek Watershed Planning Unit, 2005). Providing adequate flows during critical life stages will be important to reviving rainbow trout populations in WRIA 56, but on their own will not be sufficient. Fish presence, and suitable habitat and water quality (particularly stream temperature) are also limiting in WRIA 56 (The Hangman Creek Watershed Planning Unit, 2005).

Instream Flows

The planning group completed an instream flow study to evaluate stream flow conditions primarily for fisheries. They developed flow recommendations for three levels of habitat protection, but could not achieve consensus before plan adoption. The planning group continued to work on instream flow recommendations during 2008, and is closer to reaching consensus. They have agreed conceptually to a minimum instream flow, but want to develop recommendations for managing groundwater (specifically domestic exempt wells) before requesting Ecology to begin rulemaking. Significant growth is anticipated in Lower Hangman, within Spokane County, and increased use of domestic exempt wells for single and group homes is anticipated. Given the absence of any well monitoring network in the watershed and lack of data about groundwater, the planning group is seeking funds to: establish a well monitoring network, complete a detailed water supply and demand analysis, and complete groundwater inventory and mapping (Department of Ecology, 2011).

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MIDDLE LAKE ROOSEVELT, WRIA 58

Background

Middle Lake Roosevelt watershed includes the portion of Lake Roosevelt and its numerous tributary creeks and streams, extending from the mouth of the Colville River to the mouth of the Spokane River. The portion of the watershed west of Lake Roosevelt is in Ferry County, while the portion east of Lake Roosevelt is in Stevens County.

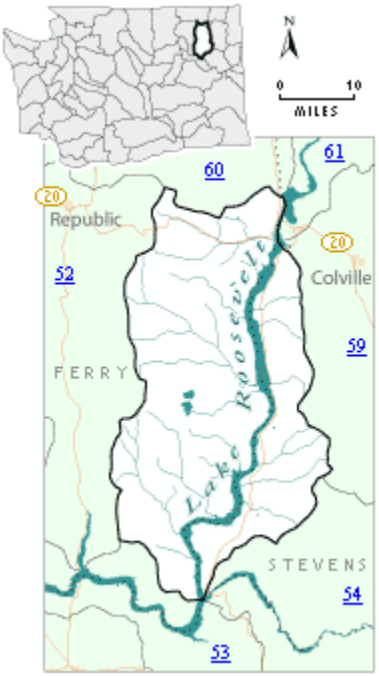

Figure G-30. Map of Middle Lake Roosevelt (WRIA 58) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

More than half of the area of the watershed (towards the south and west) is within the reservation of the Colville Confederated Tribes. The south-east corner is part of the Spokane Reservation. Other areas were historically part of the First Columbia (Colville) Reservation (to the east) and the Second Columbia (Colville) Reservation (to the north) (Department of Ecology, 2011).

Middle Lake Roosevelt is not working under the watershed planning process, and there are very few documents available on this watershed. Almost all of the available documents address water quality issues and were not relevant to the forecasting effort.

Current Water Supply

Surface Water

Lake Roosevelt was created by the Grand Coulee Dam, and forms the major surface water feature in Middle Lake Roosevelt. Numerous other tributaries enter Lake Roosevelt within the watershed. Annual precipitation in the Middle Lake Roosevelt Watershed ranges from 10 inches per year near the mouth of the Spokane River to 30 inches in higher elevations and mountainous areas (Department of Ecology, 2011a). Most of the precipitation occurs during winter months, when demands are low (Department of Ecology, 2011a).

Groundwater

Availability and yield of groundwater from bedrock in this WRIA is generally very limited, based on climate and geology (Department of Ecology, 2011a).

Current Out-Of-Stream Water Demand

Agricultural activities in this watershed include dryland wheat, a few orchards, horse pastures, and livestock rangeland grazing for cow-calf production (Patrice Beckwith, personal communication).

No information on municipal or domestic water usage was found for Middle Roosevelt.

Most adjudicated water basins (including Alder Creek, Corus Creek, Cheweka Creek, Jennings Creek, Harvey Creek, Magee Creek, O-Ra-Pak-En Creek, Quilisascut Creek, and Stranger Creek) have annual water shortages, indicating that water in these basins may be over-allocated (Department of Ecology, 2011a).

No other information on out-of-stream water uses was found.

Current Instream Water Demand

No information on instream water demands in this watershed was found.

Instream Flows

There are no proposed instream flows for WRIA 58. As of 2010, Ecology did not plan to propose instream flows in the near future (Department of Ecology, 2010).

