WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Final Programmatic Environmental Impact Statement For The Ahtanum Creek Watershed Restoration Program

June 2005
Shorelands and Environmental Assistance Program
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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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Dear interested parties:

This State Environmental Policy Act (SEPA) Final Environmental Impact Statement (EIS) has been prepared to assist the Department of Ecology (Ecology), other participating agencies and entities, and the public in evaluating conceptual approaches to the development of a Watershed Restoration Program for Ahtanum Creek. The creek and its associated watershed are currently experiencing significant problems associated with habitat degradation, low stream flows, and inadequate supplies of water for irrigation. Over the past several years, Ecology and a number of tribal, federal, state, and local agencies and entities have been working together to identify the most appropriate methods for addressing those problems.

The Draft EIS for the Watershed Restoration Program was released in February 2005. Written public comments on the Draft EIS were accepted until March 24, 2005. A public open house was held on March 10, 2005 to solicit additional comments on the Draft EIS. The comments received are included as Chapter 9 of the Final EIS. Written responses are provided for each comment. Where appropriate, changes have been made to the EIS text in response to comments or to provide clarification or updates to information. These text changes are included in the Final EIS in redline/strike out mode.

The Final EIS will form the basis for subsequent development of the Ahtanum Creek Watershed Restoration Program. This EIS process has evaluated a programmatic or non-project action for Watershed Restoration. It is likely that a number of the major elements of the completed Watershed Restoration Program would trigger additional project level environmental review under SEPA.

Sincerely,

Derek I. Sandison
Central Regional Director
SEPA Responsible Official

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR THE AHTANUM CREEK WATERSHED RESTORATION PROGRAM

FACT SHEET

Brief Description of Proposal:

The Washington State Department of Ecology (Ecology) is facilitating development of a Watershed Restoration Program for the Ahtanum Creek Watershed. The Ahtanum Creek Watershed Restoration Program (ACWRP) is intended to resolve water resource problems in the watershed by providing a unified program to restore streamflows and fish habitat and to improve water supply for irrigation. The Programmatic Environmental Impact Statement (EIS) evaluates conceptual approaches to a watershed restoration program. The evaluation of the conceptual approaches will be used by Ecology in conjunction with other interested agencies and entities to develop the Ahtanum Creek Restoration Program.

Proposed or Tentative Date for Implementation:

The exact timeline for the ACWRP is not known at this time. To facilitate the analysis in this Programmatic EIS, the impacts and benefits of the project were evaluated for a period of 30 years following implementation of the restoration program. For purposes of the analysis, it was assumed that the reservoir, if it were constructed, would be operational in 2010. The 30-year time frame for analysis was chosen because that is the likely time period in which the benefits of habitat restoration would be realized (for example, it takes 30 years for trees to mature) and it was a likely time period in which on-farm conservation measures and changes in cropping would take place. The actual timeline for the project would likely vary and adjustments would be made when the project level EIS is prepared.

Proponent:

Ecology will facilitate the development of the ACWRP in conjunction with various interested agencies and entities.

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Permits, Licenses, and Approvals Potentially Required for Proposal:

In consideration of the potential variability in content of the proposed alternatives, it is not possible to present an exhaustive list of permits, licenses, and approvals that may be required for each alternative presented in this Programmatic EIS. It is possible, however, to identify a number of the most common types of permits, licenses, and approvals associated with water resources and habitat that would generally be required for the alternatives presented in this document. These permits, licenses, and approvals, listed below by the jurisdictional agency, would be required for portions of the watershed not located on the Yakama Reservation:

Federal Permits, Licenses, and Approvals

Section 404 permit – U.S. Army Corp of Engineers
Section 10 permit – U.S. Army Corp of Engineers
Endangered Species Act consultation – NOAA Fisheries
Endangered Species Act consultation – U.S. Fish and Wildlife Service
Section 106 of the National Historic Preservation Act – federal lead agency

State Permits, Licenses, and Approvals

Water use permit/certificate of water right – Department of Ecology
Reservoir permit/aquifer storage and recovery/secondary permit – Department of Ecology
Dam safety permit – Department of Ecology
National Pollutant Discharge Elimination System permit – Department of Ecology
Section 401 water quality certification – Department of Ecology
Shoreline conditional use permit, or variance – Department of Ecology
Water system plan approval – Department of Health
Hydraulic project approval – Department of Fish and Wildlife
Forest practices approval – Department of Natural Resources

Local Permits, Licenses, and Approvals

Critical areas permit or approval – Yakima County, City of Yakima or City of Union Gap
Floodplain development permit – Yakima County, City of Yakima or City of Union Gap
Shoreline substantial development permit, conditional use permit, or variance – Yakima County, City of Yakima or City of Union Gap
Clearing and grading permit – Yakima County, City of Yakima or City of Union Gap

Activities undertaken on properties located on the Yakama Reservation would require permits from the Yakama Nation, including permits from the Yakama Nation Water Code Program and Zoning Office. A list of applicable permits for activities on the Yakama Reservation would be developed when the details of the ACWRP are known.

Authors and Contributors to the Programmatic Environmental Impact Statement

Adolfson Associates, Inc. – Principal Author, Earth, Plants and Wildlife, Aesthetics, Land Use, Public Utilities
Montgomery Water Group – Surface Water, Water Rights, Public Utilities
SLR, Inc. – Earth, Groundwater
Cascadia Law Group – Water Rights
Mobrand Biometrics – Fish and Wildlife
Richard Mack, Ph.D, Central Washington University Department of Economics – Economics
Western Shores Heritage Services – Cultural

Date Final Action Is Planned or Scheduled:

It is anticipated the final selection of an alternative presented in this draft Programmatic EIS will be made by Ecology in coordination with other interested parties or entities in 2005. It is anticipated that the Watershed Restoration Program will be ongoing thereafter.

Timing of Additional Environmental Review:

This basin-wide nonproject Programmatic EIS has been prepared to generally address probable significant adverse impacts associated with proposed Ahtanum Creek Watershed Restoration Program alternatives. Individual projects associated with the restoration program will require additional environmental review. If a reservoir alternative is selected, it is anticipated that the project level EIS on reservoir construction would be prepared in 2007.

Date of Issue of the Draft EIS

February 22, 2005

Date of Issue of the Final EIS

June 23, 2005

Changes to the Draft EIS

For this Final EIS, the Draft EIS has been amended to reflect responses to comments. Changes to the text of the Draft EIS are indicated as follows: new text is bold and underlined and deleted text is shown in strikeout mode (~~deleted~~). A bar is present on either the left or right side of the page to indicate revised text. Comments received on the Draft EIS are include in Chapter 9 along with responses to those comments. Figures 1-2, 4-2, and 4-8 have been revised.

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FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR THE AHTANUM CREEK WATERSHED RESTORATION PROGRAM

ACKNOWLEDGEMENTS

This project was managed by the Washington Department of Ecology. Ecology worked cooperatively with members of the Ahtanum Core Group to develop the alternatives for this EIS. The Ahtanum Core Group consists of representatives of the Ahtanum Irrigation District, Yakima County Public Works Department, NOAA Fisheries, US Fish and Wildlife Service, Washington Department of Fish and Wildlife and the Yakama Nation. The Ahtanum Core Group also provided valuable guidance throughout the process and promoted open and thoughtful technical discussions during the project.

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Abbreviations and Acronyms

AID	Ahtanum Irrigation District
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
cfs	cubic feet per second
cm/sec	centimeters per second
Ecology	Washington State Department of Ecology
EDT	Ecosystem Diagnosis and Treatment model
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEMA	Federal Emergency Management Agency
HPA	Hydraulic Project Approval
IFIM	Instream Flow Incremental Methodology
LWD	large woody debris
NEPA	National Environmental Policy Act
NOAA Fisheries	National Oceanographic and Atmospheric Administration, National Marine Fisheries Service
NRHP	National Register of Historic Places
OAHP	Office of Archaeology and Historic Preservation
PIA	Practicably Irrigable Acreage
QHA	Qualitative Habitat Analysis tool
RCW	Revised Code of Washington
RM	river mile
SEPA	State Environmental Policy Act
SMA	Shorelines Management Act
SMP	Shoreline Master Program
SSTEMP	Stream Segment Temperature Model
TWSA	Total Water Supply Available
UGA	Urban Growth Area
UGB	Urban Growth Boundary
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WIP	Wapato Irrigation Project
YTAHP	Yakima Tributary Access and Habitat Program

CHAPTER 1.0 DESCRIPTION OF PROPOSAL AND BACKGROUND

1.1 Introduction

The Ahtanum Creek Watershed is located on the east slope of the Cascade Mountains in Yakima County and on the Yakama Reservation. Ahtanum Creek is a tributary of the Yakima River and enters the river south of the city of Union Gap (see Figure 1-1)[1]. The Ahtanum Creek Watershed covers approximately 116,000 acres (approximately 181 square miles). There are two forks of Ahtanum Creek—the North and South Forks. For purposes of this Environmental Impact Statement (EIS), the watershed has been divided into three reaches (see Figure 1-2). The upper reach encompasses the North and South Forks and extends from the headwaters east to their confluence near Tampico. The middle reach extends east from Tampico to Wiley City, and the lower reach extends east from Wiley City to the confluence of the creek and the Yakima River.

The upper reach of the watershed is in mixed tribal, public and private ownership and is mostly managed forest lands with some residential and agricultural lands, especially near the North and South Forks confluence. The middle reach of the watershed is dominated by agriculture (primarily pasture lands) mixed with residential lands. The lower reach of the watershed becomes increasingly residential and urban as the creek approaches the Yakima River, but there are also agricultural lands located in the lower reach.

The Ahtanum Creek Watershed is located in Yakima County, and most of the watershed is in the county's unincorporated area. The lower reach of the watershed falls within the jurisdiction of the cities of Yakima and Union Gap. The southern portion of the watershed falls within the Yakama Nation Reservation, with Ahtanum Creek forming the northern boundary of the Reservation in the middle and lower reaches. There are three~~two~~ unincorporated communities in the watershed—Wiley City, ~~and~~ Tampico, and Ahtanum.

Ahtanum Creek is used extensively for irrigation. The Yakama leader Kamiakin irrigated gardens along the creek and one of the state's first irrigation diversions, which is still active, is located at the St. Joseph Mission in the middle reach. Most of the irrigated lands in the watershed are located within the Ahtanum Irrigation District (AID). AID was formed in 1918 and operates under Revised Code of Washington (RCW) Title 87 (see Chapter 3, Section 3.1.3 for additional information). The total area within the AID's jurisdictional boundary is 10,320.67 acres (16.13 square miles). ~~The~~ According to AID, it currently assesses 10,319~~8,285~~ acres for tax purposes and serves approximately 5,470 acres with water. All surface water rights in the Ahtanum Watershed are currently being adjudicated. The Adjudication Court will confirm the number of acres that are actually irrigated by AID. Most of the AID water supply is pumped ~~directly~~ from the creek to Bachelor and Hatton Creeks and diverted directly from those creeks.~~;~~ ~~t~~The AID has little infrastructure. Some water users in the AID also use groundwater for irrigation and stock watering.

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[1] Standard maps have been used in this document; however, the Yakama Nation disagrees with the location of the reservation boundary depicted.

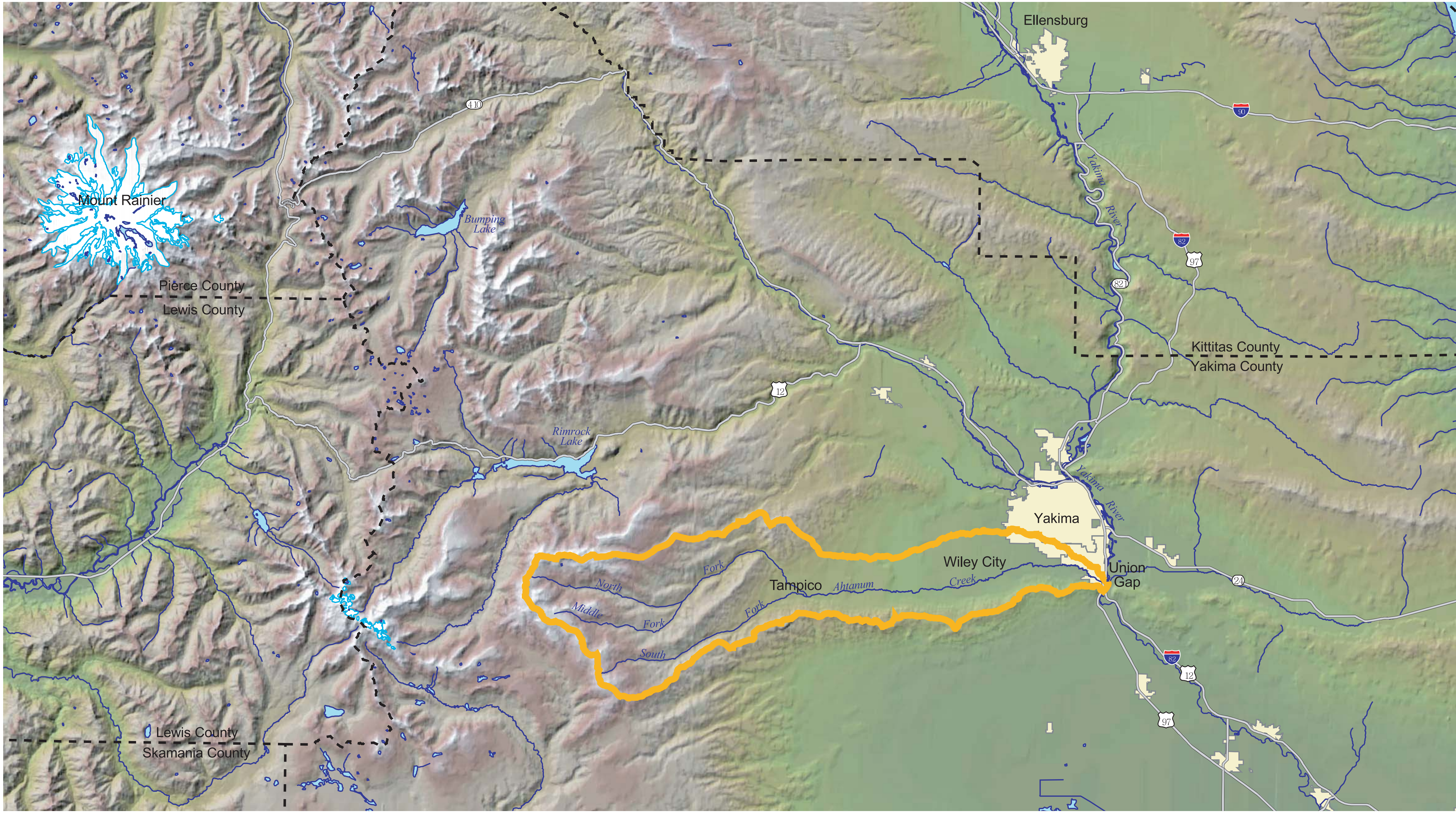
Other irrigation projects in the watershed include the Wapato Irrigation Project (WIP) and the Johncox Ditch. The WIP diverts water from Ahtanum Creek to serve Yakama Nation Reservation lands. The WIP is operated by the Bureau of Indian Affairs in coordination with the Yakama Nation (see Chapter 3, Section 3.1.3 for additional information). The Johncox Ditch is a private irrigation system that diverts water from the North Fork of Ahtanum Creek. This ditch serves the area south and west of the proposed Pine Hollow Reservoir location.

The dominant crops in the watershed under current conditions are hay and pasture. Other crops in the watershed include hops, vegetables, and fruit. Diversions from Ahtanum Creek are inadequate to meet the water demand for the crops grown in the watershed; therefore, most crops grown are of relatively low value (Golder, 2004). In areas where a more reliable water supply (such as groundwater) is available, higher value crops such as fruit and vegetables are grown. Most crops in the watershed are irrigated by sprinkler irrigation (82 percent). Only 2 percent of the crops are irrigated with efficient systems such as drip irrigation and 16 percent are irrigated with furrow and flood irrigation (Golder, 2004).

The Ahtanum Creek Watershed has historically been an important area for salmon, steelhead, and resident salmonids. Fish numbers have declined in the watershed because of degraded channel conditions, reduced stream flows, and fish passage blockages. Two fish species in the watershed are currently listed as threatened under the federal Endangered Species Act (ESA)—summer steelhead and bull trout.

1.2 Description of Proposal

The Washington State Department of Ecology (Ecology) is facilitating development of a Watershed Restoration Program for the Ahtanum Creek Watershed. Ecology managed the recently completed *Ahtanum Creek Watershed Assessment* (Golder, 2004), which evaluated current and probable future conditions in the watershed and provided the technical basis for developing strategies to protect stream flow, fish habitat, stream channels, and floodplains, while addressing needs for agriculture and other out-of-stream uses. The Ahtanum Creek Watershed Restoration Program (ACWRP) is intended to resolve water resource problems in the watershed by providing a unified program to restore stream flows and fish habitat and to improve water supply for irrigation. This Programmatic Environmental Impact Statement (EIS) evaluates conceptual approaches to a watershed restoration program. The evaluation of the conceptual approaches will be used by Ecology to develop the ACWRP.



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SOURCE: Golder Associates, 2003

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0 30,000
FEET

Map Projection:
Washington State Plane South
NAD83, Feet

LEGEND

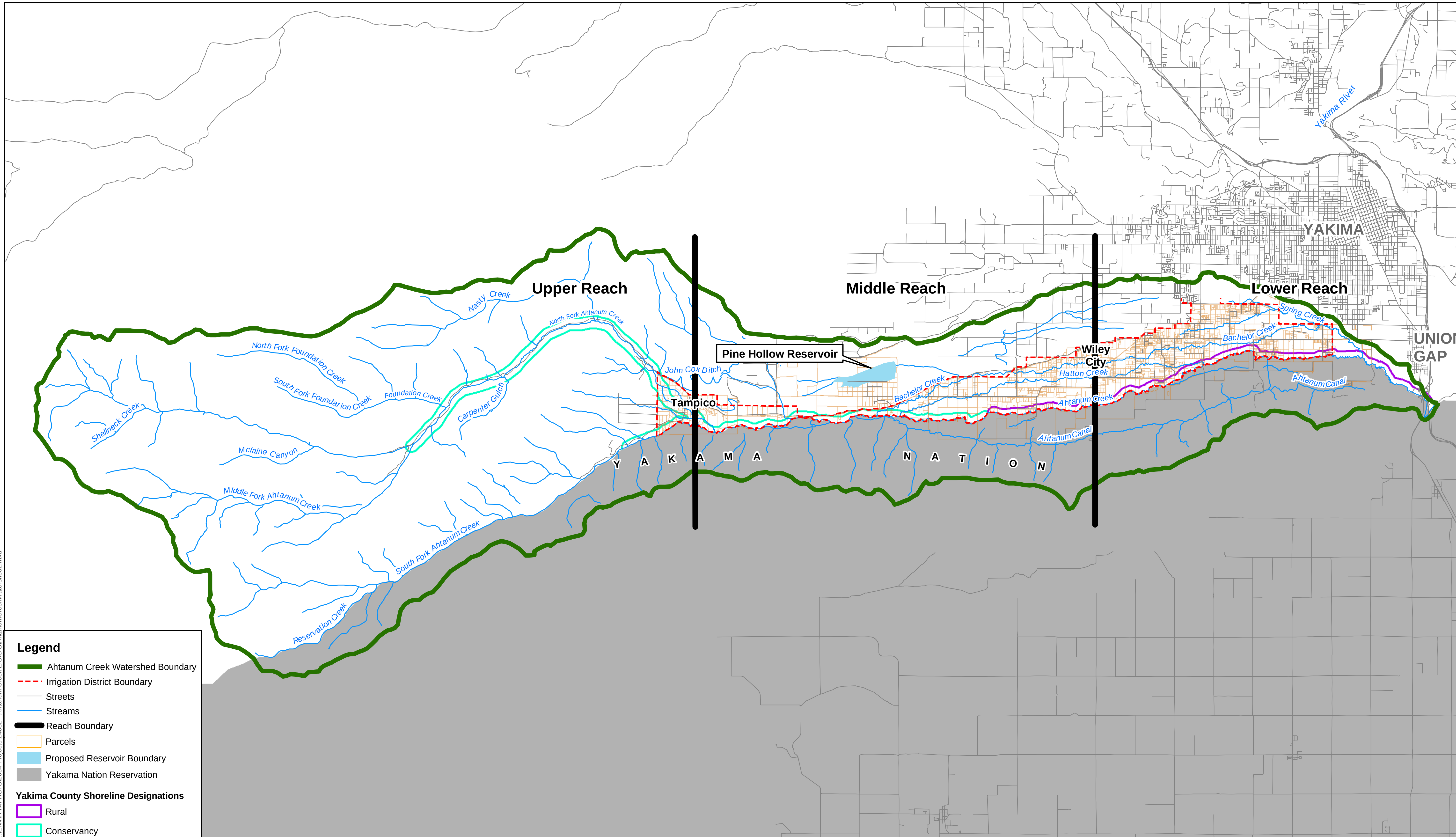
- Counties
- Roads
- Rivers and Streams
- Ahtanum Creek Watershed
- Water Bodies
- Ice / Snow

FIGURE 1-1

AHTANUM CREEK WATERSHED BASIN MAP

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON



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SOURCE: Ahtanum EIS, 2004; USGS topographic map, 1995

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0 6,250 12,500 25,000 37,500 50,000 Feet

1:150,000
1 inch equals 12,500 feet

FIGURE 1-2

AHTANUM CREEK WATERSHED REACHES

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON

1.3 Purpose and Need for the Proposal

The Ahtanum Creek Watershed is affected by a variety of water resource management problems related to unreliable water supplies, which cause problems for agriculture as well as fish habitat. Factors contributing to water resource problems in the watershed include the following:

- Insufficient stream flow to maintain channel conditions and high habitat values for fish species;
- Limitations in water supply for agricultural cropping and livestock production;
- Periodic flooding; and
- Periodic droughts (Golder, 2004).

The purpose of the ACWRP is to develop a coordinated program to address the water-related problems in the watershed.

1.4 Objectives of the Proposal

The objectives of the ACWRP are to:

- Develop water management strategies to improve water availability for agricultural and other out-of-stream uses in the Ahtanum Creek Watershed and provide a net benefit to the watershed aquatic ecosystem (such as fish, wildlife, plants, and habitat).
- Develop land use protection and restoration strategies to preserve and enhance Ahtanum Creek floodplain and habitat value, as well as the stability and longevity of the agricultural land uses and economy within the Ahtanum Creek Watershed.

1.5 Purpose of the Programmatic EIS

The purpose of this Programmatic EIS is to provide ~~the~~ a basis for assessing the effectiveness of specific projects or actions intended to meet the objectives of the ACWRP. The EIS assesses the effectiveness of such actions as the Pine Hollow Reservoir project, conservation measures, habitat restoration projects, and other actions in meeting the ACWRP goals of improving instream flows, fish habitat, irrigation water supply, water quality, stream channel integrity, groundwater recharge, and riparian habitat. The EIS meets the requirements of the State Environmental Policy Act (SEPA) to evaluate the impacts of the proposal at a programmatic level. A Programmatic EIS evaluates nonproject governmental actions such as policies, plans, or programs and is used as the basis for future project decisions.

1.6 Next Steps

Preparation of this EIS is the beginning of the process to develop a restoration program for the Ahtanum Creek Watershed. Ecology, in coordination with the Ahtanum Core Group, will use the findings of this EIS to develop the ACWRP. Elements of the ACWRP would be selected from the alternatives evaluated in this EIS. Depending on the alternative selected, additional

SEPA review may be required. Water conservation and habitat restoration projects could require state or federal permits or consultation under the ESA.

Many of the elements of the ACWRP would require additional economic, technical, cultural and environmental review. In addition, funding sources for elements of the program would have to be identified. If the funding source were federal, or if other federal actions were involved, a National Environmental Policy Act (NEPA) evaluation may be required.

The exact timeline for the ACWRP is not known at this time. To facilitate the analysis in this EIS, the impacts and benefits of the project were evaluated for a period of 30 years. For purposes of this analysis, it was assumed that the reservoir, if constructed, would be operational in 2010. The 30-year timeframe for analysis was chosen because that is the likely period in which the benefits of habitat restoration would be realized (for example, it takes approximately 30 years for many riparian trees to mature) and it was a likely time period in which on-farm conservation measures and changes in cropping would take place. The actual timeline for the project would likely vary, and adjustments would be made depending on the alternative selected for implementation.

