

EXECUTIVE SUMMARY

CHAPTER 1 - INTRODUCTION

History of Resource Planning in the Entiat Valley

In 1993 members of the Chelan County Conservation District (CCCD), the Natural Resources Conservation Service (NRCS) and the U.S. Forest Service Entiat Ranger District (USFS Entiat RD) met with the Entiat Chamber of Commerce and secured its support for a watershed planning effort for the Entiat and Mad River watersheds. In mid-1994 a decision was made to organize using the Coordinated Resource Management Plan (CRMP) model developed by the NRCS. "Stakeholders" included area landowners representing orchardists, logging and grazing interests; representatives of county, state, non-government, Yakama Nation and federal agencies; and environmental group affiliates.

The CRMP group made significant progress between 1994 and 1998. A Draft Entiat Coordinated Resource Management Plan (CCCD 1999) documented the progress made. Tackling unresolved issues, such as instream flow, was beyond the financial means of the group until the passage of key legislation in 1998 that provided funding for locally led resource planning activities similar to what had already been initiated by Entiat CRMP participants.

Watershed Planning Act

Portions of the Watershed Planning Act (WPA) (Chapter 90.82 Revised Code of Washington) are described in this section, including a description of the Act's components and where they addressed in the WRIA 46 plan.

Initiation of Watershed Planning in WRIA 46

In 1998, the Chelan County Conservation District applied for funds on behalf of the CRMP group to develop a watershed plan under the Washington State Watershed Planning Act. The group reorganized to become the Entiat WRIA Planning Unit (EWPU). The Entiat Final Coordinated Resource Management Plan was released in June 2002, formally ending the CRMP process. The 2002 document also served as the EWPU's first draft of the WRIA 46 Management Plan.

Scope of the WRIA 46 Management Plan

The WRIA 46 Management Plan addresses the required water quantity component, as well as the three other components of instream flow, habitat and water quality. The EWPU decided to include all four components due largely to the fact that the original Entiat CRMP process and participants had already begun to address many resource issues, including fish habitat and water quality, as part of the effort initiated in 1993.

The WRIA 46 document covers the Entiat and Mad River watersheds as well as some of the minor Columbia River tributaries that lie to the north and south of the mouth of the Entiat River. Refer to Chapter 1 page 1-8 for a depiction of the Entiat WRIA.

A major goal of the EWPU was to produce a living watershed management plan – one that will grow, be added to, and improved over time. In keeping with that spirit, the group views this document as a “working” final version of the WRIA 46 Management Plan envisioned under the Watershed Planning Act. The EWPU fully anticipates revisiting and updating the plan in the years to come, and hopes that the WRIA 46 Plan will contribute valuable information and local input to other ongoing local and regional processes such as salmon recovery planning.

CHAPTER 2 - PLANNING CONTEXT AND REGULATORY CONSIDERATIONS

This chapter describes some of the major governing laws that have been considered during the development of this plan, and also discusses how watershed planning in the Entiat WRIA interfaces with other ongoing federal, state, regional and local planning processes.

Federal

The U.S. Forest Service manages approximately 83% of the Entiat WRIA. Other federal land managers include the U.S. Bureau of Land Management (BLM) and the U.S. Fish and Wildlife Service (USFWS), which is responsible for the operation and management of the Entiat National Fish Hatchery (ENFH). Actions on USFS, BLM and USFWS lands within the Entiat WRIA result from the execution of various federal laws and regulations.

Some of the major federal laws governing agency practices that were considered during the development of this plan include: National Environmental Policy Act, Endangered Species Act, Clean Water Act, Federal Land Policy and Management Act, National Forest Management Act, and the Northwest Forest Plan.

Management strategies designed specifically for National Forest System lands within the Entiat WRIA area are contained in Chapter 2, Synthesis Summary Tables.

State

The development of the WRIA 46 Plan was governed by rules outlined in Chapter 90.82 RCW, described in Chapter 1. Many Washington state laws that regulate actions on private lands within the Entiat WRIA and that direct state and local agency decision-making about projects were also considered while developing this Plan.

Some of these pertinent state laws include, but are not limited to: Salmon Recovery Act of 1998 (Chapter 70.46 RCW), Shoreline Management Act of 1971 (Chapter 90.58 RCW), Water Resources Act of 1971 (Chapter 90.54 RCW), Growth Management Act of 1990 (Chapter 36.70A RCW), Forestry Practices Act of 1974 (Chapter 76.09 RCW), and the State Environmental Policy Act of 1971 (Chapter 42.21C RCW).

Regional/Local

Regional/local considerations included: Subbasin Planning, Salmon Recovery Planning, Tribal Recovery Planning / Wy-Kan-Ush-Mi Wa-Kish-Wit, and County Comprehensive Land Use Planning.

CHAPTER 3 - WRIA CHARACTERIZATION

Chapter 3 describes the location and the human and natural environment of the Entiat WRIA. The Human Environment includes a Historic Overview and a description of Land Ownership, Land Uses, Demography, Economics and Cultural Resources.

Human Environment

The historical overview is based on information taken from a recorded oral history of lifelong valley residents and from the Watershed Assessment, Entiat Analysis Area (USFS WNF 1996), with additional corrections and updates from Conard Petersen and others in 1999.

Ownership within the WRIA is predominantly public. The US Forest Service (USFS) manages approximately 83% of lands within the WRIA. Other notable federal land owners include the Bureau of Land Management (BLM) and the US Fish and Wildlife Service (USFWS). Almost all state lands (5.7%) are managed by either the Washington Department of Fish and Wildlife (WDFW) or the Washington Department of Natural Resources (WDNR). Only about 8.8% of the land is in private ownership.

Current land uses within the watershed include agriculture, primarily pear and apple orchards; livestock production and grazing; timber harvest; residential housing; and recreation.

Wilderness, old growth reserves, wildlife and riparian reserves comprise 63% of federal reserve areas, which include some areas in the lower valley that do not fall within other land use categories. Reserve areas are primarily used by wildlife, but are not specifically designated for wildlife use. "Unusable" land is intermingled with designated timber and/or grazing lands, and is unsuitable for these uses due to topography or productivity, or is inaccessible for other reasons such as rock or cliff formations. Irrigated agriculture land area comprises 0.4% of the watershed, and with developed recreation areas (including trails) and residential areas, makes up approximately 1% of the total land area.

Land use practices have contributed to some of the current resource problems within the watershed. Grazing, logging and associated road construction, flood prevention practices and early agricultural practices that were initiated before the turn of the 20th century and continued through the 1970's have declined significantly in the past two decades. These types of land uses are not expected to increase in the next twenty or more years and are never likely to reach pre-1980 levels again.