Most surface water sources (and groundwater connected to these surface waters) in the watershed are limited through administrative restrictions known as Surface Water Source Limitations (SWSLs). Often, these restrictions require that new water uses stop during low flow periods (Department of Ecology, 2011a). In addition, portions of Ninemile Creek and the North Fork of Hall Creek are “closed” to new uses by SWSL (Department of Ecology, 2011).

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References

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Department of Ecology. 2011a. Focus on water availability: Middle Lake Roosevelt Watershed, WRIA 58. August. Publication No. 11-11-062. Spokane, WA. Department of Ecology.

Department of Ecology. 2011b. Map: Washington State tribal reservations and draft treaty ceded areas. GIS Technical Services tribal-cedres map. Washington State Department of Ecology. Dated 06/14/11.

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COLVILLE, WRIA 59

Background

The Colville River Watershed (WRIA 59) covers approximately 1,007 square miles in Stevens County. The watershed includes the towns of Springdale and Loon Lake in the south and the towns of Colville and Kettle Falls in the north. The watershed is composed largely of hilly and mountainous terrain associated with the Selkirk Mountains, bisected by the Colville River Valley, which in places is less than 3 miles wide (Kahle et al., 2003).

Figure G-31. Map of Colville (WRIA 59) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The entire watershed is on land that used to be part of the Colville Reservation (under the first Columbia Reservation) (Department of Ecology, 2011).

Current Water Supply

Surface Water

The Colville River begins as Sheep Creek in the southern end of the watershed, and flows generally north past the town of Chewelah and northwest past the town of Colville. Beyond Colville, the river turns west and empties into Lake Roosevelt.

As of 2003, surface water was available for further appropriation only from October 1 through July 15th, while all streams tributary to the Colville had been fully appropriated (Chung and Slattery, 1977, as cited in Kahle et al., 2003).

Groundwater

The hydrogeology of the Colville watershed consists of glacial and alluvial deposits that overlie bedrock and are more than 700 feet thick in areas (Kahle et al., 2003). The Lower aquifer and the shallow groundwater system may act as fairly independent systems, as indicated by measured groundwater levels (Kahle et al., 2003).

A study carried out by the USGS in 2003 showed that the Colville River has both gaining and loosing reaches; during the September measurement period, the river gained flow from the shallow groundwater system near its headwaters to the town of Valley, and lost flow to the shallow groundwater system from Valley to Chewelah (Kahle et al., 2003). Downstream of Chewelah, the river generally lost flow, but losses were small (Kahle et al., 2003).

In 1994, issuance of new groundwater rights was halted by Ecology because of possible hydraulic continuity between the ground and surface water systems (Kahle et al., 2003). Further study of the groundwater system and its continuity with surface water has been subsequently carried out by the USGS, which developed a groundwater model for the watershed (USGS, 2004, as cited in Golder Associates, 2007).

Current Out-Of-Stream Water Demand

Lowland areas of WRIA 59 support numerous farms with much grazing and hay production, and increasing light commercial and industrial development, mostly in Colville and Chewelah (Kahle et al., 2003). Population has nearly doubled since the 1970s (Kahle et al., 2003).

The USGS estimated that total surface and groundwater withdrawals were 9,340 million gallons in 2001, 65% surface water and 35% groundwater (Kahle et al., 2003). Of this total, 75.3% was for irrigation, 16.3% for public water supply, 6.5% for private wells, and 1% each for industrial and livestock use (Kahle et al., 2003). Estimated actual water use is only 25.5% of the total estimated quantity of water that is represented by rights and claims on file (112, 575 acre-feet) (Golder Associates, 2007).

Current Instream Water Demand

The Colville River and its tributaries have several species of fish, but none that are listed as endangered or threatened (Kahle et al., 2003). Recreational use of the basin is commonplace, aided by the numerous pristine lakes and streams (Kahle et al., 2003).

Instream Flows

The original WRIA 59 instream flows were established on July 22, 1977 (Chapter 173-559 WAC) (Table G-9). There have not yet been amendments to the original WRIA 57 instream flows. There is a set of existing, active water rights conditioned to these flows.

The watershed planning group's detailed implementation plan calls for further flow studies to support possible opening of some of the closures. The Department of Ecology, along with the State Department of Fish and Wildlife, the Spokane Tribe of Indians, and the WRIA 59 planning group, gathered flow and habitat data throughout the basin in 2006. The planning group collected more data in the fall of 2008 and instream flow negotiations are ongoing (Department of Ecology, 2012).

Table G-9. Current instream flows for WRIA 59 (WAC, 1988).