1.7 Scoping Summary

In accordance with SEPA, a scoping period for the Draft EIS on the ACWRP was conducted from August 27, 2004, to September 16, 2004. An agency scoping meeting and a public scoping meeting were held on September 9, 2004. Public testimony was received at the public meeting. Fourteen written comments were received during the scoping period. Comments received are summarized in Table 1-1.

1.7.1 Agency Scoping Meeting

The agency scoping meeting was attended by representatives of the city of Union Gap and Ecology; members of the Ahtanum Core Group, including a representative of Yakima County; and EIS consultants. The main concerns expressed by the city of Union Gap related to the proposed Pine Hollow Reservoir and included the following issues:

- Impact of reservoir water releases on the temperature of Ahtanum Creek;
- Effect of the reservoir on domestic water supply;
- Effect of the reservoir on water quality of shallow wells near the creek;
- Effect of the reservoir and/or the associated habitat restoration program on flood control issues in Union Gap; and
- The need for reservoir flood control to be compatible with the Yakima County *Comprehensive Flood Hazard Management Plan* that is currently being developed.

1.7.2 Public Scoping Meeting

The public scoping meeting consisted of an open house with Ecology staff and EIS consultants available to answer questions from participants. Two court reporters were present to record oral comments. Although comment forms were provided for written comments, no comment forms were submitted during the open house. Two comment forms were mailed in following the open house, and those comments are included in Table 1-1.

During the open house, members of the public questioned staff and consultants about:

- Details of the alternatives;
- Location of the reservoir and who would be impacted;
- Timeline for reservoir construction;
- Details of reservoir operation; and
- Habitat restoration options.

1.7.3 Summary of Written and Oral Comments

Fourteen written comments were submitted during the comment period. Comments were received from the U.S. Bureau of Reclamation, Washington Department of Fish and Wildlife (WDFW), Yakima County Board of Commissioners, Yakima County Planning Services Division, city of Yakima City Manager, Ahtanum Irrigation District, Johncox Ditch, Director of the St. Joseph Mission, three state elected officials, and four private citizens.

Ten people provided oral testimony at the public scoping meeting. Two of these people also submitted written comments subsequent to the meeting. Oral testimony was received from a State Representative, the Mayor of Union Gap, the Director of the St. Joseph Mission, and seven private citizens.

Table 1-1 summarizes the written comments received and comments recorded at the public scoping meeting.

1.8 Summary of Alternatives

Four alternatives, including the No Action Alternative, are evaluated in this EIS. A brief description of the alternatives is provided here. A complete description of the alternatives can be found in Section 2.5.

Table 1-1. Summary of Written and Oral Comments

Issue	Comments	Total Number of Comments Received
Alternatives	Irrigation conservation measures should be included in project	1
	Include possibility of purchasing and retiring water rights in lieu of constructing reservoir	1
	Consider irrigating less than 11,000 acres from the reservoir to account for conversion of land to housing and areas that are too remote from reservoir to be efficiently served	1
	Need an alternative that allows diversion from the stream after July 10	1
Reservoir Operations	Need storage to provide water after July 10	1
	Water should be kept in Hatton and Bachelor Creeks year-round for stockwater, wildlife, and groundwater recharge	1
	Need to include provision for early season frost water	1
	Other sites for storage exist on private land that could supplement the project	1
	Project should include hydropower production	1
Water Rights	Bureau of Reclamation has a water withdrawal for available water in the Yakima River Basin associated with the Yakima River Basin Watershed Enhancement Project. The reservoir project may require a release from this withdrawal	1
	Impacts to the Total Water Supply Available (TWSA) need to be considered	1
	Agreement with Yakama Nation is needed before project proceeds	3
	Ahtanum Watershed is not subject to TWSA	1
	How will reservoir water be allocated? How much to reservation land, off-reservation land, and fish?	1
Land Use	Availability of water will make subdividing easier, increasing development pressure outside the Urban Growth Area	1
	Reservoir could result in increased demand for services and infrastructure outside the Urban Growth Area	1
	Traffic and other impacts if recreational use of reservoir is allowed	3
	Impacts of dam failure	1
	Reservoir will alter Federal Emergency Management Agency (FEMA) floodplain and affect land use limits	1
	Consider effect of current land uses and zoning on conversion to non-agricultural uses as well as preservation of agricultural land	2

Table 1-1. Summary of Written and Oral Comments (continued)

Issue	Comments	Total Number of Comments Received
	Consider zoning and land use regulation changes needed to facilitate reservoir development, habitat enhancement, and stream channel stabilization	1
	Consider impacts of changing land use on agricultural use in the basin	2
	Include a map of all land in the area proposed to benefit from the reservoir that has been zoned, short-platted, or platted for subdivision	1
Groundwater	Higher groundwater levels will impact septic systems	1
	Changes in groundwater patterns could impact wells, sub-irrigated fields, wetland hydrology	1
	Analyze ability of groundwater in the basin to sustain irrigation without a reservoir	1
Wetlands and Streams	Reservoir could alter wetland and stream patterns	1
Fish and Wildlife	Reservoir could benefit fish	1
	How will each alternative benefit fish?	1
	Which alternative will have the most fish benefit for the least cost?	1
	Need guarantee that reservoir water will be available for fish when needed	1
	Impacts to wildlife habitat along Johncox Ditch	1
Cultural Resources	Impacts to the St. Joseph Mission, including from pipeline	1
	Impacts on tribal allotments	2
Water Quality	New crops may require pesticides that will pollute creeks	1
	Temperature impacts need to be evaluated	2
Flood Control	Flood control benefits of the project should be clarified	1
	Need to stabilize streambanks to prevent flooding	1
	Any financial benefits from flood control should include explanation of how this was quantified	1
Economics	High value crops may not be suited to the climate of the basin	1
	High value crops may require new equipment and other conversions that farmers cannot afford	1

Table 1-1. Summary of Written and Oral Comments (continued)

Issue	Comments	Total Number of Comments Received
	Cost of the reservoir needs to be studied including: • How much will irrigators pay for the water? • How much irrigated land is suitable for higher value cropping? • How much land can be converted to higher value crops before market is saturated? • What is the payback period for taxpayer investment?	1
	Economic assumptions used in the Golder Watershed Assessment are not valid	1
	Financial impact of removing land taken by the reservoir from tax rolls	1
Others	Upstream timber harvest has affected function of the creek and watershed	1
	General comments in support of reservoir construction	14
	Need to know which parcels would be affected by the reservoir and land owners should be informed	1
	How long before the reservoir silts in?	1
	EIS should include the "next steps" for each alternative such as additional environmental review and other studies with an estimated time frame	1
	How much of the water that is needed could be provided by conservation, better technology, and habitat improvements?	1

1.8.1 Alternative 1 – No Action

- No coordinated watershed management would occur
- Independent water conservation and habitat restoration projects would continue

1.8.2 Alternative 2 – Watershed Restoration with Storage

- Coordinated watershed management program would occur
- Pine Hollow Reservoir would provide irrigation water to the AID and the WIP
- Coordinated water conservation measures would be implemented
- Coordinated habitat restoration projects would be implemented

1.8.3 Alternative 3 – Watershed Restoration without Storage

- No water storage reservoir would be constructed
- Coordinated water conservation measures would occur
- Coordinated habitat restoration projects would be implemented

1.8.4 Alternative 4 – Watershed Restoration without a Habitat Component

- Pine Hollow Reservoir would provide irrigation water to the AID and the WIP
- Coordinated water conservation measures would occur
- No coordinated habitat restoration projects would be implemented—independent projects would continue.

1.9 Impact and Mitigation Summary

The following section summarizes the identified probable adverse environmental impacts and proposed mitigation measures associated with the proposed alternatives for the ACWRP. A brief discussion of the assumptions used in the evaluation is also included. Impacts for each alternative are described followed by a brief discussion of general mitigation measures. Refer to Chapter 5 for further discussion of the short-term impacts and mitigation measures and to Chapter 6 for the long-term impacts and mitigation measures.

1.9.1 Evaluation Assumptions

In order to evaluate the potential impacts of the ACWRP at this programmatic level, a number of assumptions had to be made. This is especially true for the modeling that was conducted to evaluate the operation of the proposed reservoir and the potential for fish recovery. The model used for reservoir operations included assumptions about the capacity of the reservoir, how it would be operated, stream flow levels that would be available to supply the reservoir, and target levels for instream flows. The model used to predict fish recovery under the different scenarios used the results of the reservoir operation model and also made assumptions about the level of development that would occur in the basin and the types of restoration projects that would be undertaken. Because the models attempt to predict a highly variable natural setting, it is difficult to develop conclusions about future conditions with a high degree of certainty. The model results should be considered a snapshot in time of the probable future conditions.

The assumptions used in the model for reservoir operations are described in Appendix A, Section 6.2, and Appendix D. The assumptions used in the model for fish recovery are described in Section 6.5 and Appendix C.

1.9.2 Impacts

1.9.2.1 Alternative 1 – No Action

Alternative 1 would not include a coordinated program for watershed restoration, but includes a continuation of existing programs that are already planned or being implemented. The conservation and habitat restoration projects that are currently planned or could occur in the future could reduce water demand and improve habitat, but overall, the current conditions and trends in the watershed would largely continue. There would continue to be insufficient instream flows for ~~sustained~~ fish ~~habitat~~ and an unreliable water supply for irrigation. Groundwater levels could continue to decline if more irrigators use groundwater to supplement an unreliable surface water supply. ~~Minor~~ Some improvements to fish abundance and productivity are expected as a result of the habitat restoration improvements under this alternative. Although habitat would be improved in some areas, basin-wide riparian conditions would likely continue to decline because no coordinated restoration program would be undertaken. Continued pressure to develop agricultural lands for residential uses in areas with unreliable water supplies would likely continue and/or accelerate. Habitat improvements could be offset by this increased residential development.

1.9.2.2 Alternative 2 – Watershed Restoration with Storage

Alternative 2 includes the greatest potential for short-term impacts of the alternatives considered because it requires the greatest amount of construction and property acquisition. Property acquisition would be required for the reservoir and conveyance lines and could be required for road relocations and other habitat restoration projects.

With its combination of conservation measures and reservoir construction, Alternative 2 would provide the most improvement to water supply reliability. A coordinated conservation plan would reduce the demand for surface water. Lining or piping of conveyance systems would reduce the loss of water to seepage. This would change local groundwater recharge patterns, causing both positive and negative impacts. Groundwater withdrawals could be reduced due to decreased irrigation demand.

The greatest benefit to fish habitat would be associated with habitat enhancement elements. The coordinated habitat restoration projects are expected to increase the productivity and abundance of coho, Chinook, steelhead, and bull trout in the watershed. Riparian restoration projects would also improve the condition of riparian vegetation, which could lead to increased numbers of riparian wildlife.

By itself, the reservoir would provide modest improvements to fish abundance and productivity. However, the combined effect of the habitat restoration improvements and the stream flow improvements from the reservoir would contribute to a positive trend in habitat over the long term.

The reservoir would provide increased reliability for the water supply for both irrigation and instream flows. The irrigation season for AID would be extended beyond July 10, the current shut-off date. Even with implementation of the reservoir, groundwater or other supplemental irrigation sources would still be needed to meet the irrigation demand within the Ahtanum Basin. During dry years, the reservoir would likely not be able to fill and would have little capacity to meet irrigation demands or to supplement instream flows. However, if the dry year were preceded by a wetter than average year, some carry-over storage would be available during the early part of the year to augment instream flows and supply irrigation. If water is released from the reservoir to augment stream flows, there could be a negative effect on fish because the temperature of the water releases would be higher than temperatures considered safe for fish.

Cultural impacts under Alternative 2 could include eliminating traditional cultural practices because of inundation of the reservoir footprint~~prohibiting access of tribal members to the Pine Hollow area to engage in traditional activities~~, as well as disturbance of cultural resources that could occur under all construction options. The improved reliability of the water supply might~~would be expected to~~ decrease the pressure to convert agricultural land to residential uses. New water rights would be required for storing and using water from the reservoir, and existing water rights would need to be changed to reflect changes in points of diversion and conversion from ground to surface water use. New water rights can only be issued if Ecology determines that there would be no impacts to existing water rights. The storage reservoir could be considered a source of stored water that could be claimed by the Yakama Nation to meet its practicably irrigable acreage; that is, to provide irrigation water for lands not presently irrigated on the Reservation.

The dam and reservoir operation would raise safety issues for the watershed. In the unlikely event of a dam failure, areas downstream of the reservoir would be flooded, resulting in property damage and potential loss of life. Although access is expected to be restricted, people and livestock could fall into the reservoir or from the dam.

Alternative 2 would provide the greatest economic benefit to the watershed because it would include the economic benefits associated with construction of the reservoir and the water conservation and restoration projects. The improved reliability of the water supply would support a conversion to higher value crops that could increase farm profitability, providing long-term economics benefits to agriculture.

1.9.2.3 Alternative 3 – Watershed Restoration without Storage

This alternative would have fewer short-term impacts than Alternative 2 because there would be no major construction project. Limited property acquisition could be required for conveyance lines and some habitat restoration projects. This alternative would include conservation measures and habitat restoration projects that would decrease water demand and improve habitat. Water reliability for irrigation and instream flows would not be significantly improved. The irrigation season for AID would still end on July 10. Groundwater recharge could be decreased as a result of conservation measures, but groundwater withdrawals could be reduced due to reduced irrigation water demand. The pressure to convert agricultural lands to residential uses could be reduced and higher value crops may be grown, but these effects would be lower than under Alternative 2 with the reservoir. Overall economic benefits would be lower for this alternative than Alternative 2 because there would be no direct benefits associated with a major construction project. Construction of the conservation and habitat projects would provide some economic benefits to the area associated with modest improvements in irrigation reliability.

The coordinated habitat restoration projects would provide similar benefits to Alternative 2. Fish productivity and abundance would be increased, and riparian improvements would increase wildlife.

1.9.2.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

The impacts on water reliability for this alternative would be similar to Alternative 2. The reservoir and conservation components would improve surface water reliability, the irrigation season would be extended beyond July 10, there could be a shift to higher value crops, and there would be decreased pressure to convert agricultural lands to residential uses. Groundwater recharge patterns would change, resulting in positive and negative impacts to groundwater.

This alternative does not include a coordinated habitat restoration program, which would mean that fish populations would not be significantly improved. Impacts to fish and riparian habitat would be similar to Alternative 1. Overall riparian conditions would continue to decline.

1.9.3 Mitigation

Mitigation measures to minimize short-term impacts would include construction best management practices to reduce erosion and sedimentation. Archaeological monitoring could be conducted during construction. All property and right-of-way acquisitions would be conducted in accordance with federal and Washington state law. Acquisitions would be negotiated with each landowner on a case-by-case basis.

The proposed alternatives are considered mitigation for current impacts to conditions in the watershed. The alternative components are intended to improve water supply reliability for irrigation and stream flows and to improve riparian habitat and fish populations. As part of the restoration program, joint operating agreements would be developed to facilitate cooperative management of the projects and the reservoir, if it is constructed. Mitigation for long-term impacts to cultural resources would be determined in consultation with the Office of Archaeology and Historic Preservation~~, and stakeholders such as~~ the Yakama Nation, and other stakeholders. Any new water rights or water rights change applications would be evaluated by Ecology to determine if existing water rights would be impacted. Ecology would propose mitigation for any impacts to existing water rights.

The reservoir, if constructed, would be designed in compliance with Ecology dam safety requirements. An emergency action plan to respond to a dam failure would be developed in cooperation with local service providers. The dam would include monitoring and warning systems. A plan would also be developed to address safety issues associated with the reservoir. Safety measures could include limited access and fencing of key areas.

1.10 Areas of Uncertainty and Controversy

There are several areas of uncertainty associated with the proposed ACWRP, in part because the exact elements of the ACWRP have not been selected. The alternatives that have been evaluated in this EIS are conceptual in nature. The EIS evaluation is intended to provide decision makers with information that can be used to develop a detailed ACWRP. At that time, additional environmental review may be conducted on selected program components. That additional review could resolve some of the uncertainties associated with the ACWRP.

Other areas of uncertainty relate to the models that were used to evaluate the operation of the reservoir and the recovery of fish. Any model results are dependent on the assumptions that were incorporated into the model. Model results represent a snapshot in time of the conditions and cannot predict with complete accuracy the complex interactions of variables in natural systems. The assumptions used in the EIS models were developed in cooperation with people who are familiar with the Ahtanum Creek Watershed. These assumptions represent a reasonable estimate or best guess of the operating conditions for the reservoir and the types of conservation and restoration projects that would be implemented.

Another area of uncertainty associated with the project is the issuance of water rights for a potential reservoir. As discussed in Chapter 3 and in Sections 4.13 and 6.13, the Yakima Basin Adjudication, the Bureau of Reclamation's withdrawal of unappropriated water in the basin, and the issue of practicably irrigable acreage for the Yakama Reservation raise questions about whether new water rights could be issued for a storage reservoir.

Before the ACWRP could be implemented, a Joint Operating Agreement would need to be developed between the key participants including the AID, the WIP, the Yakama Nation, and other key stakeholders. Funding for the project is uncertain at this time. A separate study is being conducted to identify potential funding sources for restoration projects. Results of this study will be available for review from Ecology~~included in the Final EIS~~.

A final area of controversy related to the ACWRP is the ongoing debate throughout the West about the construction and operation of reservoirs. Typically construction of a large reservoir is accompanied by controversy, with some people opposed to any reservoir construction. Property owners who would be directly affected by reservoir construction and flooding of the Pine Hollow area may oppose the project.

CHAPTER 2.0 ALTERNATIVES

2.1 Alternative Development Process

Alternatives for the ACWRP were cooperatively developed by the Ahtanum Core Group, whose members include the AID, Ecology, NOAA Fisheries, US Fish and Wildlife Service (USFWS) WDFW, Yakama Nation, and Yakima County Public Works Department. The Ahtanum Core Group developed a number of conceptual approaches to watershed restoration alternatives that are based on the findings of the *Ahtanum Creek Watershed Assessment* (Golder, 2004). The conceptual approaches include:

- Construction and use of an off-stream storage reservoir in Pine Hollow;
- Implementation of physical habitat improvement and protection efforts;
- Land use, shoreline use, and floodplain management strategies; and
- Water conservation strategies.

These conceptual approaches were refined into the alternatives presented and evaluated in this EIS. Section 2.3 describes the alternatives considered in this EIS. The EIS will be used by Ecology and other interested agencies and entities in formal development of the ACWRP.

2.2 Ahtanum Creek Watershed Area Habitat Programs, Projects and Planning Efforts

There are several ongoing projects to improve habitat in the Ahtanum Creek Watershed. There is currently no coordinated management of these projects, which are being administered and implemented by individual agencies or entities.

2.2.1 Yakima Tributary Access and Habitat Program

The Yakima Tributary Access and Habitat Program (YTAHP) is a Bonneville Power Administration- (BPA) funded program to screen unscreened irrigation diversions; provide fish passages at man-made barriers; and provide assistance and information to landowners interested in improvements to water quality, water reliability, and habitat.

The program has provided funding to screen pump intakes in the Ahtanum Creek Watershed and to replace a gravity diversion with a pump and pump screen. Additional diversion screening, removal of fish passage barriers, and on-farm irrigation improvements will be undertaken in the future as part of this program.

2.2.2 Yakima County Comprehensive Flood Hazard Management Plan

Yakima County, in cooperation with the Yakama Nation and the cities of Yakima and Union Gap, is developing a Comprehensive Flood Hazard Management Plan. This plan is being developed in stages, with the upper Yakima River (Union Gap to Kittitas County) being done first, the Naches River Basin was recently completed and the plan for the Ahtanum Creek Basin is currently underway. The Comprehensive Flood Hazard Management Plan could include measures that would improve habitat conditions in the Ahtanum Creek Watershed including increased stream setbacks, prohibitions on development within the floodway, buyouts of frequently flooded areas, zoning changes to uses more compatible with flood areas, improvements to culverts, and bank stabilization using bioengineering.

2.2.3 Yakima Subbasin Planning

The Northwest Power and Conservation Council (originally named the Northwest Power Planning Council) was established in 1980 to provide the Pacific Northwest with greater involvement in decision making concerning power generation at federally owned dams on the Columbia River and in fish and wildlife issues. The 2000 Columbia River Basin Fish and Wildlife Program created a framework for protecting and rebuilding fish and wildlife populations. This program called for the development of more specific objectives and measures through plans for tributary subbasins, including the Yakima Subbasin. Subbasin plans are to be developed through the collaboration of tribal and state fish and wildlife managers, local governments, interest groups and stakeholders, and other state and federal land and water use managers. The plans will be used to prioritize habitat restoration project implementation and funding.

Development of the Yakima Subbasin Plan is being coordinated with the Yakima Basin Fish and Wildlife Board. The Yakima Subbasin Plan was submitted to the Northwest Power and Conservation Council in 2004. The Plan outlines objectives and strategies for protecting, enhancing, and restoring fish and wildlife populations and watershed conditions in the basin. The management plan section describes prioritized habitat restoration actions to be implemented through a comprehensive and coordinated approach throughout the basin. Specific habitat restoration strategies are recommended for the low elevation tributaries, including Ahtanum Creek Watershed, in order to improve watershed function and enhance aquatic habitat diversity and quantity. These strategies include managing stream flows to mimic more natural flow regimes; reducing net water use; reconnecting floodplain side channels; restoring riparian areas, especially in agricultural, rural residential, and urban lands; improving fish passage at culverts and other barriers; placing large wood instream channels; inventorying sediment source areas and reducing sediment loading; and relocating roads to improve riparian conditions and reduce fine and course sediment loading.

2.2.4 Yakima Habitat Improvement Project, City of Yakima

The Master Plan for the Yakima Habitat Improvement Project was developed with the goal to maintain, preserve, and restore functioning stream habitat in the Yakima urban area. Funding for the project was provided by the BPA. The Master Plan was developed in coordination with a Technical Work Group consisting of representatives of local, state, and federal agencies; local irrigation districts; and environmental groups. The Master Plan prioritizes parcels for acquisition along the Yakima River and its tributaries including Ahtanum, Bachelor, and Hatton Creeks.

Areas in the Ahtanum Creek Watershed that were identified for acquisition are located between Ahtanum and Bachelor Creek downstream of Hatton Creek.

2.2.5 Other Programs and Projects

There are several other programs and projects in the Ahtanum and Yakima Basin areas that could benefit conditions in the Ahtanum Creek Watershed. These include riparian and stream enhancements being undertaken by the Yakama Nation.~~ The Bureau of Indian Affairs is undertaking repairs to the Wapato Dam on the Yakima River that could benefit flow conditions at the mouth of Ahtanum Creek.~~ The North Yakima Conservation District is implementing projects to screen diversions, eliminate fish blockages, and restore riparian vegetation. Yakima County is in the process of updating its critical areas ordinance, which may result in improvements to stream buffer regulations. Several road projects are proposed in the area that could include mitigation measures that would improve stream conditions.

2.3 Description of Alternatives

The following alternatives are evaluated in this Draft EIS. As noted above, these alternatives represent a conceptual approach to developing the ACWRP.

2.3.1 Alternative 1 – No Action

Under Alternative 1, no coordinated watershed management program would be developed, but individual watershed management efforts would continue much as they do today. No reservoir would be constructed under this alternative and there would be no coordinated water conservation or habitat restoration programs. However, various agencies and entities, including the AID, Yakama Nation, Yakima County, WDFW, and the North Yakima Conservation District, would continue to undertake individual actions. These actions could include water conservation, fish passage and screening improvements, bank stabilization, riparian restoration, and administration of current land use codes. These actions may be coordinated to some degree under other programs or processes such as the Comprehensive Flood Hazard Management Plan or comprehensive land use plans.

2.3.2 Alternative 2 – Watershed Restoration Program with Storage

Under Alternative 2, a coordinated watershed restoration would be developed and include a storage reservoir, agricultural conservation, and habitat restoration. A 24,000-acre-foot Pine Hollow Reservoir would be constructed to supply water to Ahtanum Creek water users and the WIP. The reservoir would be filled during high flows in the winter and spring. This alternative would also include the conservation measures and habitat restoration and protection measures listed in Section 2.3.3 for Alternative 3.

Only preliminary design has been done for the Pine Hollow Dam and Reservoir, so only a general description can be provided. The dam would be an earth-filled dam, requiring 4 to 5 million cubic yards of fill for construction. The dam would be approximately 180 feet high and span approximately 2,400 feet between the two ridges of Pine Hollow. The maximum capacity of the reservoir would be 24,000 acre-feet, with a permanent pool of approximately 2,000 acre-feet. The reservoir would be approximately 1.5 miles in length.