The one exception to the downward trend in land use is subdivision development, which has recently surged due to the increase in urban residence and/or vacation home construction. High-density development of private lands on or near the river has the potential to threaten the existing water quality. The Chelan County Comprehensive Plan should help to reduce the threat of this trend.

The WRIA has experienced a fairly recent surge in urban population growth and rural part-time/vacation home construction. US Census data showed that the population within the city limits of Entiat remained relatively constant between 1981 and 1990; however,

between 1991 and 2000 it grew by 133%, from 449 to 957 people (US Census Bureau 1991a, 2001a). During the past decade, the rural year-round population within the subbasin portion of the Entiat CCD grew by approximately 11%, from 739 to 829 people (US Census Bureau 1991b, 2001b). Although recent year-round rural population growth occurred at a slower rate than urban population growth, 2000 Census data reported that the number of homes in the rural Entiat subbasin area of the WRIA grew by about 41%, from 278 to 470 units. Of these, 160 (34%) were reported as part-time/vacation homes (US Census Bureau 2001b). Economic strengths and weaknesses identified by the community are also covered in Chapter 3.

Native Americans were the first occupants of the Entiat WRIA. The Entiat band of the Moses-Columbia Indians, who lived along the Columbia River and its tributaries between Priest Rapids and Wells Dam, use the word Entiat to name the area around the mouth of the River. Their translated meaning of the word Entiat is “grassy water place” (M.D. Kinkade, pers. comm. 2002). The Entiat WRIA lies within territory ceded by the Yakama Nation in 1855. The traditional Yakama spelling is “Int-yat”, which is described as meaning either a rich and abundant area, or happiness, depending on pronunciation (Johnson Meninick, pers. comm. October 31, 2003).

Cultural resources found within WRIA 46 represent a range of artifacts and sites, which may include:

- historic cabins, trails, mines, ditches, railroad grades, emigrant trails, original highway grades, mills, and homesteads; and
- historic Forest Service structures including guard stations, lookout towers, corrals, camps, administrative centers, and Depression-era campgrounds and buildings; and prehistoric campsites, villages, graves, quarries, pictographs, workshops, trails, rock shelters and religious sites.

Natural Environment

The combination of topography, climate, and hydrology found within the Entiat watershed results in a somewhat harsh environment for fish. The gradient of the Entiat River is steep due to the 8,500-foot change in elevation that occurs over only 25 miles between the headwaters near the Cascade Crest and the river’s mouth at the Columbia River. The climate is highly variable year to year and even within a single year, with 90 and 100-degree temperatures that last for several weeks at a time in the summer, and sub-zero temperatures during many winters. Rapid snowmelt results in high volumes of run-off in late spring and early summer, and low stream flows in late summer, early fall, and throughout the winter. Refer to Chapter 3, Page 3-53 for a typical Entiat River hydrograph.

Soils within the Entiat valley are generally highly erodible due to deposits of volcanic ash and pumice or loess at the surface. Three general zones based on soils/geology/land type association exist in the WRIA (Refer to Chapter 3, page 3-41 for Analysis Zones Graphic):

- Transport zone– usually the source of most sediments,
- Transitional zone –most of the bedload and nearly all of the suspended sediments pass through this area,

- Depositional zone –significant portions of bedload and suspended sediments are normally deposited here. The depositional zone is often where many agricultural, residential and commercial properties are located.

Vegetation community types range from near-desert shrub steppe at lower elevations to sub-alpine at higher elevations. Forested and shrub- grassland communities varies depending on slope, aspect and elevation. Wildfire, fire suppression, logging, grazing and other land use activities have altered vegetation community structure within some areas of the watershed.

Natural events such as wildfire and floods occur frequently within the watershed. Over 60% of the Entiat watershed has been affected by wildfires that occurred between 1970 and 1994. One of the worst floods in recent history occurred in 1948, and significant flooding also occurred in 1972, twice in 1977 and in 1989 following wildfires.

CHAPTER 4 - WATER QUANTITY

This chapter describes estimates of surface and ground water present in the Entiat WRIA; a summary of water rights, claims, and applications; and estimates of actual water use. Information about the WRIA stream gaging network, results of the aquifer storage model and gain-loss analysis are also presented. Estimates of future water supply requirements are included.

Hydrograph Separation Analysis

The WDOE performed hydrograph separation on the Entiat River as part of an effort to evaluate groundwater contribution to total streamflow (baseflow) at active and inactive stream gaging stations throughout Washington State (Sinclair and Pitz 1999). The Planning Unit also used HYSEP to perform hydrograph separation analyses. Results comported well with the WDOE HYSEP analysis results based on the Entiat at Entiat and Stormy records.

Well Monitoring Study

In 2001, the EWPU initiated a domestic well monitoring effort in order to collect data on groundwater levels within the unconsolidated alluvial aquifer, and examine hydraulic continuity within the Entiat valley. All wells currently monitored within the Entiat WRIA are permit exempt domestic wells, and all but two of the monitored wells draw water from the shallow, unconfined and unconsolidated alluvial aquifer of the Entiat River. Well monitoring data indicate a high degree of connectivity of this aquifer to flow in the Entiat River, with seasonal variations in streamflow being reflected in static water levels within the wells.

Aquifer Storage Model

Aquifer areas ranged in size from 2 acres to as large as 3,210 acres with an average size of 52 acres. The total area of the mainstem Entiat River valley aquifer was estimated to be 10,732 acres. During 2002 the saturated thicknesses within the unconfined valley aquifer ranged from 10 feet to 151 feet, with an average aquifer depth of 52 feet. Exclusion of the 3,210 acre outlier polygon, which defines the uppermost headwater aquifer for which no

well data were available, reduced the average aquifer polygon size to 37 acres with a maximum polygon size of 467 acres.

Gain-Loss Study

The gain/loss analysis shows all mainstem measurement reaches, reach gain or loss in cubic feet per second (cfs), and the net rates of gain/loss per unit channel length. It is clear that the Entiat River experiences significant and widely varying ground-water/surface-water interchange within its identified reaches. Two lower mainstem Entiat reaches had a net gain in discharge per unit channel length greater than 10 ft³/sec/mile; the overall net increase in discharge due to groundwater contribution on the mainstem Entiat River was 11.51 ft³/sec. Overall, areas of measured gains and losses agreed well with predictions based on geologic interpretation (mentioned above). The Mad River also showed significant groundwater/surface water interchange within the study reaches.

Water Recharge Areas

Chapter 90.82.070 RCW requires watershed planning units to provide “an identification of the areas where aquifers are known to recharge surface bodies of water and areas known to provide for the recharge of aquifers from the surface”. The most important and obvious cases of these relationships in WRIA 46 are the interactions between the Entiat River and the Entiat valley unconsolidated alluvial aquifer.