		Upper Colville	Lower Colville
		Control Station No. 12.4080.00, RM 32.1	Control Station No. 12.4090.00, RM 5.0
January	1	30	80
	15	30	80
February	1	30	80
	15	38	100
March	1	47	124
	15	59	157
April	1	76	200
	15	76	200
May	1	49	200
	15	32	135
June	1	20	90
	15	17	70
July	1	15	55
	15	13	43
August	1	11	33
	15	11	33
September	1	14	40
	15	18	49
October	1	22	60
	15	27	70
November	1	35	84
	15	43	100
December	1	43	100
	15	36	90

References

Department of Ecology. 2012. Watershed management updates by WRIA: Colville, WRIA 59. Accessed February 10, 2012. http://www.ecy.wa.gov/programs/eap/wrias/Planning/59.html.

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Kahle, S.C., C.I. Longpre, R.R. Smith, S.S, Sumioka, A.M. Watkins and D.L. Kresch. 2003. Water resources of the ground-water system in the unconsolidated deposits of the Colville River watershed, Stevens County, Washington. Prepared in cooperation with the Colville River watershed planning team for the 2000-2004 WRIA 59 Colville River watershed planning project. Water Resources Investigations Report 03-4128. Tacoma, WA. U.S. Geological Survey, U.S. Department of the Interior.

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KETTLE, WRIA 60

Background

WRIA 60 occupies all of the Kettle Watershed within Washington State, an area of about 1,022 square miles in eastern Okanogan County, Ferry County, and western Stevens County (Holiday, 2004). However, the majority of the watershed extends into British Columbia, including both the headwaters of the Kettle, and a lower portion of the river that exits Washington State and then returns to WRIA 60.

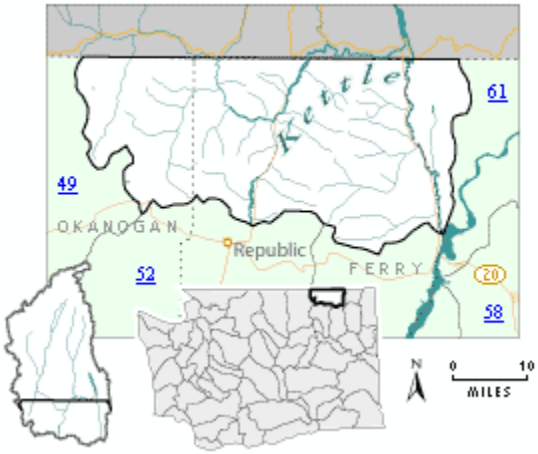

Figure G-32. Map of Kettle (WRIA 60) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

Nearly three quarters of the WRIA is forested or logged, mostly in rugged upland regions (Holliday, 2004). An additional 10% is grassland. Over half (56%) of the WRIA land is owned by the federal government, whose land management can thus have a major impact on WRIA water supplies.

Current Water Supply

Surface Water

Average annual precipitation is about 21 inches per year, with most of this falling between November and January (with significant amounts also in May and June) (Ecology, 1995). Based on seasonal precipitation patterns, parts of the Kettle River and tributaries have extremely low or non-existent stream flows during summer months (Ecology, 1995). A water balance estimate carried out by Holliday (2004) suggested that nearly 3 times as much surface water enters the WRIA from upstream areas of the watershed (in Canada), as from precipitation within the WRIA (roughly 3,247,000 AF per year from entering surface waters, versus 1,096,000 acre feet per year in precipitation) (Holiday, 2004).

Connections between surface and groundwater are not well understood (Holliday, 2004).

Groundwater

Groundwater within WRIA 60 occurs primarily within factures in basement rocks (resulting generally in low yield wells), and within alluvial sediments (Holliday, 2004). Water allocation documents suggest that groundwater is a relatively minor portion of water supply in WRIA 60 (Ecology, 1995). There is a relatively limited amount of information on groundwater resources for this WRIA, and watershed-level groundwater flow modeling has not been carried out (Holliday, 2004).

Current Out-Of-Stream Water Demand

Kettle does not have urban areas.

There is a very small amount of pasture/hayland in WRIA 60 (representing 2.25% of land use), but irrigated agriculture is very limited in this WRIA (Holiday, 2004).

Current Instream Water Demand

No hydroelectric demands were noted in this WRIA by Holliday (2004).

WRIA 60 waters support a number of fish. A 1995 assessment identified two common sport fish, including resident rainbow trout and Eastern brook trout, in addition to brown trout, sculpins, bridgelip sukers, and mountain whitefish. Bull trout had been documented in one major tributary to the Kettle River (Ecology 1995). Although there were several species of salmon that spawned in the Kettle prior to the construction of the Grand Coulee Dam, there are no longer anadromous fish within WRIA 60 (Ecology, 1995).