The actual details of reservoir construction and operation have not yet been determined. For the purposes of this EIS, this alternative includes the following conceptual operational characteristics:

- The reservoir would provide all out-of-stream water use within the reservoir service area for the entire irrigation season, including water for the WIP.
- There would be no individual creek diversions within the reservoir service area.
- Water from the reservoir would be used to augment stream flow in Ahtanum Creek when natural flows cannot meet target flows (minimum flows to be maintained in the Creek).
  - For the purpose of evaluating this alternative, minimum instream flow targets would be established as well as targets for channel maintenance flows.
  - For the purpose of evaluating the alternative, a target for fish production would be established as three returns per spawner.
- The WIP canal would be lined or piped.
- All water from the reservoir would be delivered through a piped system.
- The potential to maintain flows in Bachelor and Hatton Creeks would be evaluated, with priority given to maintaining flows in Bachelor Creek.
- Reservoir operations would include a "smart" diversion to divert reservoir water through the expanded Johncox Ditch and meet instream flow targets, fish screens, and lined or piped conveyance systems. Additional information on reservoir operations is provided in Appendix A.

2.3.3 Alternative 3 – Watershed Restoration Program without Storage

Under Alternative 3, an attempt would be made to achieve the ACWRP objectives without a major storage facility. Major elements would include irrigation conservation measures and habitat restoration and protection projects to be implemented in a coordinated manner with other planning and land use processes. These measures are summarized below.

2.3.3.1 Conservation Measures

Irrigation conservation measures could include:

- Lining and piping of conveyance systems;
- Development of conservation plans;
- Water metering;
- System automation;
- On-farm system improvements including conversion to sprinkler or drip irrigation, tail-water runoff and reuse systems, or improved system maintenance.

2.3.3.2 Habitat and Protection Measures

Habitat restoration and protection measures could include:

- Fish screening;
- Riparian restoration and enhancement;
- Increased stream and wetland buffers;
- Streambank stabilization;
- Property acquisition;
- Floodplain restoration;
- Adding channel roughness;
- Bridge and road improvements;
- Fencing riparian areas;
- Erosion control;
- Higher development standards;
- Pesticide and herbicide reduction programs;
- Public education;
- Fish passage improvements.

2.3.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Under Alternative 4, the Watershed Restoration Program would be implemented primarily through construction and management of an off-stream reservoir in Pine Hollow and irrigation conservation measures, which may or may not include on-farm conservation. No habitat restoration measures other than those identified in the No Action Alternative would be implemented. The reservoir would be operated to supply both instream and on farm water demands. Under this alternative, the reservoir operations would be the same as described in Section 2.3.2 for Alternative 2. The irrigation conservation measures described in Section 23.3 for Alternative 3 would be included.

CHAPTER 3.0 LEGAL AND REGULATORY FRAMEWORK FOR WATER AND HABITAT MANAGEMENT IN THE AHTANUM CREEK WATERSHED

3.1 Introduction

Implementation of the ACWRP could involve changes to water withdrawals and habitat affecting endangered fish species. This chapter provides background on the complex legal issues surrounding water withdrawals specifically water rights in the Yakima Basin, as well as background on key regulations relating to habitat management that could influence the implementation of the ACWRP. Additional details on water rights can be found in Appendix B.

3.2 Water Rights

The following discussion of the legal framework of water rights is provided to help readers understand what would be required to implement different components of the alternatives if these components involved new water rights or changes in existing water rights. The discussion includes an explanation of what is required to obtain a new water right, including a right for storage; the law regarding changes in water rights, including changes in the point of diversion for surface water rights and changes in the point of withdrawal for groundwater rights; new rights for delivery from storage; how trust water rights for instream flow are created; and how water rights are adjudicated.

Water users in the Ahtanum Creek Watershed have both surface water and groundwater rights. These water rights are a mixture of state-based water rights, federal tribal reserved water rights, water rights held by individual tribal allottees and their successors, and water rights held by individuals in private or through a combined entity such as an irrigation district. This mixture of water rights is determined by and subject to state and federal laws, laws specific to irrigation districts, and U.S. Bureau of Reclamation (Reclamation) policies and regulations.

3.2.1 State-Based Water Rights

3.2.1.1 Acquisition of Water Right

Since enactment of the state’s surface water and groundwater codes in 1917 and 1945, the only way to obtain authorization to appropriate surface or groundwater is to apply for a permit from the Department of Ecology. When surface water diversion works or a groundwater well have been completed and the water has been applied to beneficial use, Ecology issues a certificate for the quantity of water put to actual beneficial use.

One exception to the requirement to obtain a permit from Ecology is the legislatively created exemption for the withdrawal of groundwater. Under the exemption, a well can be constructed and water withdrawn from an aquifer without a permit if the water will be used for (1) stock watering; (2) lawn or non-commercial garden watering in an area not exceeding .5 acre; (3)

single or group domestic uses not exceeding 5,000 gallons a day; or (4) an industrial purpose not exceeding 5,000 gallons a day (RCW 90.44.050). This section of the RCW is commonly referred to as the “groundwater exemption,” and wells developed meeting the use requirements listed above are known as “exempt wells.” There are numerous exempt wells in the Ahtanum Creek Watershed. Because these wells are exempt from Ecology’s permit requirements, it is difficult to know how much groundwater is being used in the watershed.

Water rights are regulated based on priority date. During water shortages, a senior water right holder is entitled to use their full water right before the next junior right can be exercised. The priority date for any water right is generally the date of the original water right application. Any change in water rights in the Ahtanum Creek Watershed would need to be evaluated to ensure that it would not impair existing water rights.

3.2.1.2 Changes and Transfers

Changes and transfers of water rights are governed by statute, regulations, policy, and case law. A complete discussion of this area of law is beyond the scope of this EIS. In general, changes in place of use, purpose of use, and/or points of diversion or withdrawal of a water right, or transfers of water rights to others require approval by Ecology under RCW 90.03.380 or 90.44.100. As discussed in Section 3.2.4, Ecology does not regulate changes or transfers that occur entirely within an irrigation district or joint board of control. In the Yakima Basin, because of the ongoing water rights adjudication (see Section 3.2.1.5), the Court approves temporary changes in water rights based on input from Ecology. Ecology continues to make decisions on permanent changes. A water right approved for change or transfer retains its original priority date.

In making a decision on a water rights change application, Ecology must make a tentative determination of the validity and extent of the water right, whether all or part of the right has been lost due to nonuse, and whether the change would impair any other water right—either senior or junior in priority to the right being changed. In contrast to an application for a new water right, Ecology is not required to consider potential impairment of pending applications for water rights when Ecology makes a decision on a change application. Existing rights are impaired if there would be a detrimental impact on the quantity or quality of the right or direct interference with the ability to exercise the right. As part of this determination, Ecology must quantify the consumptive use of the right (consumptive use is water lost to the environment through evaporation or transpiration). If the requested change would increase the amount of water used, the right would be unlawfully enlarged. For example, Ecology may approve a “change in the place of use, point of diversion, and/or purpose of use of a water right to enable irrigation of additional acreage or the addition of new uses . . . of such change results in no increase in the annual consumptive quantity of water used under the water rights” (RCW 90.03.380(1)). Annual consumptive quantity is defined as “the estimated or actual annual amount of water diverted pursuant to the water right, reduced by the estimated annual amount of return flows, averaged over the two years of greatest use within the most recent five-year period of continuous beneficial use of the water right” (RCW 90.03.380(1)).

To speed up the decisions on change requests, the state legislature created county Water Conservancy Boards to make initial decisions on such applications (Chapter 90.80 RCW). The Yakima County Water Conservancy Board would likely review any change requests associated with the Ahtanum Creek Watershed Restoration Program. Change requests could also be filed with Ecology. The Water Conservancy Board applies the same standards as Ecology and sends its record of decision to Ecology. Ecology may affirm, reverse, or modify the action of the Water Conservancy Board.

3.2.1.3 Relinquishment

When a water right is perfected, it must continue to be used or it will be considered lost through abandonment or relinquishment (commonly referred to as the "use it or lose it" provision). Relinquishment occurs when all or a portion of a water right is not used for five successive years, unless there is a sufficient cause for the nonuse (RCW 90.14.160-180).

The legislature has defined sufficient cause to include, but not be limited to, the following circumstances: drought or other unavailability of water, operation of legal proceedings that prevent the use of water, and federal or state leases/option to buy land or water rights that preclude or reduce the use of the right by the owner of the water right (RCW 90.14.140(1)). The water code includes several sufficient causes for nonuse that apply specifically to irrigation water rights, including temporary reductions due to varying weather conditions, temporary reliance on return flow instead of withdrawal from the primary source when the return flows are measured or reliably estimated; and reductions in water use due to crop rotation (RCW 90.14.140(1)).

Ecology may acquire trust water rights, including storage rights, on a permanent or temporary basis "by purchase, lease, gift, or other appropriate means other than condemnation" (RCW 90.38.020(1)(a)). If Ecology acquires such a right for instream flow purposes, it must be administered in compliance with that condition (RCW 90.38.020(1)(a)). Trust water rights retain the same priority date as the water right from which they originated. Trust water rights cannot be authorized unless Ecology determines that no existing water rights would be impaired (RCW 90.38.040(5)(a)).

3.2.1.4 Trust Water Rights

In the Yakima Basin, a trust water right means both a water right that is no longer required to be diverted for a beneficial use because of water conservation measures that improve an existing system and any other water right acquired by Ecology for management in the Yakima River Basin trust water rights program (RCW 90.38.010(3)). Ecology may acquire trust water rights, including storage rights, on a permanent or temporary basis "by purchase, lease, gift, or other appropriate means other than condemnation" (RCW 90.38.020(1)(a)). Trust water rights may be used for instream flows, irrigation or other beneficial uses.

The trust water rights statute authorizes Ecology to enter into contracts with water users to assist in financing water conservation projects with state and/or federal funding (RCW 90.38.030). In exchange for funding, the water users convey the trust water rights to Ecology. A trust water right created by a conservation project is "that portion of an existing water right, constituting net water savings, that is no longer required to be diverted for beneficial use due to the installation of a water conservation project that improves an existing system" (RCW 90.38.010(3)). The statute defines net water savings as "the amount of water that through hydrological analysis is determined to be conserved and usable for other purposes without impairing existing water rights, reducing the ability to deliver water, or reducing the supply of water that otherwise would have been available to other water users" (RCW 90.38.010(2)). Each of the alternatives considered in this EIS, including the No Action Alternative, include water conservation measures, which may result in the creation of trust water rights.

If Ecology acquires a water right for instream flow purposes it must be administered for those purposes (RCW 90.38.020(1)(a)). Trust water rights retain the same priority date as the water right from which they originated. Trust water rights are not subject to relinquishment for nonuse under RCW 90.14.140 through 90.14.910 (RCW 90.14.140(2); 90.38.040(6)).

3.2.1.5 Statutory Adjudication of Water Rights

A water rights adjudication is a court proceeding to establish the title (quiet title) to water rights by determining the validity and extent of existing water rights in a specified area (RCW 90.03.110 to 90.03.240). New water rights are not granted as part of the adjudication process. The proceedings take place in county superior courts. The surface water rights in the entire Yakima Basin are being adjudicated in Yakima County Superior Court. The decisions made in the adjudication will determine the extent, validity, and relative priority of all surface water rights in the Yakima Basin, including those in the Ahtanum Creek Watershed.

At the end of the adjudication, the court issues a decree confirming water rights and describing the nature of those rights. Ecology subsequently issues a water right certificate that incorporates the court's findings (RCW 90.03.240). Water rights subject to an adjudication that are not confirmed by the court are lost or extinguished. Additional information on the Yakima Adjudication is located in Appendix B.

3.2.2 New State-Based Water Rights

Ecology must make four findings regarding a new water right application to issue a permit: (1) the proposed use of water must be for a beneficial purpose; (2) there must be water available for appropriation; (3) the proposed use must not impair existing water rights; and (4) the proposed use must be in the public interest (RCW 90.03.290).

Beneficial uses include such things as stock watering; industrial, commercial, agricultural and domestic use; irrigation; and fish and wildlife maintenance (RCW 90.54.020(1)). Water must be available for appropriation from both a legal and a technical perspective. Technically, there must be water physically available from the source to meet the requested quantity of water. Legally, water is available only if it can be appropriated without impairing existing water rights, either by reducing the quantity available to satisfy those rights or by reducing the quality of the water available. For purposes of the impairment analysis, water rights include rights to withdraw groundwater or divert surface water, applications for new water rights, and instream flows set by administrative rule. Ecology can only issue a permit if the use of water would be in the public interest and would not be a detriment to public welfare.

In 1979, Reclamation filed for withdrawal from appropriation all unappropriated surface water in the Yakima River Watershed under Chapter 90.40 RCW. The filing was made when Congress authorized the Yakima River Basin Water Enhancement Project. The withdrawal needs to be extended every five years or less by the Department of Ecology. The Reclamation withdrawal has received extensions and is still current. Therefore any new surface water use in the Yakima River Basin, such as the storage right for the Pine Hollow Reservoir, would need to be agreed to by Reclamation. The new surface water user would need to demonstrate to Reclamation and Yakima Project water users that the new use would not adversely impact their water rights and not affect the Yakima River Basin Water Enhancement Project.

Construction and operation of new storage facilities would require obtaining a reservoir permit from Ecology (RCW 90.03.370). Applications for reservoir permits are subject to the permitting requirements in RCW 90.03.250 through 90.03.320. Generally, parties that propose to put the stored water to a beneficial use must also file an application for a secondary permit. However, a secondary permit is not required where a water right permit or certificate for the source of the stored water authorizes the beneficial use (RCW 90.03.370(1)(c)). Thus, a secondary permit would not be required for water users in the Ahtanum Creek Watershed who currently have water rights to Ahtanum Creek that are confirmed in the Yakima Adjudication. If water users wish to have additional quantities of water from storage over and above their adjudicated amount, they would be required to file for a secondary permit.

3.2.3 Tribal Water Rights

Federal tribal reserved water rights are primarily based on the *Winters* Doctrine (*Winters v. United States*, 207 U.S. 564 (1908)). The two main principles of this doctrine are that: (1) when the United States creates reservations, it implicitly includes a reservation of water in an amount necessary to fulfill the purposes of the reservation; and (2) the priority date of the water right is the date the reservation was created. Courts have generally held that tribal reservations created in the nineteenth century were primarily intended to give the tribes an agricultural base. Creation of a tribal reservation may also imply the use of water for long-established aboriginal uses such as fishing and hunting. The priority date for water for such aboriginal uses is time immemorial.

Federal tribal reserved water rights are not subject to relinquishment or abandonment for nonuse. The reserved rights are for potential future use as well as historic use. The future water right for agriculture is defined by the practicably irrigable acres (PIA) standard—those areas susceptible to sustained irrigation at a reasonable cost. The number of acres included within PIA is the number currently under irrigation plus those susceptible to irrigation but not yet developed.

Federal reserved water rights may be adjudicated in state court under the McCarran Amendment, (43 U.S.C. sect. 666(a)). Yakama Nation water rights are being adjudicated as part of the Yakima Basin Adjudication. The Yakama Nation's water rights are briefly described in Appendix B (page B-11).

3.2.4 Irrigation District Laws

Irrigation districts are public entities formed according to state law. The primary purpose of an irrigation district is to divert and convey water to the water users for irrigation of the lands within the district. An irrigation district may be formed for several purposes, including the construction or purchase of new irrigation works, construction or repair of diversions structures, and contracting with the federal or state government for irrigation purposes (RCW 87.03.010).

Under Washington law, individual water users within the irrigation district are the owners of the water rights. An irrigation district is a trustee for the water users within the district and is obligated to deliver water to the water users based on their water rights and subject to the bylaws and regulations of the district. Special provisions apply to transfers of water rights within and between irrigation districts. A change in place of use by one or more water users within an irrigation district does not require Ecology's approval if the water use continues within the irrigation district; the only approval required is from the board of directors of the irrigation district. Additional information on the transfer of water rights within and by irrigation districts is included in Appendix B.

The only irrigation district in the Ahtanum Creek Watershed is the AID, which is an unusual district because it does not own any canals, diversions, or distribution works. The AID uses Ahtanum, Bachelor, and Hatton Creeks as the conveyance works to deliver water to the individual users who divert directly from the creek. In addition, the WIP, an irrigation project operated by the Bureau of Indian Affairs in consultation with the Yakama Nation, is located on the south side of Ahtanum Creek within the boundaries of the Yakama Reservation. The WIP diverts water from Ahtanum Creek and delivers it to reservation landowners in the northern portion of the WIP (Ahtanum Unit) via the Ahtanum Main Canal and Lower Canal. ~~Water users pay assessments to the WIP, and t~~The WIP delivers water to tribal and non-tribal fee owners and properties held in trust for the benefit of the Yakama Nation.

3.2.5 Bureau of Reclamation Laws and Policies

Reclamation operates the Yakima Irrigation Project (Yakima Project) for irrigation water supply, instream flows for fish, and flood control. The Yakima Project~~which~~ supplies water to most of the water users who divert surface water from the Yakima, Naches, and Tieton Rivers. The Yakima Project provides water to about 361,000 irrigated acres in the Yakima Project and represents about 70 percent of the total surface water diversions for major irrigation entities in the Yakima River Basin. The Yakima Project includes five major reservoirs with a total capacity of 1,065,400 acre-feet. A sixth reservoir, Clear Lake, has a capacity of 5,300 acre-feet and is used primarily for recreational purposes. The water supply for the Yakima Project is derived from natural runoff, storage, and return flow from irrigated areas.

Reclamation prepares forecasts of the expected Total Water Supply Available (TWSA) for the Yakima Project. TWSA represents the combined quantity of unregulated flow, return flow, and stored water available for use. TWSA is computed at Sunnyside Dam. The forecast is used to determine the adequacy of water supply to meet entitlements. Since 1995 the forecast of TWSA has also been used to determine the magnitude of target flows over Sunnyside and Prosser Diversion Dams pursuant to the Yakima River Basin Water Enhancement Project (Title XII, Public Law 103-434). Instream flow needs (target flows) are met from TWSA prior to determining if proration is necessary. Proration is the process Reclamation employs in water-short years to allocate the TWSA.

The volume of TWSA can vary substantially depending on snowfall conditions in the Cascade Mountains. The average TWSA, covering a period since 1940, is over 3,000,000 acre-feet. During drought periods such as in 1977, 1993 and 1994, TWSA was just over 2,000,000 acre-feet. In most years, unregulated flow (flow in excess of that needed for filling reservoirs or derived from tributaries without storage reservoirs) can meet irrigation demands up to early July. At that time, the Yakima Project goes on “storage control” and most irrigation demands are then met from reservoir releases. During drought periods that date is earlier, usually during May.

3.3 Habitat Management

There are several federal and state regulations and policies related to the protection of habitat. This section describes those regulations and policies that are relevant to habitat protection in the Ahtanum Creek Watershed.

3.3.1 Federal Endangered Species Act

The ESA was enacted in 1973 to conserve endangered and threatened species and the critical habitat on which these species depend. In the Ahtanum Creek Watershed, Two fish species and one bird are listed as threatened species: Middle Columbia River steelhead, bull trout, and bald eagle.

The ESA is administered by NOAA Fisheries and the USFWS. Terrestrial and freshwater species are the responsibility of the USFWS, while marine and anadromous species such as salmon are the responsibility of NOAA Fisheries. The ESA defines an endangered species as one in danger of extinction throughout all or a significant portion of its range, and a threatened species is defined as any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA includes protective regulations for listed endangered or threatened species.

The primary protective regulations of the ESA are included in Sections 7 and 9 of the Act. Section 7 of the ESA addresses the impacts of federal actions on listed species and states that no federal agency may take an action that would jeopardize a listed species. This section of the ESA requires that any agency undertaking an action that might affect a listed species is required to consult with the USFWS or NOAA Fisheries. This “consultation” requirement extends to non-federal actions that receive federal funding or require a federal permit. The consultation is achieved through a Biological Assessment (BA), which determines the potential effect of the action on listed species. The BA is submitted to the Services for concurrence. If it is determined that an action has the potential to have an adverse effect on a species, the Services must prepare a Biological Opinion in which the agency recommends reasonable and prudent alternatives for project modifications to avoid jeopardy to the species.

Section 9 of the Act prohibits any person from "taking" a listed species. To "take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a species. The Services have defined harm to include significant damage to habitat, and the U. S. Supreme Court has upheld this interpretation.

Because there are listed species in the Ahtanum Creek Watershed, projects proposed for the ACWRP would need to be in compliance with the ESA. If any of the proposed projects have federal funding or require a federal permit, the project would be required to undergo consultation with the federal services as described above.

3.3.2 Salmon Recovery Act

In response to the proposed listing of salmonids species under the ESA, the state legislature enacted the Salmon Recovery Act (Chapter 77.85 RCW) in 1998. The Salmon Recovery Act provides state leadership in conducting planning and undertaking actions that would lead to recovery of listed species. The Act created the Governor's Salmon Recovery Office to manage the statewide salmon recovery strategy. The Act establishes a process for independent science review to ensure that sound science is used in salmon recovery planning. The Salmon Recovery Funding Board is responsible for making grants and loans for salmon habitat projects. The Board establishes criteria for allocation of funds and the review of projects.

Habitat recovery projects in the Ahtanum Creek Watershed may be eligible for funding under the Salmon Recovery Act. Funding requests should be coordinated through Yakima Basin Fish and Wildlife Recovery Board, a regional recovery organization that has been established to coordinate regional recovery planning.

3.3.3 Shoreline Management Act

The Washington State Shoreline Management Act (SMA) (Chapter 90.58 RCW) regulates development along "shorelines of the state" throughout Washington's cities and counties. The SMA does not apply to tribal reservation lands. The state dedicates stream shorelines as Shorelines of the State if water flow is greater than 20 cubic feet second (cfs) mean annual flow. The SMA requires local governments to implement three basic policies when regulating Shorelines of the State: accommodation of reasonable and appropriate uses, protection of shoreline environmental resources, and protection of the public's right to access and use shorelines (RCW 90.58.020). Preferred uses include single-family residences, ports, shoreline recreational uses, developments that provide public access opportunities, and other uses consistent with control of pollution and prevention of damage to the natural environment. Environmental protection actions refer to preserving shoreline natural resources that include vegetation, wildlife, and the water of the state and its aquatic life against adverse effects. The SMA also requires that jurisdictions include a public access element in their shoreline master programs, thus ensuring that public access is available to publicly owned areas. Portions of the shoreline of Ahtanum Creek are Shorelines of the State.

3.3.4 Hydraulic Project Approvals

Any person or agency proposing construction that would affect the flow or bed of waters of the state must obtain a Hydraulic Project Approval (HPA) from WDFW (Chapter 77.55 RCW). The HPA can impose conditions on the applicant to insure that the project will protect fish and their habitat. Examples of projects that require an HPA include streambank protection and stabilization, construction of bridges, channel changes, culvert installation, dredging, and installation or maintenance of water diversion structures. Construction of the Pine Hollow Reservoir and some of the habitat conservation projects would require an HPA. The required mitigation measures for the projects would be included in the HPA.

3.3.5 Growth Management Act

The state's Growth Management Act (Chapter 36.70A RCW) establishes goals for land use planning for cities and counties and includes a number of mandatory planning requirements. One of these requirements is that counties and cities must designate natural resource lands and critical areas within their jurisdictions. These critical areas include wetlands and fish and wildlife habitat conservation areas, including streams. Counties and cities must establish development regulations to protect critical areas. The jurisdictions must consider best available science in developing the regulations. The regulations for protecting critical areas typically include prohibitions on altering wetlands or stream channels and buffer areas to protect streams from development. Yakima County expects to adopt its revised critical areas regulations by the end of 2005. The enforcement of critical areas regulations on new development along Ahtanum Creek could help improve riparian conditions.

3.3.6 Watershed Planning Act

The Watershed Planning Act (Chapter 90.82 RCW) establishes a comprehensive and cooperative method for assessment of the current status of water resources within the state's watersheds. Under the Act, watershed plans are developed by Planning Units that are comprised of local government and interest group representatives. The watershed plans create frameworks for addressing water resource issues. The watershed plan for the Yakima River Basin was adopted in 2003. The plan identifies Ahtanum Creek as a medium priority for restoration efforts. Habitat problems identified for Ahtanum Creek include degraded riparian habitat, inadequate flows, and erosion problems.

CHAPTER 4.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions in the Ahtanum Creek Watershed that would be affected by the ACWRP.