Water Rights, Claims and Applications

Summary of surface and ground water certificates, permits, and claims.

	# of Records	Sum of CFS	# of Records Reporting CFS	Sum of Ac-Ft	# of Records Reporting Ac-Ft	Calculated Ac-Ft ³
Surface water certificates and permits	115	210,166.1 ¹	111	392,131.3 ¹	57	3,340.8
Surface water claims	173	5,392.0 ²	92	383,774.1 ²	140	18,227.0
Ground water certificates and permits	38	22.2	38	4,266.4	38	38
Ground water claims	172	15.4	122	4,806.1	119	172

1. Includes a reported 210,000 cfs and 390,000 ac-ft for power generation.

2. Includes numerous claims with questionable reported values totaling 3,400 cfs & 370,213 ac-ft.

3. Calculated acre-feet values for surface water rights and claims are based on irrigated acres reported multiplied by 4.0 acre-feet per acre plus reported values for non-irrigation uses.

Ardenvoir gage for the months of April - October show that sufficient water will likely be present 90% or more of the time from April through July for existing conditioned water right holders; however, certainty of water availability decreases during the months of August-October, as evidenced by the flow exceedence values.

The WDOE Water Rights Application Tracking System (WRATS) showed that 34 applications have been filed for water rights in WRIA 46 since 1991.

Actual Water Use

Obvious inconsistencies exist between the amount of water use reported in the paper record and what is observed at gaging stations in the subbasin. Thus, the EWPU employed a variety of methods and data sources to generate estimates of actual irrigation and in-house domestic water use.

Domestic In-house Net Water Use

The equations used to estimate total daily net water use were as follows:

$$470 \text{ housing units} \times 2.71 \text{ people per unit} = 1274 \text{ people}$$

$$1274 \text{ people} \times 35 \text{ gallons pcpd} = 44,590 \text{ gallons net water use per day}$$

Daily net water use was multiplied by the number of days in each month to approximate monthly net water use. Monthly in-house net water use estimates were converted to acre-feet using the standard 1 ac-ft = 325,850 gallons. Current domestic in-house net water use ranges from 3.8 to 4.2 ac-ft or approximately 0.07 cfs on an average monthly basis.

Irrigation Water Use

Refer to Chapter 4 page 4-35 for Table 4-16, WRIA 46 estimated average monthly/seasonal irrigation water use in acre-feet.

Reserve Water

It is important to note that water for homes, commercial enterprises, and other uses in the Entiat subbasin is not currently provided by a municipal water system, but via withdrawals occurring under permit exempt wells, water rights and claims. Thus, all future water withdrawals in the subbasin, whether associated with new water rights or permit exempt wells, would be conditioned by codified minimum instream flows. Codification of the Administrative Instream Flow regime proposed in Chapter 5, or for that matter the Planning Unit Flow regime (whose monthly flow exceedence values were usually higher than those of the Administrative Flow regime), would not provide a reliable year-round water supply sufficient to support new growth and associated water use in the valley. Recognizing this, the Planning Unit agreed to explore negotiation of a "Reserve" of water that would be senior to codified minimum instream flows.

A Reserve of 5 cfs was negotiated based on the Planning Unit's future water supply estimates and requirements discussed in Section 4.11, as well as evaluation of the potential impact of additional withdrawals. Biologists and resource specialists involved with creation of the Administrative [minimum] instream flow and Planning Unit flow recommendations described in Chapter 5 agreed that the Entiat system could support additional withdrawals up to 5 cfs without significantly impacting aquatic resources/existing beneficial uses.

Future Water Supply Requirements

A goal of the EWPU's water resources planning effort was to estimate what unconditioned reserve volume will likely be adequate to satisfy additional water needs in the Entiat subbasin through the year 2025. In doing so, the Planning Unit made a projection of the

population growth that may occur through the year 2025. A population larger than what was predicted by the county for the rural area of the Entiat CCD may or may not exist in 2025. Given that uncertainty, the EWPU used a higher projection to assure that adequate unconditioned water will be available for appropriation to beneficial uses in the Entiat valley if growth within this rural area of the Entiat CCD exceeds the county's projections, and ensure that adequate year-round water will be available to help the EWPU meet its long-term vision and goals for the subbasin, which include: providing for the coexistence of people, fish, and wildlife; sustaining lifestyles through planned community growth; and emphasizing local culture and economic stability in balance with natural resources. A future adequate tax base to insure support for the local school system is a high priority for local landowners.

In an effort to estimate what population was living solely in the Entiat and Mad watersheds in the year 2000, the Planning Unit used a GIS to select census blocks from the Entiat CCD that fell entirely or largely within the Entiat and Mad River watersheds, but outside of the UGA. Entiat CCD census blocks that included people living in the Entiat UGA or the minor Columbia River tributaries area were excluded from consideration. Data showed that approximately 839 people were living in the subbasin in the year 2000.

To project what future Entiat subbasin population may require water appropriated from within this area of the WRIA, the Planning Unit analyzed census block data from 1990 and 2000. The average annual rate of growth in the subbasin over this decade was 1.156%. This rate of population growth was applied to the year 2004 potential population of 1274 people (470 housing units x 2.71 people per household = 1274) to derive a future population estimate of 1641 people total, or up to 367 additional people living in the Entiat and Mad watersheds in 2025.

Future Domestic Water Estimates

It was estimated that 0.02 cfs of water may be necessary to satisfy future domestic in-house net water use needs for 135 new housing units through the year 2025.

It was estimated that about 1 cfs will likely be sufficient to accommodate future domestic in-house, irrigation and stock water needs in the Entiat and Mad River watersheds through 2025 if population growth in the subbasin continued at the rate experienced over the period 1991-2000.

Future Commercial Agriculture Irrigation Water Estimates

The EWPU estimated that if 150 acres of orchard were planted, about 220 acre-feet of water would be needed during a very dry year in July. This volume translated into a maximum instantaneous rate of approximately 3.6 cfs. The EPWU agreed that 3 cfs of the Reserve should be sufficient to satisfy new agricultural uses through the year 2025.

Future Commercial/Industrial Water Estimates

The EWPU estimated that approximately 1 cfs of water should be placed in reserve for appropriation to future commercial and light/clean industrial uses in the subbasin. This estimate was made based on discussions with the LSC and other members of the EWPU about the desire to assure that water is available to support future economic growth in the valley.

Water Banking/Water Leasing

The EWPU agreed to provide information to water right holders in the Entiat and Mad River watersheds about the Washington Trust Water Program and similar water banking/leasing programs designed to prevent the relinquishment of existing water rights due to non-use, especially when orchard/agricultural land conversion occurs, and encourage use of such programs.