Instream Flows

Although there are no instream flows established by rule for the Kettle River watershed, Ecology documents suggest that water rights issued since 1990 for the main stem of the Kettle River have been made subject to low flows of 600 cfs (April through July) and 300 cfs (August through September) at Ferry, and a year-round low flow of 570 cfs at Laurier where the river re-enters Washington (Ecology, 1995). These flows are met 99% of the time in spring and early summer, but only 50% of the time in the late summer and fall (Ecology, 1995). Some tributaries of the Kettle River are also subject to administrative restrictions based on flow, while other streams are closed, meaning that new uses are not allowed (Ecology, 2008).

The watershed planning process was discontinued at the end of Phase 2 in 2004, and therefore does not plan to propose instream flows. As of late 2009, Ecology did not have immediate plans to propose instream flows (Department of Ecology, 2010).

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UPPER LAKE ROOSEVELT, WRIA 61

Background

The Upper Lake Roosevelt watershed, in northeastern Washington, encompasses about 576 square miles. It encompasses the Columbia River from the point where it crosses the Canadian border into the U.S., downstream to WRIA 58, in Lake Roosevelt (Department of Ecology, 2008). Most of WRIA 61 is in Stevens County, though the eastern parts of the WRIA extend into Pend Oreille County.

Figure G-33. Map of Upper Lake Roosevelt (WRIA 61) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The land in Upper Roosevelt is within areas that were part of the First Columbia and Second Columbia Reservation of the Colville Confederated Tribes (Department of Ecology, 2011b).

Current Water Supply

Surface Water

Lake Roosevelt is an impoundment of the Columbia River created by the Grand Coulee Dam, and is the most significant surface water feature in the WRIA.

Annual precipitation in the Upper Lake Roosevelt watershed falls predominantly during the winter months, and ranges from 21 inches per year near the Town of Kettle Falls to 55 inches or more in the higher elevation mountainous areas (Department of Ecology, 2011a).

Groundwater

Availability and yield of groundwater from bedrock in WRIA 61 is very limited by climate and geology (Department of Ecology, 2011a).

Current Out-Of-Stream Water Demand

No information was found covering out-of-stream water demands in WRIA 61.

Current Instream Water Demand

No information was found covering instream water demands in WRIA 61.

Instream Flows

There are no proposed instream flows for WRIA 61, and as of late 2009, Ecology had no immediate plans to propose instream flows (Department of Ecology, 2010).

References

Department of Ecology. 2008. Focus on Upper Lake Roosevelt. Publication No 08-11-025. Spokane, WA: Department of Ecology, Eastern Regional Office.

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PEND OREILLE, WRIA 62

Background

The Pend Oreille watershed, WRIA 62, covers about 1.300 square miles in Washington State. This represents about 5% of the total Clark Fork-Pend Oreille drainage basin, which spans about 26,000 square miles and includes Flathead Lake in Montana and Lake Pend Oreille in Idaho (Entrix, 2002). Most of WRIA 62 drains to the lower Pend Oreille River, which then flows northward into British Columbia before meeting the Columbia River 13 miles downriver. The watershed is mostly rural with large areas of forest, mountains, valleys, and open pastures (Entrix, 2002). Forestry and recreation are predominant economic activities, supplemented with grazing, mining, and heavy industry. The majority of land is managed by state and federal entities.

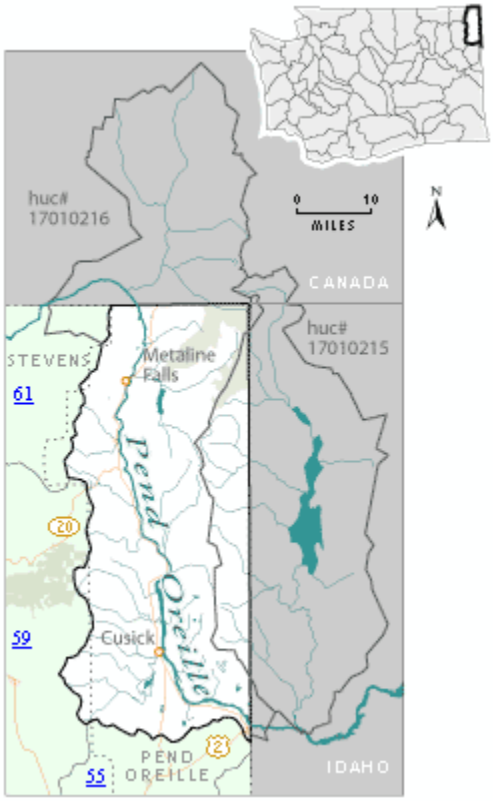

Figure G-34. Map of Pend Oreille (WRIA 62) (used with permission from the Department of Ecology and adapted by Sylvia Kantor).