4.1 Earth

This section summarizes the geologic and geomorphic setting for the Ahtanum Creek Watershed. The focus of the discussion is the potential for erosion and sedimentation.

4.1.1 Geologic and Geomorphic Overview

The Ahtanum Creek Watershed straddles two very different physiographic and geologic provinces: the Cascade Mountains in the western part of the watershed and the Columbia Plateau to the east. East to west trending rounded or flat-topped ridges characterize the upper Ahtanum Creek and tributary watersheds, where deep, steep-walled canyons cut into the eastern foothills of the Cascade Mountains. The valleys and floodplains widen in the middle portion of the watershed near the confluence of the North Fork and South Forks with the mainstem; the valley continues to widen as Ahtanum Creek flows eastward toward the Yakima River. Elevations range from 940 feet where Ahtanum Creek joins the Yakima River to 6,981 feet at the creek's headwaters on Darland Mountain in the western portion of the watershed.

The geology of the Ahtanum Creek Watershed is dominated by Columbia River Basalts, which underlie a large portion of the watershed and control much of its topographic character. The Columbia Basin Basalts eruptions began~~ed~~ between 15 and 16 million years ago, transforming much of eastern Washington into a broad, flat basin. Later, as the north to south trending Cascade mountain range developed, the basalt flows were tilted and uplifted into a series of east to west trending folds that formed ridges along the eastern slopes of the Cascades. Flows of the Columbia River Basalt Group overlap a wide variety of rocks and structures along the northwestern margin of the basalt, including several large fault-bounded basins. The basalts are probably 5,000 feet thick on the eastern edge of the watershed, transitioning to less than 500 feet thick in the western upper end of the drainage (WDNR, 1997a). Between eruptions, lakes and streams deposited blankets of fine sediment buried by later basalt flows. These deposits form the sedimentary layers located between successive basalt layers. The sedimentary rock and cemented gravel thicken from west to east. Alluvium covers the floor of the lower Ahtanum Valley, and cemented sand and gravel form the ridges and upland terraces north of Ahtanum Road.

Recurring cycles of Pleistocene (1.81 to 0.01 million years ago) alpine glaciation in the Cascade Mountains within the upper Ahtanum Creek Watershed created glacial cirques in the heads of some tributary drainage basins. The basalt flows overlap into the eastern edge of the Cascade Mountains. Differential erosion of individual basalt flows developed a cliff-bench or stair-stepped profile along canyon walls of the upper and middle portions of the watershed. Numerous catastrophic floods during the Pleistocene inundated the lowlands of the watershed, modifying the topography and depositing fine to coarse unconsolidated materials (Dames and

Moore, 1999a). These flood deposits extend through the lower watershed and cover~~define~~ much of the wide floodplain in this area (Golder, 2004).

Soils in the watershed have been mapped by the Natural Resource Conservation Service (formerly known as the Soil Conservation Service) (2003). General soil groups present in the watershed are shown on Figure 4-1 and are briefly described below. Soils mapping is unavailable for large portions of the Yakama Reservation.

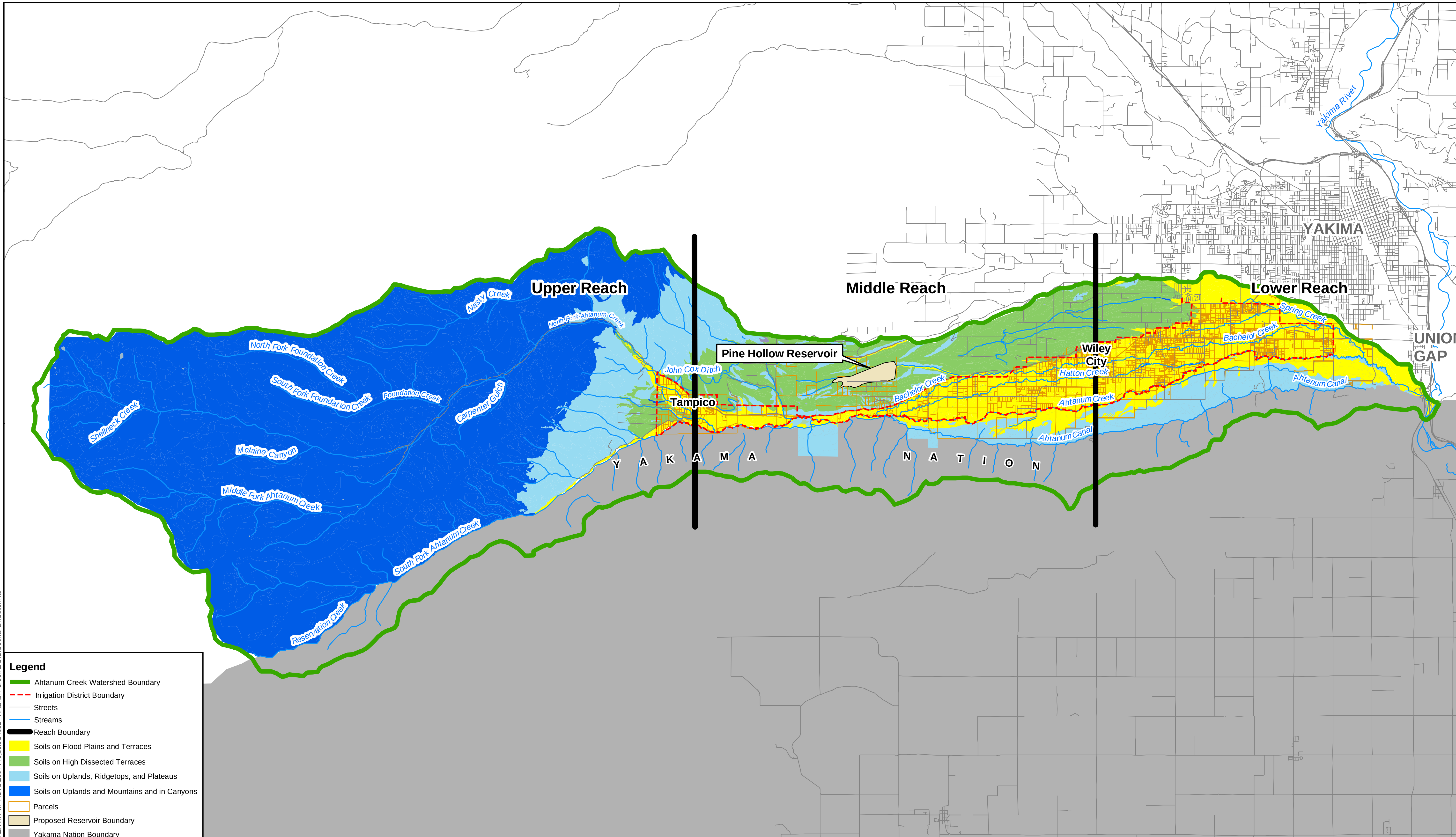
Access roads are a major source of sediment delivery to streams in the Ahtanum Creek Watershed. Early in the twentieth century, road access was initiated from the lower ends of Ahtanum Creek, and tributary streams and the valley bottoms provided the easiest transportation routes (WDNR, 1997a). As a result, roads parallel all of the major streams in the watershed for much of their length, often on the active floodplain and close to the channel. These streamside roads, particularly improperly drained gravel- and dirt-surfaced roads, contribute to generally high rates of sediment deposition in stream channels (WDNR, 1997a).

4.1.2 Upper Reach

Canyons and stream courses dissect the landscape of the upper reach of the Ahtanum Creek Watershed (Figure 1-2). The relief is generally steep. Alpine glacial erosion created broad U-shaped valleys at high elevations, while streams formed narrower V-shaped canyons in the lower portions of the drainages. During and after glaciation, large quantities of glacial drift were deposited in the form of moraines, outwash, and lacustrine materials (WDNR, 1997a). Erosion has dissected the Columbia River Basalts to expose pre-basalt units in the valley bottoms. These older, exposed units are composed of metamorphosed marine sediments and volcanic rocks (WDNR, 1997a). In the middle of the upper reach of the watershed, later basalt flows interfinger with the Ellensburg formation. The Ellensburg formation is a sedimentary formation consisting of weakly cemented gravels, silts, sands, and clays that were deposited by debris flows and gravel bedload (Figure 4-2) (WDNR, 1997a).

Stream courses in the middle portion of the upper reach of the Ahtanum Creek Watershed transition from narrow, steep headwater channels to low-gradient systems in the valley bottoms. The very high-gradient headwater channels are subject to intermittent scour by torrent and debris flows (Montgomery and Buffington, 1993). As the gradient decreases, the headwater channels transition into moderately steep tributary streams; these moderately steep channels rapidly convey increased sediment inputs and are minimally responsive to inputs of sediment, bedload, and wood (WDNR, 1997a). In the widening stream valleys of the lower portions of the upper watershed, the low gradient tributary and mainstem channels of the South and North Forks of Ahtanum Creek have defined floodplains and are more morphologically sensitive; these streams have the potential for significant channel adjustment in response to increased flow and inputs of sediment, bedload, and woody debris (Montgomery and Buffington, 1993).

Large, ancient deep-seated landslides have shaped significant portions of the landscape in the upper Ahtanum Creek Watershed (WDNR, 1997a). Recent landslides, however, are rare. The low rate of recent landslides is the result of minimal annual precipitation and generally stable soil and bedrock units (WDNR, 1997a).



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Inaccuracies may exist, and Adolfson Associates, Inc. implies no warranties or guarantees regarding any aspect of data dipiction.
SOURCE: Ahtanum EIS, 2004; USGS topographic map, 1995
NRCS-SSURGO, 2002

0 6,250 12,500 25,000 37,500 50,000 Feet

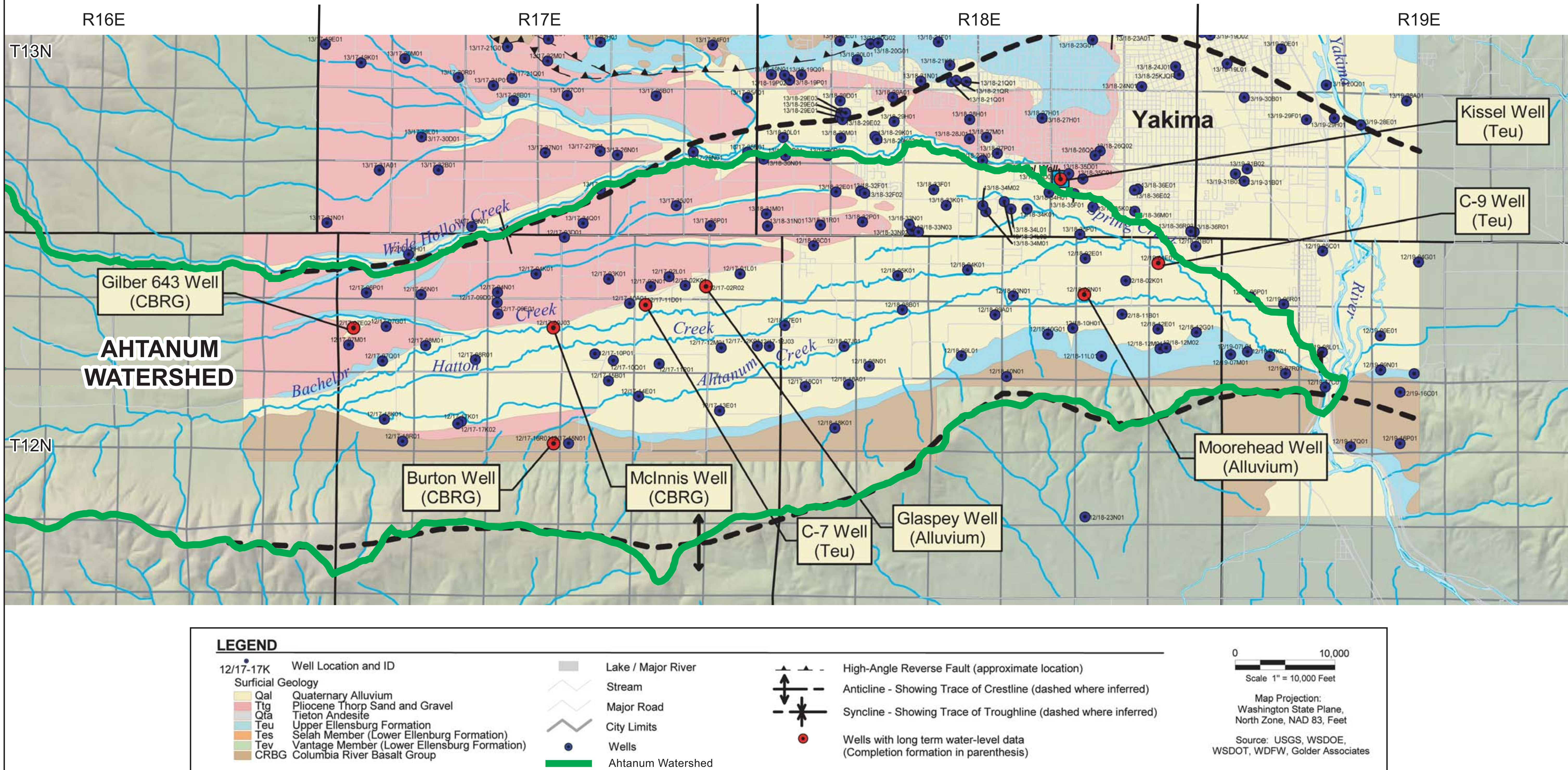
1:150,000
1 inch equals 12,500 feet

FIGURE 4-1

AHTANUM CREEK WATERSHED GENERAL SOIL UNITS

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON



NOTE: Information provided by the well owner indicates that the McInnis Well is actually located 300 feet south of Bachelor Creek.

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ADOLFSON

FIGURE 4-2

GENERALIZED GEOLOGIC MAP OF THE LOWER AHTANUM VALLEY

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON

Slope aspect exerts a strong influence on vegetation and soil development. North facing slopes typically have more dense vegetation and are likely to have more pronounced soil profile development because of higher soil moisture. In general, soils on the north-facing slopes of the upper reach are deep and well drained, have moderate permeability, and have a surface consisting of stony loam. Soils in the upper reach of the watershed consist mainly of the Jumpe-Sutkin-Sapkin and Rock Creek-McDaniel soil map units (Figure 4-1) (NRCS, 2003). These soil units are well drained. They formed in residuum (mineral material that accumulated as consolidated rock and disintegrated in place) and/or colluvium (soil material and/or rock fragments moved by creep, slide, or local wash and deposited at the base of a steep slope) derived from basalt containing a minor amount of loess (fine-grained wind deposited material) and volcanic ash. The surface layer is a stony loam to very stony loam. The erosion potential of these soils is moderate. A combination of glacial deposits and wind-blown material form soils in the higher elevations of the upper reach of the watershed.

Residential development, recreational vehicles, and roadways in proximity to the creek and riparian area have resulted in significant impacts to bank stability and sedimentation upstream of Tampico on both the North and South Forks of Ahtanum Creek (Yakima Subbasin Fish and Wildlife Planning Board, 2004). The Washington Department of Natural Resources (WDNR) has completed a watershed analysis on the upper North Fork and South Fork Ahtanum basin that examined the delivery of sediment to stream channels. These studies indicate that the high-density road networks in the upper reach increase the contribution of fine-grained sediments into the streams (WDNR, 1997a).

4.1.3 Middle and Lower Reaches

The middle and lower reaches of Ahtanum Creek are characterized by a broad valley and wide floodplain (Figure 4-1). Loess deposits can be found throughout the lower watershed on top of major geologic formations. This unconsolidated, silt-sized, basalt rich sediment was deposited by wind and varies in depth from 0 feet on exposed southeast ridge flanks to over 20 feet on protected slopes (north side). The source of most of the loess is considered to be the Glacial Lake Missoula Flood sediments, which were deposited by wind from the southwest blowing across the area over the past 20,000 years. The modern soil and most of the farmlands are developed on these loess deposits. Soils in the middle and lower reaches of the watershed consist mainly of Harwood-Gorst-Selah soil units on highly dissected terraces, and Weirman-Ashue and Umapine-Wenas soil units on floodplains and terraces (NRCS, 2003). The Harwood-Gorst-Selah soils are well drained and formed in loess and old alluvium (material deposited on land by streams). The Weirman-Ashue and Umapine-Wenas soil units formed in alluvium. Drainage of these soil units varies from excessively well drained to poorly drained. The surface layer is loam to loamy fine sand. The erosion potential of these soils is slight to moderate. These soils are also subject to periods of flooding.

The lower mainstem Ahtanum Creek flows through a wide valley with an extensive floodplain. The channel through the lower watershed is low gradient and moderately sinuous, and the floodplain increases in width downstream of the confluence of the North and Middle Forks of Ahtanum Creek. Glacial Lake Missoula Flood deposits underlie much of the wide floodplain in the lower watershed. The channel through the lower watershed exhibits high stream powers during peak flow events and is very sensitive to inputs of sediment. Recent habitat studies completed in the lower watershed indicate that accumulations of sediments in Ahtanum Creek are contributing to habitat degradation. There are specific areas in the lower reach of Ahtanum Creek where both fine- and coarse-grained sediments are causing a variety of problems with water and bedload conveyance, channel form, and channel forming processes, all of which are leading to aquatic habitat changes (Golder, 2004). To date, there have been no comprehensive assessments of sediment transport and channel deposition linking the upper, middle, and lower Ahtanum Creek Watershed (Golder, 2004).

4.2 Surface Water

This section summarizes the characteristics of surface water in the Ahtanum Creek Watershed.

4.2.1 Surface Water Overview

The Ahtanum Creek Watershed consists of approximately 116,000 acres from which surface water runoff is collected and conveyed through Ahtanum Creek and its tributaries. Stream flow in the watershed is typically characterized by the occurrence of high stream flows during the late spring and early summer and low flows during the late summer and early fall.

Stream flow through the upper watershed is influenced primarily by snowmelt and rainfall. As reported in the *Ahtanum Creek Watershed Assessment* (Golder, 2004), precipitation varies from less than 10 inches a year in the lower watershed near the Yakima River, to more than 40 inches a year in the higher elevations along the west end of the upper watershed. A significant portion of the precipitation falls over the upper watershed as winter snow. High stream flows during the late spring and early summer are primarily due to snowmelt runoff from the upper watershed. As was noted previously, the upper watershed includes mountainous terrain, and steep, narrow stream channels. These channels convey runoff from rainfall and snowmelt to the North and South Forks of Ahtanum Creek.

The North and South Forks join near Tampico to form the mainstem of Ahtanum Creek (Figure 1-1). The mainstem of Ahtanum Creek collects and conveys surface water through the middle and lower reaches of the watershed. Stream flows in the middle and lower portions of the watershed are influenced by flows from the upper watershed, diversions for irrigation, and interaction between surface water and groundwater. In lower portion of the upper reach and in the middle reach, the stream transitions to wider, more gently sloping channels. Because of the gentle slope and broad floodplain that characterizes the lower reach, surface water flows through a network of natural stream channels, including Bachelor and Hatton Creeks.

There are currently conflicting demands for surface water within the Ahtanum Creek Watershed. Agriculture is the primary land use in the watershed, and surface water is generally the preferred source of irrigation water. Ahtanum Creek and its tributaries also provide habitat for fish and wildlife.

Evaluation and analysis of surface water conditions in the watershed have focused on the North Fork and mainstem of Ahtanum Creek, because the flow of surface water in those streams would be influenced by the ACWRP. Current surface water conditions are described in the following sections.

4.2.2 Upper Reach

The upper reach consists primarily of the South and North Forks of Ahtanum Creek. The North Fork is the larger of the two tributaries, and currently provides surface water for irrigation to the Johncox and Shaw Knox Ditches. Previous studies indicate that the upper watershed includes long reaches of stream that would be considered excellent habitat for fish species. However, low flow conditions in the lower watershed have created problems for fish passage; therefore, the habitat in the upper watershed is not being fully used by fish.

Historical stream flow data for the upper watershed have been gathered by gauges operated by the U.S. Geological Survey (USGS) for water years[1] 1911 to 1978, by the WIP for water years 1979 to 1992, and by the AID for water years 1993 to 1998 on both the North and South Forks of Ahtanum Creek. Although the gauges have not been operated continuously during the periods shown, the set of average daily flow data is complete from water year 1932 to water year 1992. Several months of available data are also available through water year 1998. These gauges are located above the irrigation diversions, so the flows measured represent naturally occurring stream flow conditions. Stream flows in the upper watershed are primarily influenced by snowmelt and rainfall.

Analysis of flow records indicate that the mean monthly stream flow for the North Fork ranges from a low of approximately 20 cfs in September and October to a high of approximately 190 cfs in May. Mean monthly stream flows for the South Fork range from a low of approximately 7 cfs in September and October to a high of approximately 46 cfs in May. Peak flows during flooding have been as high as 1,230 cfs on the South Fork and 1,580 cfs on the North Fork (both occurring on January 15, 1974). No data are available from the most recent large flood that occurred in February 1996.

Figure 4-3 illustrates the pattern of runoff from the upper reach of the Ahtanum Creek Watershed. Mean monthly flows from the period of available flow records for the North and South Forks (water year 1932 to water year 1998) are plotted and compared to records for dry (water year 1977) and wet (water year 1951) years. The graph illustrates the difference in stream flow and water supply that occurs during dry years. The mean monthly flow in May 1977 (dry year) on the North Fork was approximately 28 cfs, or 162 cfs less than the historical mean for that month.

Flows with a recurrence interval of approximately 1.5 to 2 years have been identified as “channel-forming” flows, or flows that have statistically been determined to be most active in forming the channel and transporting sediment. The channel-forming flow was determined by calculating the recurrence interval for flows in the North Fork based on historic stream flow data. The data indicated that channel-forming flows are likely in the range of 350 to 400 cfs.

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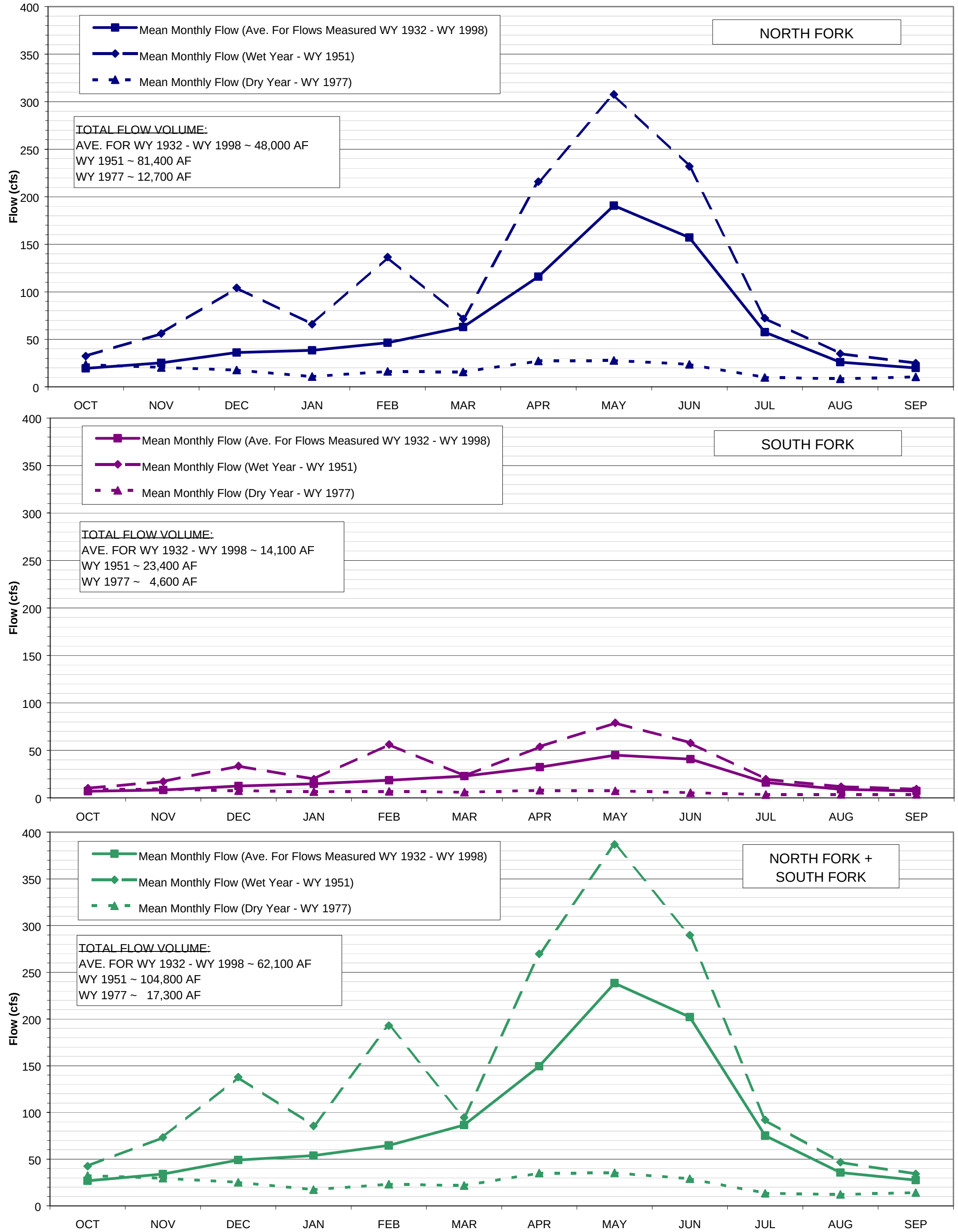
[1] A water year is measured from October 1 to September 30.