Water Storage Opportunities

The EWPU determined that once Administrative Flow numbers have been met during a given month, the opportunity for water storage should be available. The WDOE made a preliminary determination of water availability for the May 1 – July 15 time period so that a certain portion of actual flows that exceed recommended minimum instream flow numbers could be stored,

CHAPTER 5 - INSTREAM FLOWS

Instream Flow Incremental Methodology (IFIM)

IFIM is made up of a combination of problem solving tools and integrated computer models, such as PHABSIM, as well as steps intended to involve all stakeholders. It consists of four interrelated phases:

- Phase I: Problem identification and diagnosis,
- Phase II: Study planning,
- Phase III: Study implementation, and
- Phase IV: Alternatives analysis/problem resolution.

In preparation for developing minimum instream flow recommendations, the Planning Unit and WDOE sponsored a three-day IFIM training in March 2000 to educate interested parties on the IFIM process and instream flow setting in Washington State. Subsequently, at their June 2000 meeting, the EWPU agreed to use a robust application of IFIM as their approach to addressing instream flow issues. The Planning Unit obtained Salmon Recovery Funding Board (SRFB) funding, and the consulting firm ENTRIX, Inc. (ENTRIX) was hired in September 2001 to work with the EWPU and the instream flow subcommittee on this issue. Information needed for setting instream flows was collected within the watershed in 2002/2003.

Instream Flows

Between February and October 2003, six professionally facilitated meetings were held to bring stakeholders together to craft instream flow recommendations for the Entiat and Mad Rivers. Significant effort was made to ensure that interested stakeholders not participating as regular Planning Unit members were either present at the table or informed of the EWPU's efforts.

Planning Unit Instream Flows

The Planning Unit and ENTRIX developed three biologically-based Planning Unit flow regimes for subbasin management and monitoring purposes. These flows are displayed in Chapter 5, beginning on page 5-13.

Administrative Instream Flows

The Planning Unit also developed Administrative Instream Flow recommendations for codification as minimum instream flows in Chapter 173-546 WAC. Three flow regimes were developed and tied to USGS gages:

- lower Entiat River, tied to the Keystone gage (USGS #12452800, Entiat near Entiat);
- upper Entiat River, tied to the Stormy gage (USGS #12452890, Entiat near Ardenvoir);
- Mad River, tied to USGS #12452990, Mad at Ardenvoir.

The following table displays the recommended administrative instream flows for the Entiat and Mad Rivers:

Monthly/Semi-monthly period	Recommended Flow (cfs) for Lower Entiat RM 0-16.2	Recommended Flow (cfs) for Upper Entiat RM 16.2-25.8 miles	Recommended Flow (cfs) for Mad River at RM 4
January	185	175	32
February	185	175	32
March 1-15	185	175	32
March 16-31	250	285	68
April 1-5	250	325	100
April 16-30	350	375	100
May 1-5	474	375	100
May 16-35	720	375	100
June 1-5	898	325	100
June 16-30	617	325	100
July 1-15	365	275	68
July 16-31	268	275	68
August 1-15	185	275	68
August 16-31	185	275	51
September	185	175	32
October	185	175	32
November	185	175	32
December	185	175	32

Percent exceedence levels associated with the above flows are displayed on tables in Chapter 5, e.g. an exceedence of 90% indicates that the given flow is expected to be met or exceeded 90 percent of the time. Refer to Chapter 5 for a discussion of Percent Exceedence levels; see page 5-17 for the beginning of the proposed Administrative Instream Flows tables and hydrographs.

CHAPTER 6 - WATER BUDGET

Introduction

A water budget is basically an accounting ledger that contains water credits and debits, i.e. an estimate of water present within the system (credit); what water is needed to accommodate future domestic, commercial and agricultural use (debit); what flows are required to be left in stream for the protection of *existing* beneficial uses, including water for

irrigation and fish (debit); and what actual water use is occurring (debit). The difference between the credit and debit numbers shows what water is available during different months of the year for future appropriation.

Water Budget Format

A primary reason for development of a water budget is to determine at what times of year water resources are scarce and/or require management. Consequently, the EWPU water budget shows flow and water use data by month, with semi-monthly values added as necessary due to administrative instream flow recommendations.

WRIA 46 is composed of two main drainages, the Entiat and Mad River watersheds, as well as an area containing minor Columbia River tributaries. A water budget spreadsheet was developed for each of the major drainage areas in the WRIA (Entiat River, Mad River, and minor Columbia River tributaries); the Entiat River was also split into upper and lower reaches. Dividing the WRIA into four different areas was done to facilitate estimation of the amount of water present and actual water use, as well as the development of instream flow and water management recommendations. Channel geomorphology, fish habitat and use, land and water use, settlement patterns, and the hydrologic connectivity of these areas, as well as where administrative instream flows would be monitored, were all used to help determine how to split the WRIA.

Data Inputs

A number of studies were sponsored by the EWPU to collect data for use in the development of its water budget. Data from a number of sources, including stream gage records, in-field flow measurements, and Geographic Information System (GIS) modeling of aquifer thickness and extent were used. These studies and data have been detailed previously in Chapter 4, Water Quantity.

Upper Entiat River Budget

Flows for the upper Entiat River are monitored at the Stormy gage (Entiat near Ardenvoir USGS gage, at RM 18). It was estimated that water use occurring upstream of this point is associated with the irrigation of approximately 20 acres of residential property (lawn), and totals only 80 acre-feet annually. Average peak monthly use in July accounts for approximately 20 acre-feet, which is negligible in comparison to the average July monthly volume of stream flow produced by the entire subbasin (46,955 acre-feet, based on composite Keystone gage record).

The tables in Chapter 6 on pages 6-4 and 6-5 show mean monthly and/or semi-monthly flow recorded at the Stormy gage in cfs and acre-feet, respectively, as well as the estimated water use occurring upstream of this point.

Lower Entiat River Budget

Flows in the lower Entiat River are monitored at the Keystone gage (USGS gage #1245990, Entiat near Entiat), located approximately 1.4 miles upstream of the Entiat's confluence with the Columbia River. In this portion of the Entiat River watershed irrigation water use accounts for almost all use occurring in the subbasin. Peak use occurs in July, with average monthly net irrigation water use totaling 1511 acre-feet (~25 cfs), or 3% of the average

monthly volume of water produced during this month (47,039 acre-feet or ~765 cfs). As the Keystone gage site is essentially the “pour point” for the entire Entiat subbasin, the water budget tables for the lower Entiat River in Chapter 6 on page 6-7 and 6-8 reflect all upstream water uses recorded within the subbasin. The “Naturalized” mean flow approximates what stream flow would be recorded at the Keystone gage were no upstream water use occurring. Additionally, *water use associated with residences found in the lower Mad River was included as part of the lower Entiat River use for the following reasons:*

- There is a high degree of connectivity between surface and ground water in the Entiat subbasin;
- There is very minimal private land ownership upstream of RM 2 in the Mad River;
- The primary domestic water source in the lower Mad River is wells; and
- The lower Mad River and area around its mouth are part of an alluvial fan, and therefore groundwater drawn from the lower Mad River is likely a part of the larger unconsolidated alluvial valley aquifer.