The Kalispel Tribe has approximately 4,550 acres of reservation lands in WRIA 62, and ancestral lands throughout the Pend Oreille Valley (Entrix, 2002).

Current Water Supply

Surface Water

Most of the water in the Pend Oreille River comes from the watershed upstream of WRIA 62; thus dam operations and climatic conditions upstream largely control the amount of surface water in WRIA 62 (Entrix, 2002). The Clark Fork-Pend Oreille watershed is highly regulated, with Hungry Horse Dam (in the upper Clark Fork Watershed in Montana) and Albeni Falls Dam (in Idaho) having the most influence on water levels in WRIA 62. Both these dams are operated federally, as part of the Federal Columbia River Power System (FCRPS) dams. Water supply and water ecosystems in WRIA 62 are also impacted by Box Canyon Dam and Boundary Dam, within the WRIA itself.

The climate in WRIA 62 is typical of northeast Washington State, combining characteristics of mountain/continental climates and more maritime features (Entrix, 2002). Average precipitation varies greatly though it generally increases with elevation. As much as 60-75% of moisture falls during the period from October to March, falling as snow at higher elevations (Entrix, 2002).

During the spring, flooding can be an issue, mainly along the mainstem of the Pend Oreille River (Golder, 2005). In March and April, runoff within the Calispell basin occasionally causes local flooding. In May and June, runoff from the higher headwaters of the basin outside of WRIA 62, including the Clark Fork, Flathead, and Priest River drainages, can cause more widespread flooding issues. The planning group found that out of 83 years, there were 24 floods with glows greater than 100,000 cfs at Albeni Falls Dam. Flooding events cause severe disruption, as well as significant costs to local governments and the communities involved (Golder, 2005).

Groundwater

The most important geologic features of WRIA 62 in terms of groundwater supply are unconfined and sand and gravel aquifers, generally located along the Pend Oreille River valley and adjacent to the Pend Oreille River tributaries. Wells supplying domestic supplies in the WRIA are generally shallow and relatively close to surface water. Groundwater is generally not well characterized, and Interactions between surface water and groundwater in the WRIA are not well understood (Golder, 2005; Entrix, 2002).

Current Out-Of-Stream Water Demand

Agricultural use is dominated by livestock grazing, with some crop (mostly hay) and pasture land (Entrix, 2002).

WRIA 62 is sparsely populated compared to many other portions of the state, and has experienced relatively show growth in recent years (Entrix, 2002). Population growth in WRIA 62 is expected to be greatest in the southern part of the watershed and along the mainstem of the Pend Oreille River from Newport to Ione (Entrix, 2002).

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Current Instream Water Demand

Within WRIA 62, there are two dams on the Pend Oreille mainstem: Box Canyon Dam (essentially a run of the river dam) and Boundary Dam. Boundary Dam is owned by the City of Seattle and operated by Seattle City Light. The project provides approximately 40% of Seattle's annual energy and is operated for optimum energy production and system reliability (Entrix, 2002). Other dams exist on tributary streams, including the Power Lake Dam, owned and operated by the Pend Oreille PUD No. 1, is located at the outflow of Power Lake to Calispel Creek.

The construction of the dams in WRIA 62 has changed the character of the river, from a free flowing cold water system that predominantly supported native salmonids, to a slow moving warm water system that supports mostly introduced spiny ray and rough fish such as yellow perch and largemouth bass (Ashe et al., 1991, as cited by Entrix, 2002). Areas upstream of WRIA 62 include important spawning areas for kokanee (Golder, 2005).

Instream Flows

The planning unit chose not to take on the optional instream flow component of watershed planning, but has recommended collaborative instream flow setting in WRIA 62 during Phase IV of watershed planning for the Calispell, Davis, Skookum, Kent, and McCloud sub-basins. These basin are essentially closed to further appropriation by Ecology administered SWSLs, and are expected to experience populations growth in the future (Golder, 2005). The Planning Unit also has acknowledged that instream flow studies may be needed in a variety of other major tributaries in order to understand surface water availability in the Pend Oreille watershed.

Ecology and the Washington Department of Fish and Wildlife have preliminarily agreed to a flow of 7,700 cfs at Newport (Golder, 2005), though Ecology does not currently have rule-making scheduled for the basin (Department of Ecology 2012). Water rights issued by Ecology for the mainstem Pend Oreille for the last several years have been conditioned to 7,700 cfs at the Newport gage (in the form of a SWSL, not as an instream flow). The historic record shows that flows normally fail to meet this level about one year in ten, normally in August (Golder, 2005).

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