Figure 4-3. Mean Monthly Flows – Upper Reach of Ahtanum Creek Watershed



4.2.3 Middle and Lower Reaches

The mainstem of Ahtanum Creek begins at the confluence of the North and South Forks and extends to its mouth at the Yakima River in Union Gap (Figure 1-2). Stream flows in the mainstem are influenced by a variety of conditions, including surface water flows from the upper watershed, diversions for irrigation, runoff, and seepage losses and gains.

Historical flow data for the mainstem of Ahtanum Creek are available from gauging stations operated by the USGS near Tampico (water years 1909 to 1968), just below the confluence of the North and South Forks, and at Union Gap (water years 1904 to 2003) near the mouth of the creek. The gauge near Tampico has only been operated for a few years at a time. The gauge at Union Gap has been operated nearly continuously since 1961. Flow records indicate that the mean monthly stream flow at Union Gap for the period of record ranges from approximately 16 cfs in August to approximately 169 cfs in May. The highest peak flows during flooding were approximately 3,100 cfs, on January 16, 1974, and approximately 2,660 cfs, on February 9, 1996.

The *Ahtanum Creek Watershed Assessment* (Golder, 2004) noted that, in general, peak flows and base flows measured on Ahtanum Creek at Union Gap are similar in magnitude to flows from the upper watershed. This is unusual because the area contributing to the flow at Union Gap is much greater than the area contributing to the flow in the upper watershed. In addition to the impact that diversions have on the flows in the lower watershed, it has been suggested that the geology of the watershed plays a role in the stream flow pattern. Surface water is lost through seepage in alluvial deposits in the upper and middle reaches of the watershed, transported through perched channels, and regained in the lower reaches of the creek as groundwater return flow.

Stream flow is diverted for irrigation by agricultural users on both the north and south sides of Ahtanum Creek. Water diversions from the mainstem of Ahtanum Creek are operated by the AID and the WIP.

The AID diverts water from the mainstem of Ahtanum Creek for irrigation through a diversion structure to Bachelor and Hatton Creeks. Bachelor and Hatton Creeks are used to distribute surface water to customers north of the mainstem of Ahtanum Creek. Stream flows in Bachelor and Hatton Creeks, which are natural stream channels, are primarily influenced by irrigation diversions. The AID currently diverts surface water for irrigation until July 10. In 2002, the average rate of diversion ranged from 14 cfs in March to 30 cfs in May.

The WIP diverts water from the mainstem of Ahtanum Creek at two locations. The upper diversion is located just upstream of the AID diversion to Bachelor and Hatton Creeks near River Mile 19.6. The lower diversion is located upstream of the Hatton Creek return near River Mile 9.9. The WIP currently diverts surface water mostly during the late spring and summer. In 2002, the average rate of diversion ranged from approximately 56 cfs in June to less than 4 cfs in September. The 2002 diversion is the most recent information available and does not reflect the amount of diversion the Yakama Nation is entitled to under its water right.

Flows have not historically been monitored along the mainstem of Ahtanum Creek between Tampico and Union Gap below the AID and WIP irrigation diversions. However, anecdotal evidence suggests that Ahtanum Creek has often been dry below the AID and WIP diversions during the late summer and early fall. Recent changes in the amount and schedule of surface water diversions by the WIP have resulted in continuous flow being maintained in the creek after 2001. ~~Recently, routine s~~Stream flow measurements have been taken at gauging sites monitored by the Yakama Nation above the WIP Upper Canal, near Carson Road, and at American Fruit Road periodically starting in the summer of 2000. The flow data indicate that from 2000 to 2004, late summer~~continuous~~ flows have been ~~maintained~~ increased downstream of the AID and WIP diversions, but flows ~~have~~ continue to drop~~ped~~ below 10 cfs during the late summer below the ~~AID and WIP~~ diversions.

Data collected from a survey of farmers, residents, and businesses within the watershed for the analysis presented in the *Ahtanum Creek Watershed Assessment* indicate that approximately 14,000 acres were used in 2002 to grow a variety of crops within the AID and the WIP (Golder, 2004). It was estimated that approximately 11,100 acres were irrigated, at least in part, by surface water. A model was developed as part of the analysis for the *Ahtanum Creek Watershed Assessment* (Golder, 2004) to calculate crop water demand based on a variety of conditions. Based on the data from the survey, the total amount of water needed to irrigate the crops was estimated at 46,400 acre-feet annually. Based on data from the survey related to the number of acres irrigated with surface water versus groundwater each month, the surface water demand was estimated at more than 18,000 acre-feet annually. It was assumed that the remaining crop water demand was supplied by groundwater, or that some of the acreage was under-irrigated.

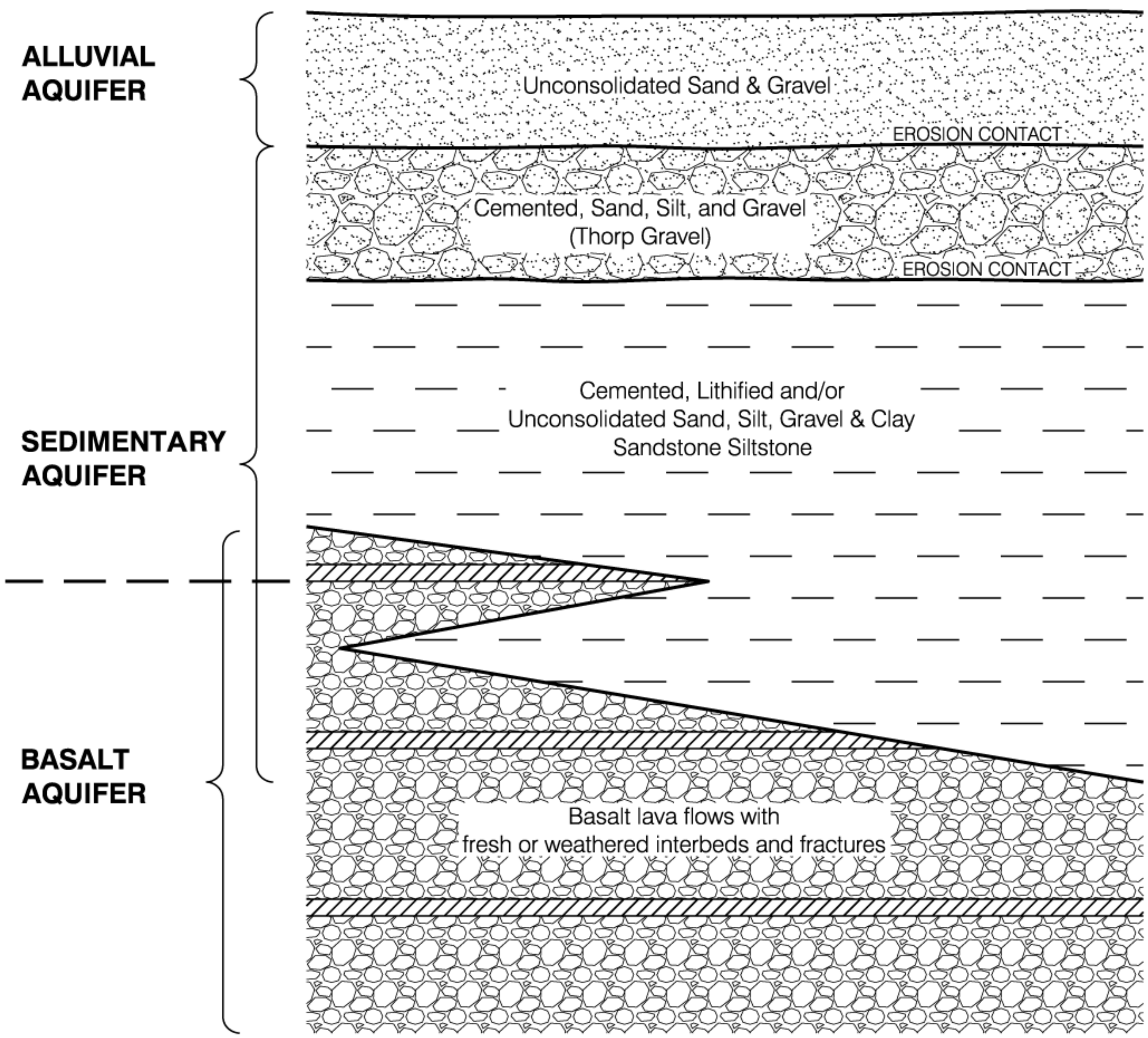
The estimate of surface water demand includes water that is diverted and lost through conveyance and on-farm irrigation inefficiencies. The AID conveys water to users through Bachelor and Hatton Creeks, which are natural stream channels. The WIP conveys water to users through two mostly unlined irrigation canals. Field inspection, conversations with AID and WIP staff, and flow measurements indicate that significant seepage occurs resulting in reduced irrigation efficiency The efficiency of conveyance and on-farm irrigation systems is the ratio of water that is actually applied to crops for their use to the amount of water diverted from the stream or pumped from groundwater wells. The *Ahtanum Creek Watershed Assessment* (Golder, 2004) estimated that the overall efficiency of the AID and WIP conveyance structures was approximately 75 percent. The analyses presented in the *Ahtanum Creek Watershed Assessment* (Golder, 2004) and in this EIS assume that the conveyance efficiency of AID facilities has typically been closer to 85 percent, and that the efficiency of WIP facilities has typically been closer to 63 percent. It was also estimated that on-farm irrigations systems were, on average, approximately 70 percent efficient. This means that overall, 75 percent of the surface water diverted from Ahtanum Creek is delivered to individual irrigation systems by the AID and WIP systems, and that 70 percent of the water delivered to individual irrigation systems from surface water and groundwater sources is consumptively used by crops. The remainder presumably seeps into the alluvial aquifer and is either pumped out by other water users or enters a surface water body at some point.

In general, stream flow in Ahtanum Creek and its tributaries is highly variable from year to year and from season to season. As a result, surface water has not been a very reliable resource for irrigation of crops, habitat for wildlife, or other beneficial uses. One of the primary goals of the ACWRP is to increase the reliability of surface water.

4.3 Groundwater

Groundwater in the Ahtanum Creek Watershed flows within three distinct hydrostratigraphic units (aquifers) that control the quantity, quality, surface water recharge, and groundwater supply to wells (see Figure 4-4). The depositional and structural history of the geologic units determine the aquifer characteristics (permeability and orientation) that control groundwater flow direction within the aquifers. The hydraulic conditions that control rate and direction of groundwater discharge vary with location and depth, the seasonal and long-term variations in precipitation in the watershed, and the artificial transfer and use of groundwater and surface water in the watershed.

Figure 4-4. Hydrostratigraphic Units of the Ahtanum Creek Watershed



This section summarizes the hydrogeologic characteristics of the Ahtanum Creek Watershed. The information provided herein is compiled from several sources, including local and regional geologic and groundwater studies, driller's well logs filed with Ecology, and intermittent groundwater elevation and surface water flow data. As previous authors have concluded, a synthesis of available geologic and hydrologic information into a complete conceptual model of the groundwater-surface water system in the Ahtanum Valley does not exist. With each subsequent review, however, the general understanding of natural conditions and man-made influences on groundwater within the watershed is further developed and improved.

4.3.1 Sources of Information

The *Ahtanum Creek Watershed Assessment* (Golder, 2004) and *Naches Basin (WRIA 38) Watershed Planning* (Golder, 2002) present the most recent summaries of hydrogeologic and hydrologic conditions in the watershed. These reports describe geologic conditions based on previous investigations (Foxworthy, 1962; Campbell, 1979; Bentley and Campbell, 1983; Walsh, 1986) and provide additional geologic interpretation based on review of drillers' well logs. Water level data collected by USGS, Ecology, AID, and WIP were used to evaluate stream-aquifer relationships, seasonal variations in groundwater elevations, and hydraulic connection between aquifers. Geologic conditions are discussed above in Section 4.1.1.

4.3.1.1 Hydrogeologic Conditions

Streams within the lower reaches of the Ahtanum Watershed generally follow the east-west axis of the structural trough. Stream channels in the upland terraces north of Ahtanum Road are generally parallel to each other. These streams may follow zones of preferential weathering and erosion that developed along regionally oriented joints and fractures. Alluvial processes have obscured any east-west structural or erosional features that may exist in the Ahtanum Creek floodplain. However, east to west trending joints and faults may exist in the Upper Ellensburg Formation or basalt that underlie the lower Ahtanum watershed.

Hydrostratigraphic Units

In this study, three water-bearing hydrostratigraphic units based on distinct geologic and hydraulic characteristics have been identified: a basalt aquifer system consisting of confined porous and fractured zones between massive lava flows; a system of sedimentary aquifers consisting of unconfined to confined porous sand and gravel layers in the Upper Ellensburg Formation and Thorp Gravel; and the alluvial aquifer consisting of unconfined, unconsolidated sand and gravel lenses and layers (see Figure 4-4).

Basalt Aquifer System. The basalt aquifer system consists of porous, weathered, and fractured zones formed primarily along lava flow tops and ~~occasionally~~ in the weathered zones between lava flows. Massive lava flows and clayey sedimentary units between porous lava flow tops form zones of lower vertical permeability that may ~~tend to~~ hydraulically isolate individual water-bearing zones within the basalt aquifer system. The total thickness and depth of the basalt aquifer system beneath the valley are unknown; drilling to 1,100 feet at the east end of the Ahtanum Valley has not fully penetrated the basalt. The basalt extends the full width and length of the watershed. Basalt is exposed at the west end of the lower valley at the confluence of the North and South Forks, and forms the north and south valley walls. To the east near the Yakima airport, basalt is covered by sedimentary rock and alluvium to a depth of approximately 1,500 feet.

Porous zones within the basalt readily store and transmit groundwater primarily along the interface between flows. A complex structural pattern controls groundwater flow in the direction parallel to basalt layers. Vertical layers of basalt exposed at the ground surface readily transmit precipitation downward. Groundwater then flows along basalt layers parallel to the axis of the syncline (downward and to the east). The syncline plunges at a steeper angle than the topographic slope of the valley. Consequently, as groundwater moves deeper, artesian pressure increases toward the east within the basalt aquifer system. Fractures and joints in the basalt layers may create vertical conduits for groundwater to flow vertically upward between aquifers in the basalt.

The majority of groundwater recharging the basalt aquifer system enters along valley walls and in the upper Ahtanum Watershed above the North and South Fork Ahtanum Creek confluence. A less significant amount of recharge enters the uppermost basalt aquifers along the valley margins via the Thorp Gravel north of Ahtanum Road and the alluvium south of Ahtanum Road. Surface water recharges the basalt aquifers during periods of high flow where a thin layer of alluvium overlies the basalt, particularly along the creek near the confluence of the North and South Forks (Foxworthy, 1962).

Groundwater in the basalt aquifer system ultimately discharges laterally out of the Ahtanum Watershed into the Yakima River Watershed near Union Gap. Vertical hydraulic gradients within the basalt aquifer system indicate potential for upward vertical leakage of groundwater into overlying sedimentary aquifer system. The rate of upward vertical leakage and discharge to overlying aquifers cannot yet be determined without groundwater level data for the aquifers, surface water level data, and aquifer permeability estimates.

Drillers' logs provide information indicating that the upper layers of basalt are fractured and porous along the middle reach of Ahtanum Creek, where the alluvium cover is thin. Stream gauge data indicate that Ahtanum Creek loses water along this reach. The porous basalt receives and transmits the infiltrated water deeper into the basalt aquifer system. Groundwater following the easterly plunge of the basalt aquifer system flows from recharge areas above elevation 1,700 feet above mean sea level to the east end of the watershed at elevation 500 feet below means sea level near Union Gap. This significant topographic decrease creates artesian conditions (upward vertical gradient) at the east end of the watershed. Several wells completed in the basalt aquifers currently flow at the ground surface or historically flowed at the surface at the time of completion. Near the confluence of Bachelor and Hatton Creeks in the middle reach of the creek, groundwater occurs in wells at depths ranging from 25 to 100 feet.

Sedimentary Aquifer System. The sedimentary aquifer system consists of water-bearing solidified, partially cemented, and unconsolidated sand and gravel layers within the Upper Ellensburg Formation. An intermediate fine-grained member isolates upper and lower coarse-grained members within the sedimentary aquifers. The top of the sedimentary aquifer system also includes water-bearing layers within the cemented sand and gravel of the Thorp Gravel.

The cemented gravel increases in thickness to the east. The total thickness and depth of the sedimentary aquifer system beneath the middle and lower reaches of Ahtanum Creek ranges from tens of feet at the west end to 1,500 feet at the east end of the valley. The sedimentary aquifer system extends east from the confluence of the North and South Forks to the confluence with the Yakima River and beyond. The sedimentary aquifer system extends north beneath the Wide Hollow Creek watershed north of and including Cottonwood Canyon. Low permeability zones at the top of the sedimentary aquifer system impedes vertical groundwater flow between the alluvium and deeper units.

The sedimentary aquifer system plunges to the east and tilts inward towards the valley center. The coarse-grained upper and lower water-bearing zones of the sedimentary aquifers readily store and transmit groundwater through hydraulically continuous layers and zones beneath the lower reach of Ahtanum Creek. Well logs indicate that the base of the Upper Ellensburg Formation in some areas consists of clay or shale, which impedes hydraulic connection with the underlying basalt aquifer system. Fractures and joints in the sedimentary rocks may create vertical conduits for groundwater to flow into the underlying basalt aquifer system and overlying alluvium.

Precipitation recharges the sedimentary aquifer system. ~~Recharge~~ Leakage from underlying and adjacent basalt contributes some additional recharge to the sedimentary aquifers, primarily in the lower reaches of the valley, although the rate of recharge is unknown and inferred only from upward vertical gradients observed at the east end of the valley. The Upper Ellensburg Formation does not extend into the upper Ahtanum Watershed above the North and South Fork Ahtanum Creek confluence. Precipitation and irrigation water percolating into the Thorp Gravel north of Ahtanum Road and into the alluvium south of Ahtanum Road locally recharges the upper member of the sedimentary aquifer system. Recharge rates vary according to the amount and thickness of the clayey units in the uppermost 30 feet of the Upper Ellensburg Formation.

Some of the water lost from Ahtanum Creek along the creek by the confluence of the North and South Forks likely recharges the sedimentary aquifer system. Water level data are not sufficient to quantify the rate and timing of recharge.

The easterly sloping sedimentary aquifer system transmits groundwater from the various locations of recharge above elevation 1,700 feet to the point of discharge at elevation 1,000 to 500 feet near Union Gap. Similar to the basalt aquifer system, significant topographic decrease creates artesian conditions (upward gradient) at the east end of the valley in the sedimentary aquifers. Several wells completed in the sedimentary aquifer system currently flow at the surface, or historically flowed at the surface at the time of completion. At the west end of the valley, groundwater occurs in wells at depths ranging from 25 to 100 feet. Groundwater in the sedimentary aquifer system ultimately discharges out of the Ahtanum Creek Watershed into the Yakima River Watershed near Union Gap.

Vertical hydraulic gradients within the sedimentary aquifer system indicate the potential for upward leakage of groundwater into overlying alluvial aquifer. The rate of upward leakage and discharge of the alluvial aquifer and subsequent discharge to surface water cannot yet be determined without groundwater level data for the aquifers, surface water level data, and aquifer permeability estimates.

Alluvial Aquifer. The alluvial aquifer consists of water-bearing unconsolidated, unconfined layers of sand, silt, and gravel deposited by fluvial processes associated with Ahtanum Creek flow. The alluvial aquifer ranges in thickness from several feet up to 30 feet at the east end of the watershed. The western limit of the alluvial aquifer extends several miles upstream in the North and South Forks of the Ahtanum Creek, through the confluence of the North and South Forks, then spreads out into the middle and lower Ahtanum Creek reaches to the creek's confluence with the Yakima River and beyond. The alluvial aquifer underlies the entire lower portion of the Ahtanum Creek Watershed and generally becomes finer-grained to the east (Foxworthy, 1962). Golder (2004) reported that Glacial Lake Missoula Flood deposits potentially extend to approximately 1 mile west of American Fruit Road near the west end of the middle reach. These fine-grained deposits, if present, would impede vertical groundwater flow between the alluvial aquifer and sedimentary aquifer system. Alluvial aquifer transmissivity, therefore, likely decreases from west to east.

The coarse-grained layers of the alluvial aquifer readily store and transmit groundwater, which flows preferentially through hydraulically continuous layers and zones beneath the length of the Ahtanum Watershed. Groundwater within the alluvial aquifer occurs at depths of less than 10 feet, and the groundwater gradient slopes with topography to the east.

Groundwater within the alluvial aquifer is derived primarily from precipitation; infiltrating surface water from Ahtanum, Bachelor, and Hatton Creeks; ~~and~~ irrigation water; and upward leakage from underlying aquifers. On the basis of upward vertical gradients measured in wells, the sedimentary aquifer system appears to contribute additional recharge at the east end of the lower reach; however, recharge rates from upward leakage are unknown. Recharge rates for the alluvium vary widely based on the local geologic conditions and irrigation rates. A surface recharge map in Golder (2004) (see Figure 4-5) suggests that recharge to the alluvium is widespread in the middle reach of the Ahtanum Creek Watershed. However, this areal recharge map is based on rainfall distribution and evaporation and does not consider topography, soil type, land use, or extent of the alluvium.

Declining stream flow between stream gauges along the middle reaches of the mainstem suggest that Ahtanum Creek (and tributaries) west of American Fruit Road generally loses water to recharge the alluvial aquifer. East of American Fruit Road, stream flow generally increases, most likely from groundwater discharging from the Alluvial Aquifer and from irrigation return flow. The boundary between losing and gaining reaches varies seasonally with natural runoff and irrigation patterns. The rate and timing of stream gain and loss also varies widely, even from day to day.

Groundwater in the alluvial aquifer ultimately discharges out of the Ahtanum Creek Watershed into the Yakima River Watershed near Union Gap. Figure 4-5 illustrates the general regions of alluvial aquifer recharge and discharge.

4.3.2 Environmental Conditions that Affect Groundwater Quantity

The Ahtanum Valley experiences hot, dry summers and cool, moist winters. Winter and spring rainfall and spring meltwater generate the maximum runoff observed in late spring, which quickly declines after June. Late summer to early fall minimal stream flow derives from groundwater baseflow (and irrigation runoff) discharging from the alluvial aquifer into Ahtanum Creek. Wet season surface water flow is generally 10 times the dry season water flow. Wet season recharge from precipitation and streams (including snowmelt) accounts for most of the seasonal replenishment of the alluvial aquifer. Groundwater levels in the alluvial aquifer fluctuate between 3 and 10 feet per year, depending on the location within the lower watershed and proximity to recharge sources. This range represents direct influence of recent rainfall and snowmelt rates. Little or no snow remains in the watershed by late summer; therefore, snowmelt does not supplement runoff during drought years.