Mad River Budget

Refer to Chapter 6, page 6-9 for an overview of the Mad River budget.

Minor Columbia River Tributaries Budget

This water budget addresses the minor, often ephemeral streams above the Entiat River-Columbia River confluence as far north as Oklahoma Gulch and below the confluence as far south as Swakane Canyon (both drainages included). These drainages, though encompassed within the Entiat WRIA, flow directly into the Columbia River. Much of their area is either state (WDFW) or federally (USFS) owned; private property (excluding the City of Entiat) is largely concentrated in a narrow strip along the Columbia River and astride State Highway 97A.

Water in this area is not immediately connected to the Entiat subbasin system, nor is any surface flow from these drainages connected to or influenced by the Entiat system. For these reasons, and considering the limited potential for future residential or agricultural development of these drainages, the EWPU did not examine water quantity for the CRT with the same rigor as the upper and lower Entiat and Mad Rivers.

CHAPTER 7 - HABITAT

Aquatic Habitat

Physical, chemical and biological characteristics comprise the aquatic habitat of river systems. Physical habitat includes parameters such as channel dimension, stream flow and riparian vegetation; chemical variables include water pH and nitrate levels; and biological components serve as indicators of the ecological community that utilize the river, e.g. fish and macroinvertebrate species composition and diversity. Discussion in this chapter focuses mainly on the physical and biological habitat indicators of the Entiat subbasin, as many of its chemical characteristics are discussed in Chapter 8, Water Quality.

Physical Characteristics

Water Temperature

USFS Entiat RD temperature data collected annually since the early 1990's show state water quality temperature standard exceedences in the Entiat and Mad Rivers during the late summer/fall period for each year of monitoring. The Entiat Watershed Assessment (WNF 1996) reported that the (then) current data base showed much variation in the extent, duration, and location of summertime highs. Low winter water temperatures may be more of a limiting factor to the survival of salmonids than summer high water temperatures. Because water temperature is treated as a water quality element in this plan, additional historic data and information about Temperature modeling are contained in Chapter 8, Water Quality.

Erosion and Sedimentation

Erosion and sedimentation are natural processes, integrally woven into the hydrologic cycle. The erosion/sedimentation cycle in the Entiat is highly variable, and the natural or historic range of variability of sediment production in this system is unknown. Variability is largely a function of snowmelt runoff, storm events and related disturbances. In the Entiat subbasin, it is estimated that approximately 80% of the average annual sediment load within a given year is associated with snowmelt peak flows (USDA 1979).

Fine Sediment

The USFS initiated annual fine sediment monitoring in critical reaches of the Entiat and Mad Rivers in 1993 and 1994, respectively, to monitor fine sediment deposition in salmonid spawning habitat, and help identify baseline condition and the natural range of variability for the Entiat River subbasin. Analyses of all data collected since 1993 suggest that the Entiat and Mad River watersheds have been working to recover from the effects of fire-related events, as shown by the gradually improving trend in mean annual percent fines $\leq 1.0\text{mm}$.

Channel Morphology

Stream channel morphology (general channel shape) and stream type classification consider numerous parameters, including channel width to depth ratio, slope/gradient, substrate composition and roughness, and sinuosity.

In the fall of 1995, the NRCS "Stream Team" (an interdisciplinary team composed of specialists in riparian ecology, stream geomorphology, fish ecology, aquatic habitat, and geology) conducted a comprehensive survey of the lower 20.1 miles of privately held lands in the Entiat River corridor in order to inventory and classify stream types "...for the purpose of generating alternatives for stream bank management, fish habitat improvement, and river restoration that was compatible with the river's geomorphic features and historic anadromous fish populations (CCCD 1998. The complete study report is contained in the reports file. Information on two of the Entiat River reaches is presented below.

The Potato Creek terminal moraine at Albert "Shorty" Long's property (RM 16.2) is a key location for discussion of channel structure in the drainage. Upstream of the moraine, channel morphology is glacially influenced, and channel shape is dictated primarily by natural fluvial processes, such as bankfull discharge, and valley geomorphology. This is illustrated by the C4 and C5 stream types present upstream of the moraine (low gradient,

meandering, point-bar, riffle/pool, alluvial channels with broad, well-defined floodplains). Within this reach, conflict between streamside development and floodplain function is an increasing concern.

Downstream of the Potato Creek moraine, between the town of Ardenvoir and the mouth of the Entiat, current stream channel shape has been influenced by past human activities, such as channel straightening/widening and diking (performed in an attempt to carry flood flows safely out of the subbasin) and streamside vegetation disturbance. Consequently, the F3 stream type is prevalent below the moraine, and the lack of aquatic habitat diversity, high width to depth ratio, and stream downcutting are concerns. The overall width to depth ratio of the lower 25 miles of the Entiat River is high (greater than 25), due to a combination of natural and human disturbances.

Biological Characteristics

Macroinvertebrates

Based on samples taken on April 22, 1992 Mad River site results showed good macroinvertebrate species richness and diversity; in comparison, the lower Entiat River site had low species richness with a high Percent Dominant Taxon value, which may have indicated environmental stress or an altered site (Smith 1992).

The WDOE Environmental Assessment Program collected biological samples in the lower Entiat River near the Keystone gage on August 15, 2002 as part of a state-wide effort to collect baseline macroinvertebrate community information, determine whether streams are biologically impaired, and provide a means to see whether biological results concur with ambient water quality monitoring data. Data indicate that the benthic macroinvertebrate community condition is generally healthy; however, specific characteristics of the community condition indicate slight degradation (C. Wiseman, WDOE, pers. comm. Dec. 2003).

Fish

Many species of anadromous and non-anadromous fish utilize the aquatic habitat of the Entiat and Mad River watersheds. Some fish found in the subbasin are currently listed under the Endangered Species Act. A summary of fish known and likely to occur in the subbasin, along with federally listed fish designations and candidate species which may be proposed for listing by the USFWS and/or NOAA Fisheries, is provided in Chapter 7.

The Washington Department of Fish and Wildlife maintains a state "Species of Concern" (SOC) list, which includes all state designated endangered, threatened, sensitive, and candidate species; state SOC list designations assigned to federally listed species are also provided. On 9/12/94, NOAA Fisheries initiated a status review of late-run Chinook, sockeye, and Coho salmon to determine if listing was warranted. Although it was determined at that time that listing was not warranted, these three species should also be considered Candidate ESA species.