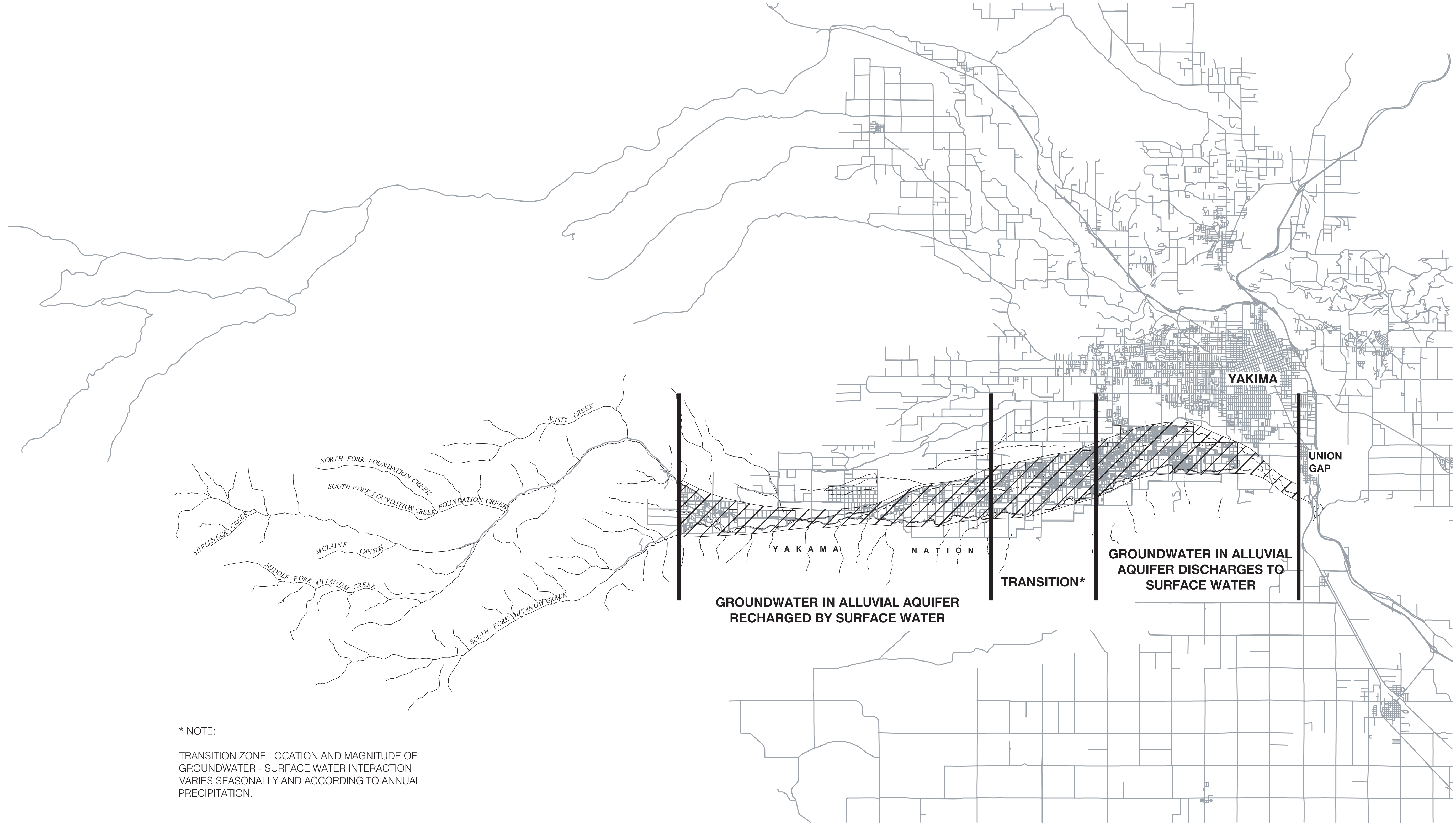
The available water level measurements from USGS and Ecology databases are not sufficient to accurately resolve seasonal fluctuations in the sedimentary or basalt aquifer systems. The groundwater levels appear to fluctuate seasonally by a few feet up to 10 feet, although groundwater pumping effects may mask water level fluctuations.

Longer-term fluctuations in groundwater levels depend on climatic conditions that affect seasonal precipitation. In general, long-term trends in groundwater levels correlate to precipitation trends. From 1980 to 1990, annual rainfall exceeded average levels, and from 1990 to 2000, rainfall generally was lower than average (PRISM data). Groundwater levels measured in wells completed in the sedimentary and basalt aquifer systems appear to have declined from 1985 to 1995, but rose thereafter. Foxworthy (1962) also reported general declines in basalt aquifer wells during the 1950s. However, the groundwater elevation data are not sufficient to quantify and distinguish between climatic and man-made influences on groundwater levels.

4.3.2.1 Groundwater Use

Approximately 2,000 water supply well logs are recorded with Ecology for the AID service area. This number does not account for wells not on file with Ecology, which could include up to 500 more wells in the service area. Figure 4-2 shows a generalized geologic map of the lower Ahtanum valley, illustrating the surface exposure of geologic rock types and mapped well locations. Figure 4-6 illustrates the west to east geologic cross-section through the middle reach of the Ahtanum Watershed. Of the recorded wells, approximately 10 percent are completed at depths less than 40 feet and are presumably completed in the alluvial aquifer. The majority of groundwater users, therefore, depend primarily on the sedimentary aquifers and basalt aquifer systems for groundwater supply.

Accounting for the rate of groundwater withdrawal by aquifer source, depth, location, and use would require a substantial effort of “ground-truthing” by direct user inquiry to establish accurate patterns of groundwater use in the watershed. However, good approximations are available using a water use survey completed by Fitch and Marshall (2003), which queried groundwater use by landowners in the watershed. The study concluded that of the 2,376 wells identified in the watershed study area, more than 2,000 wells were used for domestic supply and approximately 250 wells (10 percent) were used for agriculture. The survey results indicated that 29 percent of the domestic wells supplied some water for agricultural use, although only 3 percent of the agricultural wells supported domestic use (watering lawns and gardens).



* NOTE:

TRANSITION ZONE LOCATION AND MAGNITUDE OF GROUNDWATER - SURFACE WATER INTERACTION VARIES SEASONALLY AND ACCORDING TO ANNUAL PRECIPITATION.

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FIGURE 4-5

SURFACE RECHARGE MAP

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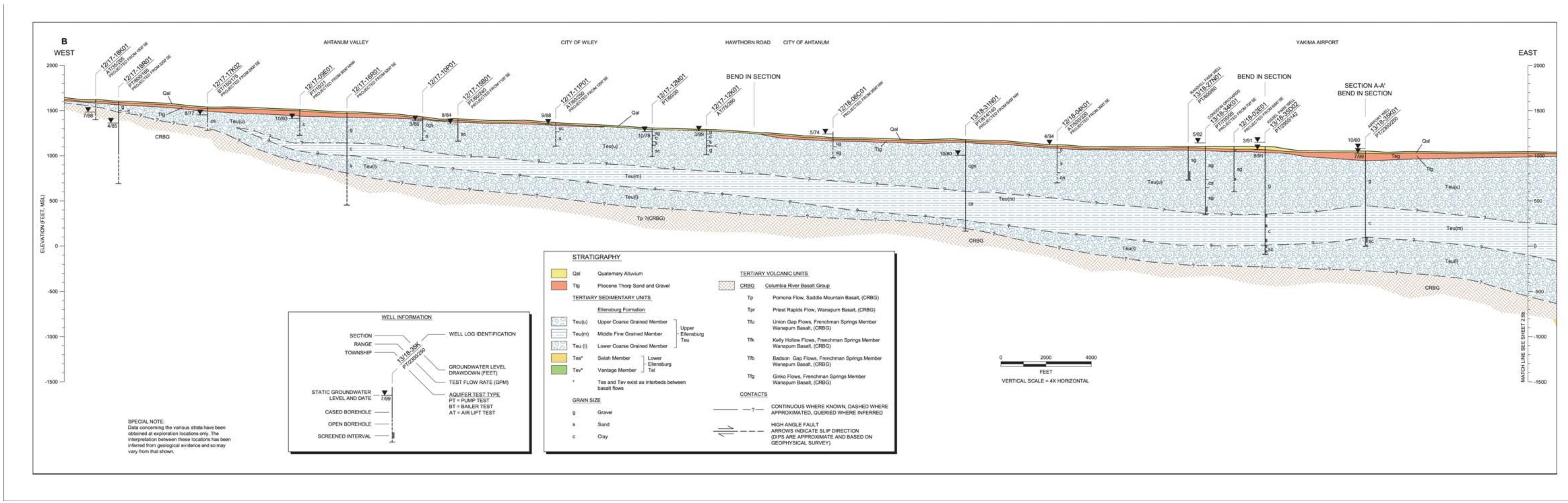

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FIGURE 4-6

GEOLOGIC CROSS-SECTION OF THE LOWER AHTANUM VALLEY

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The *Ahtanum Creek Watershed Assessment* (Golder, 2004) indicates that approximately 15,000 to 20,000 acre-feet of irrigation water applied in the AID service area in 2002 were derived from groundwater sources. Putting this volume in perspective, Foxworthy (1962) estimated that 5,000 acre-feet flows through the alluvial aquifer per year. The well depth and the irrigation use data clearly indicate dependence on deeper aquifer sources for irrigation supply.

Active groundwater rights in the AID service area total 23,280 acre-feet, which is close to the estimate of annual groundwater use. Without accurate surveys and metering, it is not possible to associate the groundwater use with a specific aquifer. Most of the irrigation water derives from wells with an average depth of 466 feet (Fitch and Marshall, 2003), which indicates sources from both the sedimentary and basalt aquifer systems.

The alluvial aquifer has the capacity to yield several hundred gallons per minute to wells and is a potential source for irrigation use. However, irrigators may limit their withdrawal from the alluvial aquifer to avoid interference with shallow domestic uses, and to avoid drawing water from streams. The alluvial aquifer tends to be used for domestic supply with demands less than 50 gpm.

The alluvial aquifer has the capacity to yield several hundred gallons per minute to wells. However, because the thickness and grain size of layers in the alluvial aquifer vary widely, wells may yield this rate only for short time periods where the aquifer is discontinuous. In addition, irrigators may not use some high-capacity wells completed in the alluvial aquifer to avoid drawing water from streams.

There are no data available to assess the amount of groundwater derived from exempt wells (see Section 3.2.1.1 in Chapter 3). The Fitch and Marshall (2003) study indicated that average depth of domestic wells in the study area is 198 feet, equivalent to the sedimentary aquifer system.

The water balance approach used by Golder (2004) to simulate effects of water transfer was calibrated by adjusting the hydraulic relationship between surface water and groundwater along different reaches of Ahtanum Creek. Actual recharge-discharge relationships were not measured. Typically, groundwater modeling assumes a local or regional value of vertical hydraulic conductivity~~aquifer transmissivity~~ and vertical hydraulic gradient to estimate the flow between surface water and groundwater. Modeling approaches, however, only generalize the patterns of flow and provide order-of-magnitude estimates of groundwater flow rates. To quantify actual flow, detailed measurements of groundwater elevations, aquifer parameters, and groundwater geochemistry are necessary. These data are not yet available.

Groundwater users in the study area primarily depend on deeper aquifers to supply most irrigation and domestic water. The alluvial aquifer meets a significantly smaller percentage of demand. Changes to groundwater withdrawal for irrigation, therefore, would affect current water balance in deeper aquifers, whereas changes to water application or efficiency would primarily affect water balance in the shallow alluvial aquifer.

4.3.2.2 Timing of Groundwater Use

Groundwater withdrawals for irrigation use occur primarily from June to September. Irrigators holding surface water rights may supplement irrigation demand with groundwater, but convert almost entirely to groundwater when the AID supply is discontinued after July 10. Groundwater withdrawn from deep aquifers for irrigation primarily returns to the alluvial aquifer and Ahtanum Creek; little of the deeper groundwater returns to the source aquifer except in the upper portions of the middle reach. Foxworthy (1962) estimated that 25 percent of the applied water returns to the alluvial aquifer and/or streams. The alluvial aquifer therefore, is recharged during much of the irrigation season.

Declines in deep aquifer groundwater levels indicate that in certain areas, the discharge from wells exceeds recharge by natural and artificial (irrigation infiltration) sources. The effect of groundwater usage is a net loss of groundwater from the deep aquifers and transfer of deep source water to the alluvial aquifer and streams. Irrigation diversion redistributes the stream flow from one to several channels and therefore distributes groundwater recharge of the alluvial aquifer throughout middle and lower reaches of Ahtanum Creek

Domestic groundwater use consists of a year-round demand for consumption and summer demand for yard and garden irrigation. Non-irrigation domestic groundwater use is non-consumptive, and the majority of the water returns to the groundwater system. Non-irrigation domestic groundwater use essentially transfers deeper groundwater from the sedimentary and basalt aquifer systems to the alluvial aquifer and Ahtanum Creek Watershed.

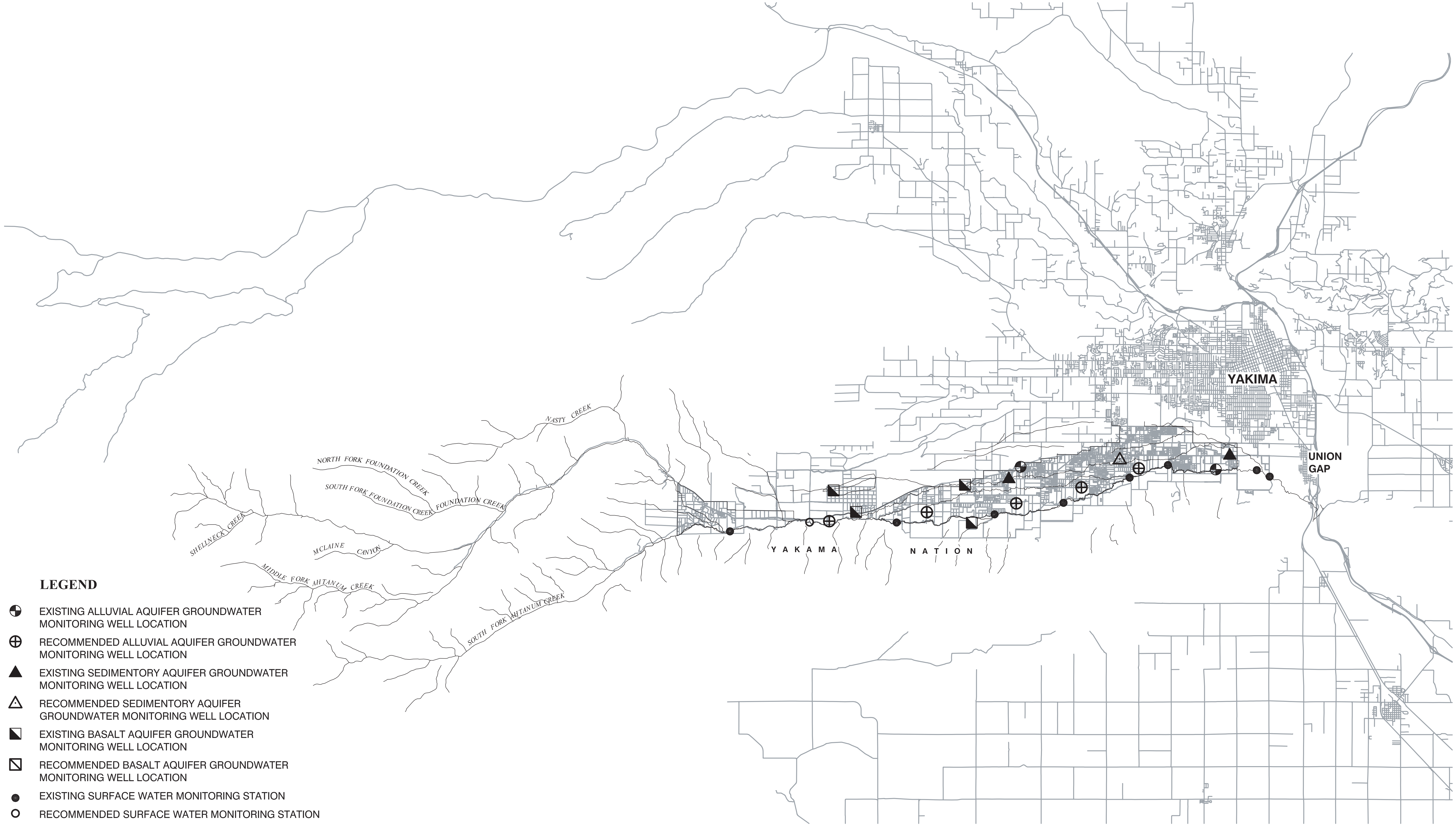
4.3.2.3 Data Needs

Groundwater level data for the study area are sporadic, discontinuous, unevenly distributed, and subject to interference by groundwater pumping. These data are necessary to identify both the natural climatic effects on groundwater levels and availability of groundwater. Data from active pumping wells can support evaluation of pumping influence on local groundwater levels and interaction with surface water. Concurrent surface water level data, however, are also needed to evaluate hydraulic continuity. Figure 4-7 shows the distribution of groundwater and surface water monitoring locations in the study area. The figure also includes recommended additional monitoring locations to support long-term monitoring and areas potentially impacted by alternative uses of surface water and groundwater in the study area.

4.4 Plants and Wildlife

This section describes the plants and wildlife in the Ahtanum Creek Watershed. Fish are described in Section 4.5.

The headwaters of the Ahtanum Creek Watershed are at an elevation of almost 7,000 feet. Elevation decreases to less than 1,000 feet at the mouth of the creek. This elevation change results in a gradient of vegetation from the headwaters to the mouth. The watershed traverses two plant community zones: the ponderosa pine *(Pinus ponderosa*) zone and the sagebrush (*Artemesia spp.)*-steppe zone (Franklin and Dyrness, 1988). Historically, the ponderosa pine



SOURCE: ATHANUM EIS, 2004; USGS TOPOGRAPHIC MAP, 1995

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FIGURE 4-7
GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS
AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS
AHTANUM, WASHINGTON

zone occupied the lower eastern slopes of the Cascade Mountains from elevations of approximately 1,800 feet to 3,000 feet. This zone currently extends from the headwaters to approximately the confluence of the North and South Forks Ahtanum Creek. The sagebrush-steppe is historically found in the lower elevations and extends from the confluence to the mouth of the creek.

The ponderosa pine zone was dominated prior to settlement by its namesake in a climax forest. Other tree species included grand fir (*Abies grandis*), western larch (*Larix occidentalis*), Douglas fir (*Pseudotsuga menzeisii*), quaking aspen (*Populus tremuloides*), western white pine (*Pinus monticola*), and lodgepole pine (*Pinus contorta*). Common understory species included grasses such as Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*), and shrubs such as antelope brush (*Purshia tridentata*) and snowberry (*Symphorocarpos albus*)(Franklin and Dyrness, 1988).

The sagebrush-steppe association in this portion of the state is dominated by antelope brush and Idaho fescue in its climax state. This association is a shrub and meadow community with significant amounts of grasses and forbs. Shrub species found in lesser amounts in this association include *green rabbit-brush (Chrysothamnus vicidiflorus)* and *common rabbit-brush (C. nauseous*). Understory associates include Sandburg's bluegrass (*Poa sandbergii*), arrow-leaf balsam root (*Balsamorhiza sagitata*), and mule's ear (*Wyethia amplexicaulis*). Vegetation communities in the Ahtanum Creek Watershed have been disturbed by human activities to various degrees throughout the lower, middle, and upper reaches of the watershed. Little of the native vegetation, especially of the sagebrush-steppe association, remains. The scale of human disturbance decreases across a continuum from the lower to upper reaches, with cropland and higher density urban and rural development prevalent in the lower watershed and forested areas dominant in the upper watershed.

4.4.1 Federally Listed Species

The USFWS lists Ute ladies tresses (*Spiranthes diluvialis),* an orchid species, as a threatened plant under the ESA. Although the USFWS list for Yakima County includes this plant, it is unlikely to be located in the project area because of the disturbed condition of vegetation. The plant is currently only known to be found in Chelan and Okanogan Counties (NatureServe, 2003).

Bald eagle (*Haliaeetus leucocephalus*) is listed as a threatened species in Yakima County. No bald eagle nesting or roosting habitat is available, and foraging habitat is limited in the Ahtanum Watershed. No bald eagle nests are located in the watershed. Communal roost sites are located along the Yakima River a few miles northeast and southeast of the project area, and a wintering area is located along the Naches River a few miles north of the project area (WDFW, 2004). Bald eagles typically nest and roost in large, old trees near open water away from human habitation (Stinson et al., 2001). Open water in the watershed is limited to several small streams and large trees are limited to the upper reach of the watershed. Foraging opportunities for bald eagles are limited to small numbers of waterfowl, fish, small mammals, and carrion.

4.4.2 Upper Reach

Vegetation at the headwaters in the upper reach is dominated by a relatively moist, high elevation Douglas fir, western larch, grand fir, and lodgepole pine forest. As elevation decreases, the forest transitions to a dry ponderosa pine and Douglas fir forest. Near the confluence of the North and South Forks, vegetation gives way to steppe and cropland. In riparian areas, black cottonwood *(Populus balsamifera ssp. trichocarpa)*, Pacific willow *(Salix lucida ssp. lasiandra)*, red alder *(Alnus rubra)*, red-osier dogwood *(Cornus stolonifera)*, and snowberry dominate. Wildlife use in the upper reach is likely to be more varied and include more forest-dependent species such as woodpeckers than the lower and middle reaches. Forests in the upper reach are used for commercial timber and have been extensively harvested. The upper reach of the Ahtanum Creek Watershed is less developed than the middle or lower reaches and has fewer areas of cropland or residential landscaping.

4.4.3 Middle Reach

Some areas of shrub or grassland steppe remain in the middle reach, although mostly in a degraded state due to grazing. Most of the remaining steppe areas are located on the Yakama Reservation south of Ahtanum Creek. Areas of agricultural and residential development have replaced the native vegetation with cropland and residential landscaping. The width of riparian vegetation along the creek varies, but it is generally more extensive than the vegetation remaining in the lower reach. Dominant plants in the native riparian communities include Pacific willow, quaking aspen, black cottonwood, red-osier dogwood, and Wood's rose *(Rosa woodsii)*.

Riparian conditions along the middle and lower reaches of Ahtanum Creek were assessed as part of the *Ahtanum Creek Watershed Assessment* (Golder, 2004). The riparian area generally has a diverse species composition and age class distribution. There are pockets of late-successional black cottonwood, which likely reflect the historic vegetation of the area. However, these stands contain high amounts of dead and decaying material and are declining, possibly as a result of limited floodplain inundation. Mid-successional Pacific willow habitat is now the dominant habitat type and is indicative of historical disturbance. Invasive plant species, such as reed canarygrass *(Phalaris arundinacea)*, are common in the riparian area. In several areas there is little or no riparian buffer, with agricultural and other land uses immediately adjacent to the creek. The watershed assessment identified four major problems that contribute to the poor riparian conditions:

- Presence of invasive plant species;
- Lack of streambank root mass protection;
- Restriction of riparian width due to encroachment and upland land uses; and
- Structural alterations of the channel.

Wildlife species observed and likely to occur in the area include beaver *(Aplodontia rufa)*, muskrat *(Ondatra zibethicus)*, meadow vole *(Microtus pennsylvanicus)*, deer mouse *(Peromyscus maniculatus)*, short-horned lizard *(Phrynosoma douglassii)*, California quail *(Callipepla californica)*, red-tailed hawk *(Buteo jamaicensis)*, northern harrier *(Cicus cyaneus)*, American kestrel *(Falco sparverius)*, barn owl *(Tyto alba)*, black-billed magpie *(Pica hudsonia)*, violet-green swallow *(Tachycineta thalassina)*, American robin *(Turdus migratorius)*, black-capped chickadee *(Poecile atricapilla),* and western meadowlark *(Sturnella neglecta)*.

The proposed Pine Hollow Reservoir location is in the middle reach of the watershed. Grasses dominate the proposed reservoir area. Vegetation in the proposed reservoir area is sparse because of the thin, gravelly soils and exposed basalt parent material.

4.4.4 Lower Reach

Little native vegetation remains in the lower reach. Vegetation in the area consists mostly of residential landscaping and agricultural crops such as pasture and hay with some orchards and vegetable crops. Riparian vegetation along Ahtanum Creek is limited or lacking in some areas, but most areas have at least a narrow band of woody, deciduous cover. Along a number of stream reaches, riparian vegetation extends at least 500 feet from the stream. Riparian species in the lower reach are similar to the middle reach, but black cottonwood is less prevalent. Riparian conditions are similar to those described in the middle reach. Wildlife use is similar to the middle reach, but species such as western meadowlark and short-horned lizard, which prefer less developed areas, are less likely to occur. Bank erosion and stream incision are problems in many areas of the lower reach.

4.5 Fish

The Ahtanum Creek Watershed provides habitat for a variety of fish species, including species listed under the ESA. Fish present in the watershed include summer steelhead (*Oncorhynchus mykiss,* ~~and its resident form, rainbow trout~~) and bull trout (*Salvelinus confluentus*), both of which are threatened species under the ESA. Currently, steelhead and bull trout spawn and rear in the watershed. In addition, spring Chinook (O. *tschawytscha*) salmon occur in the lower portion of Ahtanum Creek. Although several stocks of Chinook throughout Washington are listed under the ESA, the population in Ahtanum Creek is not part of an ESA-listed Ecologically Significant Unit (ESU). Spring Chinook are included in the Mid-Columbia River Spring-run ESU that is not listed under the ESA. Hatchery-origin coho (*O. kisutch*) are currently naturally spawning in Ahtanum Creek. Coho in Washington have been determined to not be warranted for listing under ESA.

Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) are the most widely dispersed resident fish species in the watershed (WDNR, 1997). Resident rainbow trout (*O. mykiss*, non-anadromous) are also present in the watershed. Other native fish species known to occur in the watershed are listed below (WDNR, 1997a; NPPC, 2001):

- Peamouth chub (*Mylocheilus caurinus*)
- Cottids: shorthead sculpin (*Cottus confuses*) and others
- Redside shiner (*Richardsonius baltatus*)
- Mountain whitefish (*Prosopium williamsoni*)
- Speckled dace (*Rhinichthys osculus*)

- Lamprey (*Lampetra sp*.)
- Northern pike minnow (*Ptychocheilus oregonensis*)
- Bridgelip sucker (*Catostomus columbianus*)

Figure 4-8 displays the distribution of ESA-listed and other salmonid species in the Ahtanum Creek Watershed.

4.5.1 Key Fish Population Status and Habitat Conditions

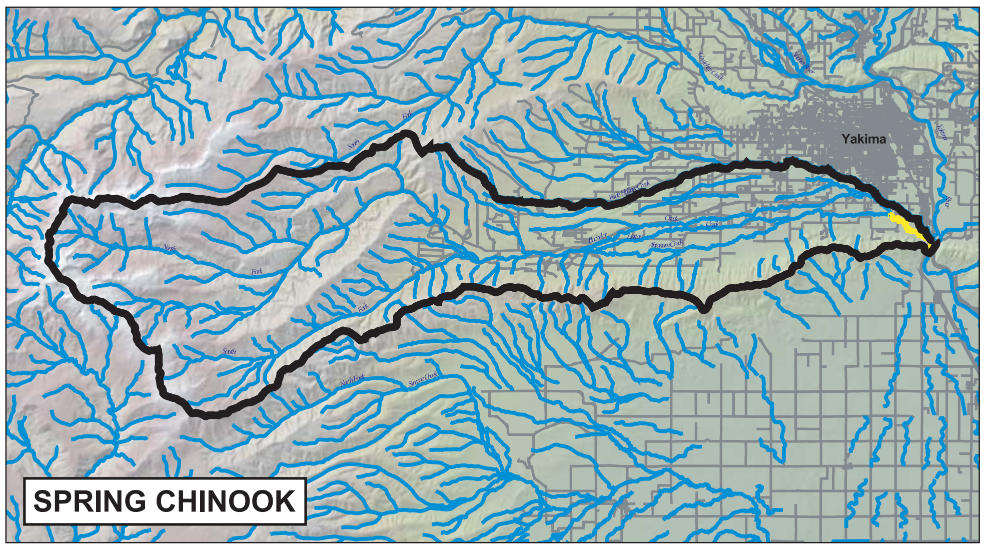
This section summarizes the status of key fish populations and aquatic/riparian habitat within the Ahtanum Creek Watershed. The discussion of fish habitat and populations focuses on spring Chinook, coho, steelhead, and bull trout. Fish habitat was characterized using a comprehensive modeling approach that compared current habitat to historic conditions. This approach identified habitat limitations for the four key fish populations and evaluated habitat restoration and protection actions and priorities throughout the Ahtanum Creek Watershed.

4.5.1.1 Modeling Fish Habitat Potential and Restoration Priorities

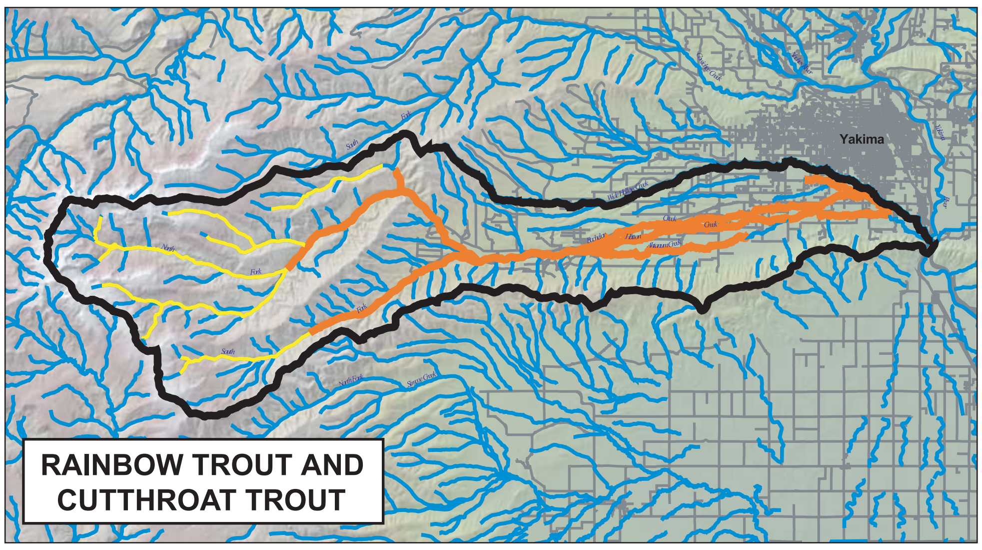
The potential of aquatic and riparian habitat within the Ahtanum Creek Watershed was identified in order to describe fish population conditions and assess habitat restoration and protection actions and priorities. Limitations of habitat were also identified. The Ecosystem Diagnosis and Treatment model (EDT) was used to identify the most important aquatic habitat and environmental factors affecting Chinook and coho salmon and steelhead populations in the watershed. An alternative model, described below, was used to assess the environmental factors impacting bull trout. The EDT model compares the potential of current environmental conditions to support fish populations to the potential under historical or normative conditions. The model uses the description of historic and current conditions to derive fish population production values from an analysis of the quantity and quality of habitat available to the different species of fish. These habitat-based performance estimates are derived from a large number of interrelated "rules" that summarize known relationships between fish survival and 46 different environmental variables.

The EDT model was used to assess the impact of the current conditions on spring Chinook, coho, and summer steelhead populations that spawn (or potentially could spawn) in the Ahtanum Creek Watershed. The model provides estimates of the key population "health" indicators of mean Abundance, Productivity, and Life History Diversity. In terms of the model outputs, Abundance denotes the expected average number of returning adults; Productivity is an estimate of the maximum number of returning adults per spawner; and Diversity describes the proportion of life history patterns that are self-sustaining (that result in at least one returning adult per spawner).

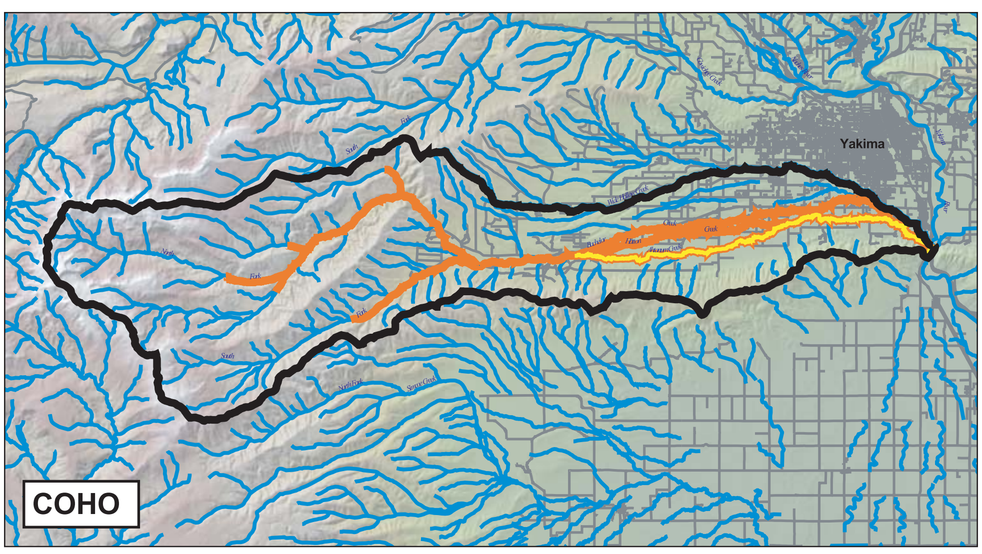
Based on the analysis of fish population performance, the EDT model provides a summary of the reaches prioritized by preservation value and restoration potential. For the purpose of the EDT analysis, Ahtanum Creek was divided into 32 reaches (see Figure 4-9). The *p*reservation value is the degree to which the population performance indicators (Abundance, Productivity, and Life



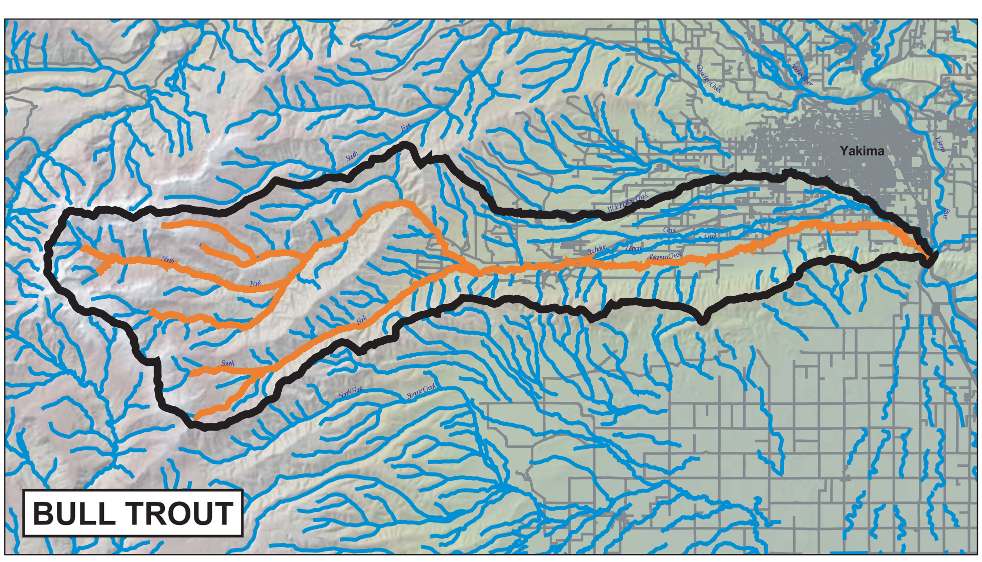
LEGEND
- Ahtanum Watershed Boundary
- Spring Chinook Distribution (Juvenile rearing only)
- Streams and Rivers
- Street and Roads



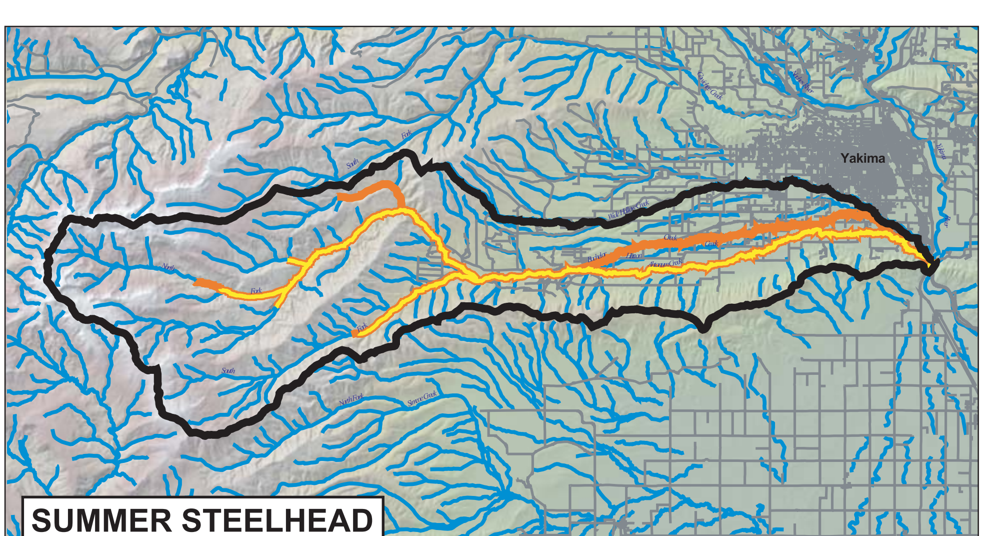
LEGEND
- Ahtanum Watershed Boundary
- Cutthroat Trout Distribution
- Rainbow Trout Distribution
- Streams and Rivers
- Street and Roads



LEGEND
- Ahtanum Watershed Boundary
- Coho Distribution (Adult spawning)
- Coho Distribution (Juvenile rearing)
- Streams and Rivers
- Street and Roads



LEGEND
- Ahtanum Watershed Boundary
- Bull Trout Distribution
- Streams and Rivers
- Street and Roads



LEGEND
- Ahtanum Watershed Boundary
- Summer Steelhead Distribution (Adult spawning)
- Summer Steelhead Distribution (Juvenile rearing)
- Streams and Rivers
- Street and Roads

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FIGURE 4-8

SPRING CHINOOK, RAINBOW TROUT, CUTTHROAT TROUT, COHO, BULL TROUT, AND SUMMER STEELHEAD DISTRIBUTION

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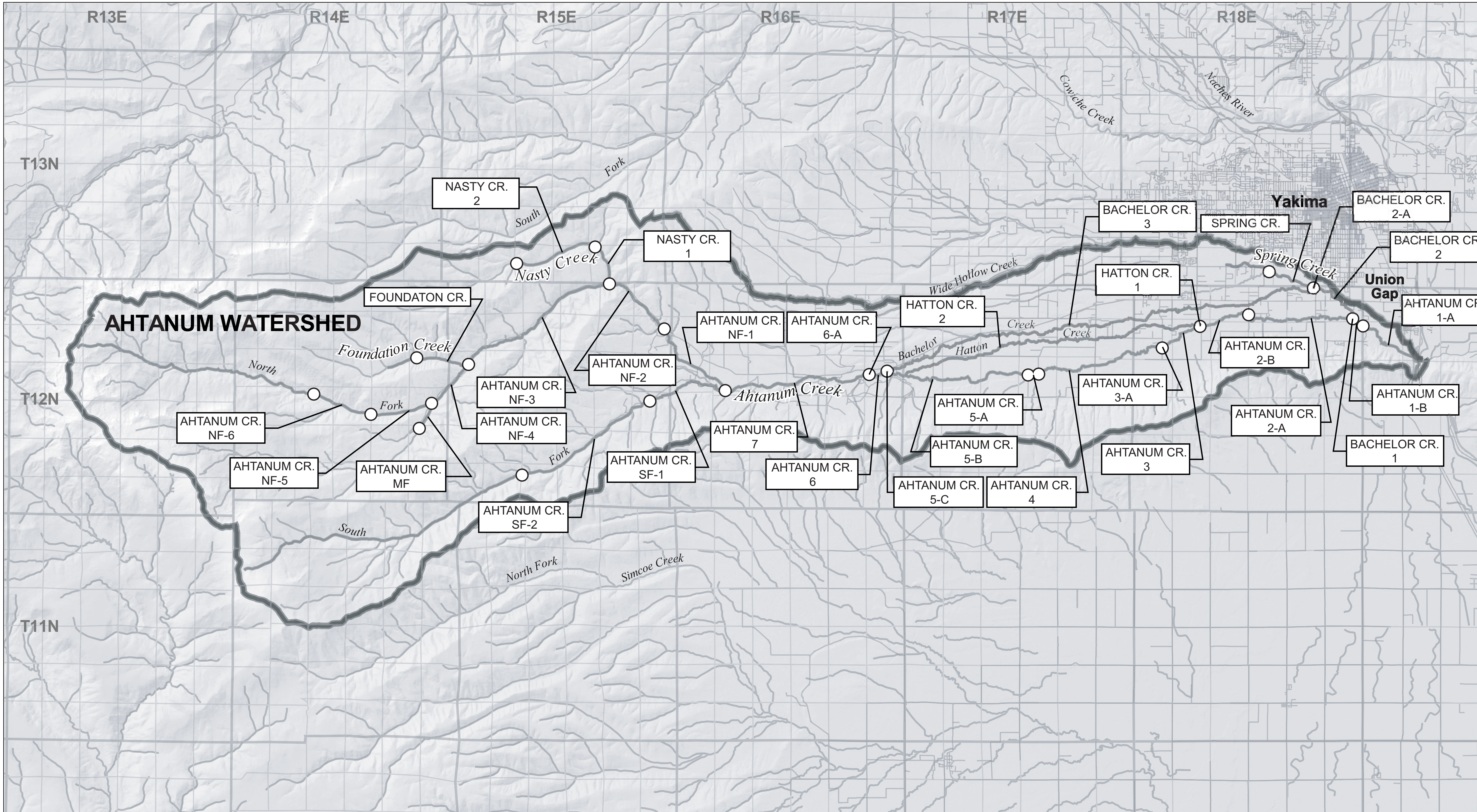

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FIGURE 4-9

AHTANUM CREEK STREAM REACHES

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON

History Diversity) for each fish species are supported by a reach. The restoration potential is the increase in the performance indicators the fish population would experience if the reach were restored to historical conditions. The preservation value is estimated as the percent decrease in the population's performance that would result if the reaches were thoroughly degraded. Reaches with a high preservation value are candidates for protection because their degradation would have a disproportionately severe impact on fish population production. The significance of a reach with high restoration potential is that a given degree of restoration there would result in considerably more benefit to the population as a whole than if the same effort was applied to a reach with low restoration value.

Because existing data were not available to expand the database to include the extreme headwaters reaches and tributaries in which bull trout spawn, the EDT model was not applied to the bull trout population. Instead, the Qualitative Habitat Analysis (QHA) tool was used to diagnose environmental limiting factors for bull trout. QHA relies on expert knowledge to describe conditions in stream reaches and assess changes in relation to a target species such as bull trout. QHA is a structured approach to gathering and organizing expert knowledge to arrive at a documented conclusion regarding habitat limitations. Because it is much less data intensive, QHA analysis can be completed much more rapidly than a full EDT analysis. The QHA tool does, however, have limitations relative to EDT. QHA results represent the subjective conclusions of experts rather than the results of application of the objective habitat rating rules in EDT. Each reach is rated independently in QHA without the connectivity between life stages in EDT. Finally, QHA does not predict future biological performance, but only describes limiting factors.

Each of the 32 reaches identified for the EDT analysis represents a relatively uniform area as defined by the general habitat types (e.g., low gradient, unconfined channels), management impacts (e.g., confined channel, fish passage obstructions), or fish distribution (e.g., limit of historical spring Chinook distribution) (see Figure 4-9 and Table 4-1). Habitat, water quality, and other characteristics potentially affecting the populations (e.g., predation and harassment) were developed for each of the reaches. In the late 1990s, habitat conditions for the Ahtanum Creek Watershed were described by Yakama Nation biologists, in collaboration with many other local biologists and resource managers. After review and refinement, this habitat data set provided the input data for the EDT analysis used in the *Yakima Subbasin Plan* (Yakima Subbasin Fish and Wildlife Planning Board, 2004). In addition, local biologists with extensive familiarity with the Ahtanum Creek Watershed further refined the watershed-specific data (Rogers, personal communication, 2004; Freudenthal, personal communication, 2004). The data used in the current analysis are the best available for the Ahtanum Creek Watershed.

Table 4-1. Ahtanum Creek Watershed EDT Reach Descriptions

Reach Name	Description	Length (mi.)[1]	Gradient	Mean Width (ft.) [1]
Ahtanum Creek-1A	Ahtanum Creek: mouth to Goodman Rd (RM 0.0 - 2.8)	2.8	0.3 %	30.3
Ahtanum Creek-1B	Ahtanum Creek: Goodman Road to Bachelor confluence (RM 2.8 - 3.2)	0.4	0.3 %	30.3
Bachelor Creek-1(Adult rack)	Bachelor Creek: Adult barrier at mouth	0.0		
Bachelor Creek-2	Bachelor Creek: Current adult rack to Spring Creek and potential new rack (RM 17.15)	2.0	0.4%	17.6
Spring Creek (Bachelor)	Spring Creek, mouth to access limit at right bank tributary 1.5 miles from mouth	1.5	0.5%	13.9
Bachelor Creek-2A(new adult rack)	Bachelor Creek: Site of potential new adult rack just above mouth of Spring Creek.	0	- -	- -
Bachelor Creek-3	Bachelor Creek: Spring Creek/new rack site to Bachelor/Hatton Diversion (RM 17.2 to 17.15)	15.8	0.8%	12.0
Ahtanum Creek-2A	Ahtanum Creek: Bachelor return to 42nd Avenue (upper end of UGA; RM 3.2 - 6.8)	3.6	0.7 %	25.0
Ahtanum Creek-2B	Ahtanum Creek: 42nd Avenue to Hatton return (RM 6.8 - 8.5)	1.7	0.7 %	25.0
Hatton Creek-1(Adult rack)	Hatton Creek: Adult barrier at mouth	0.0		
Hatton Creek-2	Hatton Creek: Return to source near Bachelor/Hatton diversion (RM 0 to 10.5)	10.5	1.0%	10.0
Ahtanum Creek-3	Ahtanum Creek: Hatton return to lower WIP diversion (RM 8.5 to 9.9)	1.4	0.8 %	19.0
Ahtanum Creek-3A (Lower WIP Diversion Dam)	Ahtanum Creek: Lower WIP Diversion Dam (RM 9.9)	--	0	--
Ahtanum Creek-4	Ahtanum Creek: Lower WIP Diversion Dam to American Fruit Rd. Bridge (RM 9.9 to 14.0) (downstream end of natural losing reach)	4.1	0.9 %	24.5
Ahtanum Creek-5A	Ahtanum Creek: American Fruit Rd to Marks Rd (subdivisions prohibited; RM 14.0 - 14.6)	0.6	1.0 %	21.9
Ahtanum Creek-5B	Ahtanum Creek: Marks Rd to Bachelor-Hatton Diversion (RM 14.6 - 18.9)	4.3	1.0 %	21.9

Table 4-1. Ahtanum Creek Watershed EDT Reach Descriptions (continued)

Reach Name	Description	Length (mi.)[1]	Gradient	Mean Width (ft.)[1]
Ahtanum Creek-5C (Bachelor /Hatton Diversion Dam)	Ahtanum Creek: Bachelor/Hatton Diversion Dam (RM 18.9)	--	1.0 %	--
Ahtanum Creek-6	Ahtanum Creek: Bachelor/Hatton Diversion to Upper WIP Diversion Dam (RM 18.9 to 19.6)	0.7	1.4 %	32.3
Ahtanum Creek-6A (Upper WIP Diversion Dam)	Ahtanum Creek: Upper WIP Diversion Dam (RM 19.6)	--	1.4 %	--
Ahtanum Creek-7	Ahtanum Creek: Upper WIP Diversion Dam to confluence of NF and SF (RM 19.6 to 23.1)	3.5	1.4 %	33.8
Ahtanum Creek NF-1	Ahtanum Creek NF: Mouth to historical spring Chinook access limit (RM 0 to 2.0)	2.0	1.6 %	25.6
Ahtanum Creek NF-2	Ahtanum Creek NF: Spring Chinook access limit to Nasty Creek (RM 2.0 to 5.3)	3.3	2.0 %	42.5
Nasty Creek-1	Nasty Creek, Mouth to end of intermittent section (RM 0.0 to 1.1)	1.1	5.6 %	8.3
Nasty Creek-2	Nasty Creek, end of intermittent section to access limit (RM 1.1 - 3.7)	2.6	4.9 %	12.5
Ahtanum Creek NF-3	Ahtanum Creek NF: Nasty Creek to Foundation Creek (RM 5.3 to 10.2)	4.9	2.0 %	20.4
Foundation Creek	Foundation Creek: Mouth to steelhead/coho access limit (RM 0 to 0.8)	0.8	6.4 %	14.7
Ahtanum Creek NF-4	Ahtanum Creek NF: Foundation Creek to MF Ahtanum Creek (RM 10.2 to 11.6)	1.4	0.8 %	19.0
MF Ahtanum Creek	MF Ahtanum Creek: Mouth to steelhead/coho access limit (RM 0 to 0.9)	0.9	3.9 %	17.2
Ahtanum Creek NF-5	Ahtanum Creek NF: MF Ahtanum Creek to McLain Canyon (RM 11.6 to 13.1) (upper access limit for coho)	2.5	3.1 %	17.2
Ahtanum Creek NF-6	Ahtanum Creek NF: McLain Canyon to upper access limit for steelhead (RM 13.1 to 14.5)	1.4	3.6	17.2
Ahtanum Creek SF-1	Ahtanum Creek SF: Mouth to historical spring Chinook access limit (RM 0 to 2.0)	2.0	1.6 %	18.9
Ahtanum Creek SF-2	Ahtanum Creek SF: Spring Chinook access limit to coho/steelhead access limit (RM 2 to 6.3)	4.3	2.6 %	17.0

[1] In the EDT reach database, fish passage obstructions, such as division dams, are designated as reaches but do not have lengths or widths.