Anadromous Fish

Several populations of economically and culturally important anadromous fish species reside within the Entiat subbasin. The Entiat and Mad Rivers currently support runs of steelhead and bull trout, and spring and late-run Chinook salmon. Coho salmon were once

present in the Entiat watershed (Mullan et al. 1992), but are now considered extinct (Nehlsen et al. 1991). Sockeye salmon were also introduced into the Entiat River at one point. Notably, both Coho and Sockeye have recently been found utilizing the Entiat River (USFWS MCRFRO 2002, 2003). Upper Columbia River (UCR) spring Chinook salmon and summer steelhead trout are listed as endangered and Columbia River bull trout are listed as threatened under the Federal Endangered Species Act (ESA).

Dams constructed near the mouth of the Entiat River beginning in 1889 blocked salmon from returning to the Entiat to spawn. Barriers erected on Entiat River persisted through the mid-1930s, and probably contributed to the Coho's extinction (Craig and Suomela 1941). A Bureau of Fisheries survey of the Entiat in 1934, 1935 and 1936 showed the river was virtually devoid of salmon and salmon runs in general were essentially nonexistent by the time Grand Coulee Dam was built in 1939 (Craig and Suomela 1941).

As part of the Grand Coulee Fish Maintenance Project (GCFMP), all returning adult salmon were trapped at Rock Island Dam from 1939 to 1943. A total of 3,015 adult late-run Chinook were collected from commingled upper river stocks and placed in upper Entiat River spawning areas; only an estimated 1,308 of these survived to spawn (Fish and Hanavan 1948). Shorty Long recalls that fish were planted in two locations above the terminal moraine, at Burns Creek and Decker's near Gray Canyon. A weir was constructed at the terminal moraine to keep the adult salmon from migrating downstream to the Columbia River before spawning.

Entiat National Fish Hatchery

The U.S. Bureau of Reclamation constructed the Entiat NFH approximately seven miles above the confluence of the Entiat and Columbia Rivers. It was authorized by Congress through the GCFMP on April 3, 1937 and reauthorized by the Mitchell Act (52 Stat. 345) on May 11, 1938. It was constructed by the US Bureau of Reclamation as mitigation for the Grand Coulee Dam, Columbia Basin Project. "The goal of these efforts was to rebuild salmon runs in the tributary streams to mitigate for lost production above Grand Coulee Dam" (USFWS MCRFRO 1998).

The U.S. Fish and Wildlife Service currently operate the hatchery as part of the Leavenworth NFH Mid-Columbia River Fisheries Research Office (MCRFRO) Complex. It is used for adult collection, egg incubation, and rearing of spring Chinook salmon. Rearing facilities include 42 starter tanks, 30 raceways, and two adult holding ponds. The Entiat River, Packwood Spring, and six wells provide water for the hatchery.

The average adult return for spring Chinook to the ENFH for the past 25 years has been just over 600 adults. This prohibits any significant harvest as all returning fish are needed to meet hatchery production level derived from the U.S. v. Oregon court decision, and other legal obligations.

Late-Run Chinook Salmon

It is suspected that late-run Chinook salmon were not a dominant life history type in the Entiat River system (Craig and Suomela 1941); however, a great effort was made to establish late-run Chinook in the Entiat after the GCFMP. Historically, two late-run

anadromous life history strategies may have been present in the subbasin. A summary of the past nine years of late-run Chinook salmon redd counts on the Entiat River is available in Chapter 7.

Spring Chinook Salmon

“Stream-type” Chinook salmon juveniles overwinter in the river and remain within the system for at least a year prior to migrating to the sea as yearlings. They return as adults to freshwater in the spring, but do not spawn until several months after their arrival. Stream-type Chinook are also referred to as spring Chinook. See Chapter 7 for a summary of spring Chinook redd expanded survey on the Entiat River.

Steelhead

Upper Columbia River summer steelhead spawn in the lower and mid-Entiat River (RM 0.5 to RM 28) and some of its tributaries, and in the lower Mad River, from March 15 to May 31. Mid-to-late-April has been observed to be the most likely steelhead spawning window in the Entiat and Mad Rivers (USFS 2003).

Survey data were used to designate a steelhead spawning index reach on the lower Mad River (RM 1.3-7.2), and future surveys of the Mad River will focus on this area. A summary of USFS spawning survey results in the Mad River may be found in Chapter 7.

USFS Entiat RD fish biologists have surveyed lower Roaring Creek (RM 1-2 during the spring of each year since 1999 in an attempt to confirm anecdotal accounts of historic steelhead spawning there. In 2003, two definite rainbow/steelhead redds with one 20-inch adult steelhead present were observed at approximately RM 1.5 (USFS 2003). A summary of steelhead redds by USFWS MCRFRO staff in the Entiat River during the spring of 2003 is found in the habitat chapter.

Sockeye Salmon

Sockeye salmon are not indigenous to the Entiat River (Craig and Suomela 1941). They were stocked only twice, in 1943 and 1944, from Lake Quinault and Lake Whatcom stocks (Mullan 1986). A small run of sockeye became established in the Entiat River, and were observed spawning in the Entiat River from 1945 to 1955 (Mullan 1986). The Entiat NFH collected sockeye from 1944 to 1963, propagated them between 1941 and 1969, and planted them elsewhere (Mullan 1986). Between 75 and 150 sockeye salmon were noted in the Entiat River during incidental counts over the period 1969 - 1981 (Mullan 1986).

Coho Salmon

Although Coho were once present in the Entiat subbasin, only 475 Coho were counted at Rock Island Dam from 1933-1943 (Andonaegui 1999). In October 2001, during their late-run Chinook spawning ground surveys on the Entiat River, the USFWS identified 12 Coho redds, three adults, and three carcasses between Dinkleman Canyon and Fire Station restoration sites. In 2002, one Coho carcass was noted between Keystone Bridge and the confluence with the Columbia River.

Non-Anadromous Fish

Rainbow (a resident form of steelhead), bull, westslope cutthroat, brook and interior redband trout use Entiat River and tributary habitat most or all their lives. Other important resident species found within the subbasin include mountain whitefish and Pacific lamprey. Bull trout are listed as threatened under the ESA, and in 2001 petition was made to list westslope cutthroat, Pacific lamprey, and other lamprey.

Bull Trout

Currently, bull trout found in the mainstem Entiat and Mad River are considered to be two distinct local populations. Bull trout have been found in small numbers in the mainstem Entiat River up to Entiat Falls, a natural barrier. The 1998 Bull Trout/Dolly Varden volume of the SaSI (Salmon Stock Inventory) report lists Entiat River bull trout stock as native with wild reproduction; however, stock status is listed as unknown. A summary of the results of all bull trout spawning surveys performed in the index reach of the Mad River is provided in Chapter 7.

Riparian Condition

The NRCS Stream Team performed an extensive survey of the lower 20 RMs of the Entiat River in 1995 (CCCD 1998). During the riparian inventory, they determined the dominant overstory species, percent of canopy cover, and dominate age class of the existing vegetation along the river. The study reported that degradation to riparian vegetation in the upper Entiat watershed was tied to historical overgrazing, road construction, certain timber harvesting activities, and recreation (CCCD 1998). Riparian vegetation and function in the lower portion of the Entiat watershed (below the FS boundary) has been affected by wildfire, agricultural encroachment on the floodplain, past flood control and channel straightening efforts, historic grazing, and rural residential development in the floodplain (CCCD 1998, Andonaegui 1999). Wildfire was noted as one of the primary disturbance factors affecting riparian vegetation.

A summary of vegetation inventory findings is provided in Chapter 7. Also refer to Chapter 9, Recommendations, for recommended riparian revegetation sites. The following text summarizes current riparian condition within the three analysis zones as described by the USFS Watershed Assessment (USFS WNF 1996).

From the headwaters to Entiat Falls, near RM 34 (transport zone): As described previously, riparian condition within this reach is good to excellent. Because most of this land is publicly owned the threat of future development and other environmental change is minimal.

From Entiat Falls to McCrea Creek, near RM 25 (transitional zone): Riparian condition within this reach is fair to excellent. As most of this zone is also publicly owned, the threat of development and other environmental change is again minimal.

From McCrea Creek to Mad River Confluence, near RM 10 (depositional zone): This reach includes the “stillwater” area, which is considered a prime fish habitat area. Some areas within this reach have been permanently protected via acquisition by the Chelan-Douglas Land Trust. Large segments of this reach burned in the 1994 Tye fire; recreation and

residential development has also affected riparian condition and function. As a result there are some areas within this reach that are either completely void of vegetation or have poor riparian function (small width).

From Mad River Confluence, near RM 10, to the river mouth (depositional zone): This is considered the priority area for riparian plantings within the Entiat watershed. Most of the stream-side land within this reach is privately owned, and data from the CWU study show that many of these areas are used for agriculture, including irrigated orchards and pastures.

The Planning Unit used riparian information documented in previous reports (USFS 1996; Lillquist and Erickson 2002; CCCD 1998), GIS analysis, and field checks to identify priority areas for riparian restoration and/or enhancement.

Fish Habitat Condition

The NRCS Stream Team inventoried the type and quality of fish habitat during their survey of the lower 20.1 miles of the Entiat River in 1995. Pools, riffles, glides/runs, and cascades were noted, as well as the presence of large pools, overhanging vegetation, large woody debris, large boulders, substrate, and undercut banks. Habitat frequency was also determined. The USFS Entiat RD also collects habitat data in reaches upstream of RM 20 via recurring stream surveys. The following synopsis of fish habitat conditions in the Entiat is based on the three analysis zones (transport, transitional, and depositional) described in the Watershed Assessment Entiat Analysis Area (USFS 1996) and also contains information from the NRCS "Stream Team" inventory (CCCD 1998) and the WRIA 46 Limiting Factors Analysis (Andonaegui 1989).

Refer to the figures beginning on page 7-43 in Chapter 7 for graphic overviews of longitudinal profile, analysis zones, channel type, gradient, fish use, and landmarks for the Entiat and Mad Rivers.

Transport Zone

In the transport zone [headwaters downstream to Entiat Falls (RM 33.8)], fish habitat condition in the mainstem is stable and assumed to be similar to the historic condition, with unembedded cobble/gravel streams and the number of large pools similar to or higher than numbers observed in the 1930's

Transitional Zone

In the transitional zone [RM 33.8 to McCreas confluence] the current condition of fish habitat in the mainstem Entiat has been modified from the condition found in 1930's surveys. Data indicate a 30-60% loss of pool habitat, yet the amount of pool habitat and large woody debris within this reach is the highest of the three Entiat reaches (CCCD 1998).

Depositional Zone

The depositional zone [McCreas Creek confluence downstream to the mouth] contains the principal spawning and rearing habitat for anadromous fish in the Entiat River. Spring and summer Chinook and sockeye salmon, steelhead and bull trout, and other resident species all use the zone. The distribution of salmonids within this area is limited to the few fish-accessible tributaries above (Stormy Creek) and below (Roaring Creek, Mad River, Potato

Creek) the Potato Creek moraine (RM16.2). Overall, the condition of fish habitat in the depositional zone is fair to poor.

Fish habitat in the zone upstream from the Potato Creek Moraine is in good condition. In general, this reach has a good pool-riffle ratio, with pool habitat (geomorphic) at every 5 to 7 bankfull channel widths. Off-channel habitat exists in stable locations. In general, above the Potato Creek moraine, spawning and rearing conditions for salmon and steelhead are considered to be good to excellent, with adequate cover, favorable velocities and high flow refuge habitat (USDA Forest Service 1996).

Spawning and rearing conditions for salmonids in the lower mainstem Entiat River below the moraine are generally deemed poor (USFS 1996). The first 15.4 miles of the Entiat River show the result of human disturbances (CCCD 1998); county roads, flood control dikes and channel straightening associated with past flood control projects have dramatically simplified habitat in this section of the river, particularly below the Mad River confluence (RM 10.5).

All of the aforementioned practices in combination constitute the greatest impact to salmonid habitat in the mainstem Entiat downstream of the Mad River confluence. Alterations to channel shape have reduced the amount of habitat available at current flow levels: the increase in water required to provide historic habitat in the altered channel is simply unavailable or impractical to attempt to achieve. A more pragmatic approach is to focus on restoring an appropriate channel morphology that supports adequate habitat given the existing hydrology. This does not preclude water conservation measures, it merely emphasizes that water alone is not the solution to restoring lost habitat.

Entiat Ecosystem Diagnosis and Treatment (EDT) Analysis

The Yakama Nation and other EWPU Habitat Subcommittee members worked with Mobrand Biometrics, Inc. to model Chinook salmon response to various restoration scenarios using the Ecosystem Diagnosis and Treatment (EDT) methodology. EDT is an analytical method relating habitat features and biological performance to support conservation and recovery planning. It brings together information from empirical observation, stakeholders and local experts, and other models and analyses tools. The Diagnosis is based on an assessment of the relative contributions of environmental factors to the biologic performance of naturally produced Chinook salmon.

A team of technical specialists using all of the information relating to habitat contained in this and other chapters and the EDT model developed alternative treatments for the habitat of the Entiat watershed. This work included field verifying reach habitat attribute values to help ensure that model inputs accurately reflected current conditions. Because the EDT analysis is highly technical and would be extremely difficult to summarize here, those interested in specifics should refer to the full analysis in the report files.

Alternative Management and Restoration Scenarios (Treatments)

In an EDT analysis, restoration scenarios are comprised of different combinations of distinct types of restoration actions. In the Entiat analysis, five types of restoration actions were combined into five restoration scenarios targeting 11 of the 16 reaches of the Entiat River.

Alternative Management Scenarios for EDT Modeling

Actions	Rock Cross Vanes or other structures (Reaches 2-9)	Riparian Plantings (Reaches 2-9)	Log / LWD Placement	Side Channel Connection (Reach 3)	Irrigation Ditch as Habitat	Habitat Protection and Restoration (Reaches 10,11,12)
Alternatives	(structures)	(lineal feet)	(sites)	Yes / No	Yes / No	(sites)
1	20	10,000	5	No	No	No
2	40	20,000	10	No	No	No
3	80	40,000	20	No	No	No
4	80	40,000	20+	Yes / No	Yes / No	Yes / No
5	80	50,000	40	Yes / No	Yes / No	Yes / No

Alternative Themes

Alt 1	This alternative describes a relatively low level of effort towards application of the "Bridge to Bridge" concept (focuses Fire Station Bridge to J/S Bridge), using additional rock cross vanes or other instream structures, associated riparian plantings and some channel stability using root-wads and LWD structures.
Alt 2	This alternative is directly associated with Alternative 2 from the Entiat Coordinated Resource Management Plan (CRMP) . Most of the work would occur in the lower Entiat main-stem. This alternative describes a "minimal" requirement for migration, spawning, resting and rearing habitats in CRMP Reaches 1-6 and minimum root-wad revetments in CRMP Reaches 7-8.
Alt 3	This alternative is directly associated with Alternative 4 from the Entiat CRMP . All of the work would be spread throughout Reaches 2-9 (as identified in the CRMP) of the Entiat main-stem. This alternative provides for "approximately 40% of the historic pool frequency, resulting in an average of 3 pools per mile in Reaches 1-6 and 8 pools per mile in Reaches 7-8".
Alt 4	This alternative provides for the maximum recommended action included in the CRMP Alternative 4. Additional enhancement components are anticipated in the Bridge to Bridge concept (Reach 3), and upstream into the Stillwater area Reaches 10, 11, 12.
Alt 5	This alternative enhances Alternative 4 by providing substantially more large wood structures, and consequently more pool habitat and habitat diversity to reaches 10 and 11. Approximately 4 lineal miles of riparian plantings are also considered. This alternative assumes some degree of conservation easements and/or habitat protection would be implemented by willing landowners.

Wildlife Habitat

Wildlife and plant species and habitats with Federal designations in the Entiat subbasin include:

LISTED**Threatened**

Bald eagle (*Haliaeetus leucocephalus*)

Canada lynx (*Lynx canadensis*)

Gray wolf (*Canis lupus*)

Grizzly bear (*Ursus arctos* = *U.a. horribilis*)
Marbled murrelet (*Brachyramphus marmoratus marmoratus*)
Northern spotted owl (*Strix occidentalis caurina*)
Ute ladies'-tresses (*Spiranthes diluvialis*), plant

Designated

Critical habitat for the northern spotted owl (*Strix occidentalis caurina*)

CANDIDATE

Fisher (*Martes pennanti*), West Coast distinct population segment
Yellow-billed cuckoo (*Coccyzus americanus*)

The Washington State Department of Fish and Wildlife publishes a "Priority Habitats and Species List" which helps to identify vertebrate and invertebrate species and habitats that are considered to be priorities for conservation and management. Priority species require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. These species include State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. Many priority species use the wildlife habitats within the Entiat WRIA for at least part of the year. Habitats included in the priority listing which occur in the Entiat WRIA include: aspen stands, caves, cliffs, old-growth/mature forests, prairies and steppe, instream, riparian, shrub-steppe (both large and small blocks), snag habitat, talus, urban natural open space, freshwater wetlands and deepwater habitats.

The WDFW also publishes a Species of Concern list of only native Washington fish and wildlife species that are listed as Endangered, Threatened, or Sensitive, or as Candidates for these designations. Endangered, Threatened, and Sensitive species are legally established in Washington Administrative Codes. The USFWS provides a list of Species of Concern as advance notice to federal agencies of species that may be proposed for listing in the future. See Appendix K for Priority Habitats and Species, Species of Concern, and rare/sensitive plants that may be found within the Entiat WRIA.

CHAPTER 8 - WATER QUALITY

The Entiat River is classified as a Class A (excellent) stream from its confluence with the Columbia River to the boundary of the Wenatchee National Forest at approximately RM 26, and as a Class AA (extraordinary) stream from the National Forest boundary to its headwaters. It supports beneficial uses including domestic, industrial and agricultural water supply and primary contact recreation.

With the exception of the post-1994 Tye Fire sampling, and ongoing USFS temperature data collection, very little of the available tributary data are more recent than the mid-1980s. Temperature exceedences are the most common type of water quality issue in the

tributaries, with infrequent excursions for dissolved oxygen, fecal coliform and pH also occurring. No increasing trends were seen.

There is no indication of any significant degradation within the WRIA with respect to fecal coliform, dissolved oxygen, pH, or turbidity. Temperature exceedences in the summer months have been identified throughout the record, beginning in 1960. Occasional temperature exceedences may have occurred naturally prior to settlement of the Entiat valley; however, it is impossible to determine the magnitude or frequency of this type of historic exceedence given the existing data record. It is likely that the number and frequency of exceedences has increased due to a combination of historic manipulation of channel geometry and removal of riparian plants, coupled with natural flood and wildfire events, which have also affected streamside vegetation.

The Planning Unit used the Stream Network Temperature Model to examine temperature exceedence patterns in the Entiat subbasin and identify actions, such as enhancing riparian vegetation, which can be implemented to help mitigate high summer water temperatures. The WDOE is recommending to the USEPA that the Entiat *not* be placed on the 2002/2004 303(d) list for temperature, but rather receive a “4b” categorization – impaired but has a pollution control plan – as a result of the Planning Unit’s past and current efforts to address the problem.

Ongoing monitoring of water quality by the WDOE ensures that any trends indicating degradation of the Entiat River will be quickly identified. Maintaining current efforts and practices, and the future implementation of specific projects aimed at improving water quality will ensure that the Entiat River and its tributaries continue to regularly meet or exceed state standards in the foreseeable future.

CHAPTER 9 - RECOMMENDATIONS

Refer to Chapter 9 for all recommendations developed during the CRMP/2514 process.

CHAPTER 10 - MONITORING AND EVALUATION

Chapter 10 provides a summary of ongoing monitoring activities, types of data collected, and partners involved with monitoring in the Entiat subbasin.