4.5.1.2 Fish Population Status Under Current Environmental Conditions

The EDT simulation analyzed the performance of adult coho, spring Chinook, and steelhead populations in terms of life history diversity, productivity, carrying capacity, and mean abundance under current and historical habitat conditions. The results of the simulation for the three populations are summarized in Table 4-2. Based on the EDT simulation results, there have been dramatic reductions in the populations from historic conditions. All three populations within the Ahtanum Creek Watershed have reduced diversity, productivity, capacity, and abundance. The fish population results derived from the model are consistent with the observations of reduced populations based on field inventories over time (Golder, 2004).

Table 4-2. Predicted Current and Historical Production of Coho, Steelhead, and Spring Chinook Populations in the Ahtanum Creek Watershed (Based on the EDT model simulation)

Population	Scenario	Diversity Index	Productivity	Capacity	Abundance
Ahtanum Coho	Current without fisheries harvest	1%	1.5	188	59
	Historic potential	98%	5.0	3,830	3,065
Ahtanum Spring Chinook	Current without fisheries harvest	4%	1.3	118	26
	Historic potential	100%	8.8	2,653	2,353
Ahtanum Steelhead	Current without fisheries harvest	2%	1.3	753	174
	Historic potential	97%	10.1	5,672	5,113

Under current watershed conditions, productivity for all three species range from 1.3 to 1.5 returning adults per spawner. These very low productivity values indicate that under current habitat conditions Ahtanum Creek Watershed coho, spring Chinook, and steelhead have very limited prospects for long-term persistence as healthy populations. Based on EDT simulations for other watersheds, fish populations with a productivity value of less than 3.0 are usually classified as “depressed,” and populations with a productivity of less than 2.0 usually have ESA-listed status or have already been extirpated. The results for Ahtanum Creek Watershed indicate that the three populations could theoretically increase if environmental conditions remained relatively stable. However, even a short period of environmentally marginal years (e.g., persistent drought conditions) could easily result in extirpation of the local populations. These productivity values describe “satellite populations” of fish that colonize marginal habitat and persist at low levels during periods with productive environmental conditions, disappear during periods with poor environmental conditions, and never become abundant. In addition, under current conditions there are extremely low life history diversity values for the three species. These figures range from 1 to 4 percent, indicating that from 96 percent to 99 percent of all biologically possible life history patterns are not viable in the current habitat available.

Information from the EDT model simulation provides an overview of the aquatic and riparian habitat factors contributing to the reduced Ahtanum Creek Watershed fish populations. The factors most responsible for limiting the production of coho and spring Chinook salmon, steelhead, and bull trout populations are fine sediment, excessive water temperatures, a lack of key habitat (especially pools and off-channel habitat), channel stability, a lack of habitat diversity associated with very low quantities of large woody debris (LWD), and fish passage barriers. Sediment deposition is probably the most important limiting factor affecting most of the reaches and all three fish populations. Low flows from diversions and withdrawals also limit fish populations primarily by contributing to higher water temperatures. Degraded riparian vegetation also contributes to factors limiting fish production through reduced canopy cover over the stream (and thus increased water temperatures), diminished channel stability through the absence of roots and supporting vegetation, and minimization of future inputs of LWD to stream channels. Fish passage barriers limit access to productive spawning and rearing areas in the watershed. The EDT simulation-based findings on key factors limiting fish populations are consistent with the general observations outlined in the *Ahtanum Creek Watershed Assessment* (Golder, 2004).

The following is a summary of the primary aquatic and riparian habitat factors limiting spring Chinook, coho, and steelhead populations in the Ahtanum Creek Watershed.

Fine Sediment

Fine sediment deposition in stream channels is perhaps the single greatest limiting factor on fish production in the Ahtanum Creek Watershed,. Sediment routing and delivery to channels is caused by different factors in different portions of the drainage. Streamside roads, particularly roads within 200 feet of streams, are the major cause of sediment in the upper watershed (WDNR, 1997a). Bank erosion and channel incision is the principal source of sediment in the middle and lower portions of the watershed, particularly along Ahtanum Creek (Golder, 2004). As a result, the sediment issues in the Ahtanum Creek mainstem are attributable both to the movement of material from upstream sources and local sources associated with bank erosion and confinement. Recent habitat studies completed in the lower watershed indicate that accumulations of sediments in Ahtanum Creek are contributing to habitat degradation. There are specific areas in lower Ahtanum Creek where both fine- and coarse-grained sediments are causing a variety of problems with water and bedload conveyance, channel form, and channel-forming processes, all of which are leading to aquatic habitat changes (Golder, 2004).

Excessive Water Temperatures

Elevated water temperatures are cited as impacting fish populations in both the upper (WDNR, 1997) and lower portions of Ahtanum Creek Watershed (Golder, 2004). The primary factor causing increased water temperature is minimal shade over stream channels from reduced riparian vegetation.

Key Habitat Quantity

Key habitats are those aquatic habitats that are essential for success of each fish life stage. For example, appropriately sized and well-sorted gravels are necessary for spawning; pools and off-channel areas are important for juvenile rearing, particularly during winter high flow periods.

Ahtanum Creek spawning habitats have been impacted by excessive sedimentation, and there has been a significant loss of juvenile fish rearing habitat associated with reduced side channel areas, channelized stream segments, and limited wood in channels.

Large Wood in the Channels

Almost the entire length of Ahtanum Creek has channels that are wood-deficient, which causes problems with fish habitat diversity (particularly pool frequency and cover) and exacerbates problems related to channel stability/bed scour, off-channel habitats, predation risk, and harassment.

Fish Passage Barriers

Currently, a rack at the mouth of Bachelor Creek blocks access to all of Bachelor Creek and to its Spring Creek tributary. This rack was installed to prevent salmon and steelhead adults from spawning in a channel that is now dewatered after July 10 each year. Spring Creek provides fair to good spawning and rearing habitat for coho and steelhead for about 1.5 miles and, as its name implies, is supplied by spring water, which is considerably cooler than the water in Ahtanum Creek.

4.5.1.3 Priority Reaches for Habitat Restoration and Preservation

Of the 32 reaches comprising the Ahtanum Watershed (See Figure 4-9), four reaches stand out in terms of combined restoration potential for spring Chinook, coho, and steelhead populations, based on the EDT model simulation. Because bull trout habitat restoration priorities were derived from QHA, the habitat restoration priorities are described separately (see the subsection on bull trout under Section 4.5.1.4). The four reaches with the highest restoration potential for the three anadromous species as well as the primary aquatic and riparian limiting factors are:

- Ahtanum Creek – Reach 7: Upper WIP Diversion to the confluence of the North and South Forks (highest restoration potential for all three species). Primary limiting factors for this reach are sediment, habitat diversity, key habitats, and elevated water temperatures.
- North Fork – Reach NF-1: The North Fork from its mouth to RM 2.0, which marks the end of historic spring Chinook distribution. Primary limiting factors for this reach are sediment, habitat diversity, key habitats, channel stability, and elevated water temperatures.
- Ahtanum Creek – Reach 5B: Marks Road to the Bachelor-Hatton Diversion. Primary limiting factors for this reach are sediment, habitat diversity, key habitats, channel stability, elevated water temperatures, and flow.
- Ahtanum Creek – Reach 4: Lower WIP Diversion to American Fruit Road Bridge. Primary limiting factors for this reach are sediment, habitat diversity, key habitats, channel stability, elevated water temperatures, and flow.

In addition, there are reaches with high quality habitat that warrant a preservation strategy to maintain the habitat. Tables C-2 though C-7 (Appendix C) describe the relative habitat protection benefits for all of the reaches by fish population. In many cases the reaches that have the highest protection benefits also have large restoration benefits. This is because these reaches are important for the fish population productivity and both habitat degradation (if not protected) and habitat restoration will have a disproportionate impact on the populations. For all of the reaches evaluated the restoration benefits are greater than the protection benefits.

Restoration benefits for stream reaches are shown in the tables in Appendix C. The five highest ranking habitat protection reaches for the spring Chinook population are (Table C-2):

- Ahtanum – Upper WIP diversion to the forks (rank = 1);
- Ahtanum – Mouth to RM 2.0 (rank = 2);
- Ahtanum – Bachelor/Hatton Diversion to Upper WIP diversion (rank = 3);
- Yakima Toppenish to Sunnyside Dam (rank = 3, tie);
- Ahtanum – Lower WIP diversion to American Fruit Road (rank = 4);
- Ahtanum – Marks Road to Bachelor-Hatton Diversion (rank = 5);
- Ahtanum –Bachelor return to 42nd Avenue (rank = 5, tie).

The five highest ranking habitat protection reaches for the summer steelhead population are (Table C-4):

- Ahtanum – Upper WIP diversion to the forks (rank = 1);
- South Fork Ahtanum – RM 2.0 to the access limit (rank = 1, tie);
- North Fork Ahtanum – McLain Canyon to the access limit (rank = 2); North Fork Ahtanum – Middle Fork Ahtanum to McLain Canyon (rank = 3);
- Ahtanum – Marks Road to Bachelor/Hatton Diversion (rank = 4);
- Middle Fork Ahtanum – Mouth to access limit (rank = 5).

The five highest ranking habitat protection reaches for the coho population are (Table C-6):

- Ahtanum – Upper WIP diversion to the forks (rank = 1);
- Ahtanum – Marks Road to Bachelor/Hatton Diversion (rank = 2);
- Ahtanum – Lower WIP diversion to American Fruit Road (rank = 3);
- North Fork Ahtanum – Mouth to RM 2.0 (rank = 4);
- Ahtanum – Hatton return to lower WIP diversion (rank = 5);

The five highest ranking habitat protection reaches for the bull trout population are (Table C-7):

- North Fork – RM 11.8 to McLain Canyon (rank = 1);
- North Fork – McLain Canyon to steelhead access limit (rank = 1, tie);
- North Fork – RM 14.5 to Cougar Flat (rank = 2);

- North Fork – Cougar Flat to Shellneck Creek (rank = 3);
- North Fork – Middle Fork to beginning of spawning in North Fork (rank = 4);
- Middle Fork – Lower end of bull trout spawning to Tree Phones Camp Ground (rank = 5).

4.5.1.4 Fish Life Histories and Key Limiting Factors

The following discussion provides an overview of the life history patterns and the primary aquatic and riparian habitat factors limiting spring Chinook, coho, steelhead, and bull trout populations in the Ahtanum Creek Watershed. The *Ahtanum Creek Watershed Assessment* (Golder, 2004) provided information on fish species life histories and population status. The current and historical habitat factors affecting each of the fish populations in the watershed are derived from the EDT model simulation.

Spring Chinook Salmon

Current spring Chinook salmon use of the Ahtanum Watershed is limited to juvenile rearing ~~and migration~~ in the lower reaches~~several miles~~ of Ahtanum Creek near Union Gap. Historically, spring Chinook use included all life history stages, including spawning and the distribution extended several miles into the North and South Forks (Haring, 2000). The following discussion of life history stages describes~~is for~~ potential spring Chinook utilization if the population and habitat were restored. Migration begins in April and lasts through June. Spawning typically occurs between July and September, with the fry emergence beginning in February and extending through June. Following emergence, juveniles colonize downstream during the spring and summer. There is extensive downstream pre-smolt migration during the late fall and early winter when water temperatures in the lower Yakima River drop sharply. Most juvenile spring Chinook salmon complete their winter migration between October and January and over-winter between December and March. Smolt out-migration typically occurs between March and June.

The EDT model simulation identified the aquatic and riparian habitat factors impacting Ahtanum Creek watershed spring Chinook populations (Table C-1 in Appendix C). The factors with the greatest impact on the population are sediment, elevated water temperatures, habitat diversity, key habitat quantity, and flow.

Based on the EDT model simulation of spring Chinook population response to historic and current habitats, the four highest priority reaches for habitat restoration, in rank order, are (Table C-2 in Appendix C) (Figure 4-9):

- Ahtanum Creek – Reach 7: Upper WIP Diversion Dam to confluence of North and South Forks
- Ahtanum Creek – Reach 5B: Marks Road to Bachelor-Hatton Diversion
- Ahtanum Creek – Reach 2A: Bachelor return to 42nd Avenue
- Ahtanum Creek – Reach 4: Lower WIP Diversion Dam to American Fruit Road Bridge

Summer Steelhead

Summer steelhead distribution within the watershed includes Ahtanum Creek, the North and South and Middle Forks, and tributaries. Summer steelhead migration typically occurs between September and May, with two peak periods: late October (fall migration period) and late February through early March (winter-spring migration period). The final migration to spawning areas typically occurs between January and May, and timing of this is likely triggered by water temperatures. Most spawning takes place in upper portions of the North and South Forks and tributary streams. Based on 1999-2003 data for Ahtanum Creek tributaries, most spawning activities occur between early Mach and mid to late June (Golder, 2004). After spawning, egg incubation takes place between March and July. Steelhead fry emerge between May and June.

Recent (1999-2003) steelhead spawner surveys suggest an upward trend in spawning activity within the Ahtanum Creek Watershed, which is consistent with other observations in the Yakima Basin (Golder, 2004). There also appears to be an upward trend in juvenile production and out-migration. Screw trap data from 2000-2002 collected by the Yakama Nation show yearly increases in juvenile observations (Golder, 2004). In 2002-2003, the breakdown of age-1 and age-2 steelhead juvenile smolts was 63.8 percent age-1, and 36.2 percent age-2 (Rogers, personal communication, 2004). The large proportion of age-1 smolts is significant because rearing out of the freshwater system greatly increases productivity. Faster growth rates that allow smoltification to occur at age-1 would results in higher smolt production because the second year of freshwater mortality is avoided.

The EDT model simulation identified the aquatic and riparian habitat factors impacting Ahtanum Creek Watershed summer steelhead populations (Table C-3 in C). The factors with the greatest impact on the population are sediment, elevated water temperatures, habitat diversity, key habitat quantity, channel stability, and flow.

Based on the EDT model simulation of summer steelhead population response to historic and current habitats, the four highest priority reaches for habitat restoration, in rank order, are listed below (Table C-4 in Appendix C) (Figure 4-9):

- Ahtanum Creek – Reach 7: Upper WIP Diversion Dam to confluence of North and South Forks; and (tie) North Fork Ahtanum Creek – Reach NF-3: Nasty Creek to Foundation Creek
- South Fork Ahtanum Creek – Reach SF-2: RM 2 to end of coho access limit
- North Fork Ahtanum Creek – Reach NF-2: RM 2 to Nasty Creek
- Nasty Creek – Reach 1: Mouth to start of perennial flow

Coho Salmon

Native coho salmon were extirpated from the entire Yakima River Basin, including the Ahtanum Creek Watershed in the ~~early 1980s~~mid to late 1970s. Coho decline was caused by a variety of in-basin and out-of-basin factors. In-basin factors included habitat degradation and stream flow impacts. Out-of-basin sources of coho mortality included over harvest and Columbia River dam impacts. Currently, hatchery-reared coho, which are ~~outplanted as smolts~~released as 0-age fry or fingerlings in the watershed, are now reproducing naturally in the system. Coho are distributed in Ahtanum Creek, the North and South Forks, and the lower portions of the Middle Fork and Nasty Creek. Historical information suggests that most of the hatchery-reared coho are early run, which is the same run timing as the native population. There is little information on the timing of life stages for Ahtanum Creek coho. Based on information supplied by the Yakama Nation, it appears that coho migration occurs between late August and late November, with most spawning activity taking place from late October through late December (Golder, 2004). Emergence takes place from late March through early June, and juveniles reside in the system for at least one year. Screw trap data indicates that juvenile outmigration peaks in May and June (Golder, 2004).

Recent (2000-2003) screw trap data supplied by the Yakima Nation provides information on juvenile coho production. Although the data are too limited to draw conclusive relationships, it appears there are yearly declines in juvenile coho production (Golder, 2004).

The EDT model simulation identified the aquatic and riparian habitat factors impacting Ahtanum Creek Watershed coho populations (Table C-5 in Appendix C). The factors with the greatest impact on the population are sediment, elevated water temperatures, habitat diversity, key habitat quantity, obstructions, and flow.

Based on the EDT model simulation of coho population response to historic and current habitats, the four highest priority reaches for habitat restoration, in rank order, are (Table C-6 in Appendix C) (Figure 4-9):

- Ahtanum Creek – Reach 7: Upper WIP Diversion Dam to confluence of the North and South Forks
- Ahtanum Creek – Reach 2A: Bachelor Creek return to 42nd Avenue
- Ahtanum Creek – Reach 5B: Marks Road to Bachelor-Hatton Diversion
- Ahtanum Creek – Reach 4: Lower WIP Diversion Dam to American Fruit Road Bridge

Bull Trout

The Ahtanum Creek Watershed supports a resident bull trout population, with all life stages represented—spawning, rearing, growth, and maturation. Bull trout spawning distribution includes Ahtanum Creek; the North, South and Middle Forks; Nasty Creek; and headwater tributaries. Both resident and fluvial life stages are likely to occur in Ahtanum Creek. Currently, the lower reaches of the stream are used mainly for migration purposes by fish seeking to access to the Yakima River. However, historically the lower stream reaches probably provided summer and winter rearing for bull trout as well. The resident population is the primary life history form present in the watershed. Historically, there was bull trout movement throughout the watershed and interaction between other Yakima River populations and the Ahtanum Creek population. The interaction between populations was limited due to low flows and other passage problems in the watershed. Interaction and movement between the bull trout populations is probably increasing as stream flows and watershed conditions improve.

The WDFW has conducted yearly resident bull trout spawner/redd counts within Ahtanum Creek mainstem and the North and South Forks; bull trout were~~are~~ present in all ~~the~~ three (see Table 4-3a). In a survey during 2000-2003, the largest number of redds were counted during 2001 and 2002, with 35 and 36, respectively (Golder, 2004).

Table 4-3a. Summary of bull trout spawning surveys (redd counts) in index areas Ahtanum Creek Watershed. (Data supplied by Washing Department of Fish and Wildlife, 2005)

Tributary Index Area	Year											
	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
N.F. Ahtanum	9	14	6	5	7	5	7	11	20	17	12	8
M.F. Ahtanum				1*	1*		0*	10*	1*	6	8	11
S.F. Ahtanum								5*	14	13	7	5

* Incomplete survey: Index area not fully defined or adequately monitored.
SOURCE: Easterbrook, personal communication, 2005.

The QHA was used to organize and rank expert knowledge of reach level habitat conditions for bull trout in Ahtanum Creek. Most bull trout spawning habitat is found in the upper watershed—especially the Middle, North, and South Forks of Ahtanum Creek. The fluvial life cycle was rated especially important in the QHA review, which led to a high prioritization of conditions affecting the migration through lower Ahtanum Creek.

Based on this general model of bull trout in Ahtanum Creek and the description of conditions in each reach, protection and restoration priorities for each reach are shown in Table C-7 in Appendix C. The relative restoration and protection values for each reach were based on the expert opinion of individuals who have knowledge of the watershed's aquatic habitat conditions and factors limiting bull trout populations. The length of the bar corresponds to the reach's relative restoration or protection value weighted by its potential importance to bull trout. The protection and restoration confidence scores reflect the relative certainty of the ratings based on the expert knowledge of habitat conditions for the specific reach. The higher the value, the greater the confidence in the relative score of habitat protection or restoration conditions for the reach. Protection values were highest in the upper watershed, reflecting both the importance of conditions in these reaches for current production of bull trout and the relatively lower level of habitat degradation compared to downstream reaches. The reaches with high protection values have relatively intact aquatic and riparian habitat and are areas where there is less value in pursuing restoration actions. Reaches with high protection values were primarily concentrated in the upper Middle Fork, North Fork, and Shellneck Creek. Restoration values were generally higher in the lower reaches of Ahtanum Creek as a result of the generally more degraded habitat condition in these reaches (Table B-7). Restoration values were also high in the lower Middle Fork and the South Fork of Ahtanum Creek. The lower Middle Fork and the South Fork of Ahtanum Creek reaches also had relatively high protection values. This indicates that these reaches are important for the current potential of bull trout in Ahtanum Creek but still have significant habitat degradation that could be addressed through restoration.

The knowledge captured in QHA was used to rank the importance of degradation of 11 habitat attributes in terms of bull trout performance (Table 4-3b). Based on relative rankings of these values averaged over the entire Ahtanum Creek, the top three limiting factors for bull trout were high temperature, pollutants, and lack of habitat diversity.

Table 4-3b. Habitat restoration rank of the eleven habitat attributes in terms of Ahtanum Creek Watershed bull trout population performance

Habitat Attribute	Restoration Ranking
High Temperature	1
Pollutants	2
Habitat Diversity	3
Channel Form	4
Obstructions	5
Fine Sediment	6
Riparian Condition	7
Low Flow	8
High Flow	9
Oxygen	9
Low Temperature	9

The relative rankings were derived from the QHA process.

Limiting factors are arrayed across the Ahtanum Creek Watershed reaches in QHA. Tables C-8 through C-10 in Appendix C show the distribution of limiting condition for the top three overall factors (water temperature, pollution, and habitat diversity) across all the reaches within the Ahtanum Creek Watershed. Within these tables, the length of the bar corresponds to the degree of degradation of the attribute weighted by its potential importance to bull trout. The larger the bar, the greater the reach's restoration value for the specific factor. For the most part, conditions were most degraded in the lower reaches and were generally better in the upper watershed. High water temperature followed this general pattern. Temperatures were elevated throughout lower Ahtanum Creek and in portions of the South and Middle Fork (Table C-8 in Appendix C). Elevated temperature received a particularly high restoration values in Ahtanum Creek because of its impact on the fluvial life history and impediment to migration between spawning areas and the mainstem Yakima River. There were also extreme water temperature restoration ratings in a North Fork reach (Nasty Creek to Foundation Creek) and a South Fork reach (River Mile 2.0).

Pollutants in Ahtanum Creek are the result of runoff from roads throughout the watershed and urbanization in the lower reaches. Pollutants were rated as an impediment to bull trout performance throughout much of Ahtanum Creek (Table C-9 in Appendix C). There were high pollutant restoration values in most of the lower Ahtanum Creek reaches, including the heavily urbanized reaches near the creek's confluence with the Yakima River.

Loss of aquatic habitat diversity impacts bull trout primarily as a result of 1) low levels of woody debris throughout the watershed and 2) channel confinement in specific reaches. Reaches with minimal habitat diversity have high habitat restoration values. Reaches with relatively high habitat diversity restoration values are primarily in the lower Ahtanum Creek and Nasty Creek (Table C-10 in Appendix C). Reaches in the South Fork also have relatively high restoration values due to limited habitat diversity (Table C-10 in Appendix C)

4.6 Scenic Resources and Aesthetics

Aesthetic qualities are generally defined as features that have intrinsic qualities including scenic, recreational, or natural features that are considered representative, unique, or distinctly characteristic of an area. This section describes existing conditions of scenic and aesthetic resources in the upper, middle, and lower reaches of the Ahtanum Creek Watershed.

4.6.1 Upper Reach

The upper watershed consists of two relatively narrow canyons along the North and South Forks of Ahtanum Creek. Roads follow the creeks up both canyons. There are several tributary streams in the upper reach, including Nasty Creek, Foundation Creek, the Middle Fork Ahtanum Creek, and Reservation Creek. The upper reach scenery is dominated by exposed basalt outcrops and mixed Douglas fir and ponderosa pine forests, including areas that have been and are currently being logged. Near Tampico where the North and South Forks converge, the canyons become more broad.

4.6.2 Middle Reach

In the middle reach of the watershed, the topography is predominantly flat. Ahtanum Road follows the creek, with views of the creek limited by dense riparian vegetation in most places. Most of this area has been developed for agriculture and housing and both dominate the views in the immediate area. Ahtanum Ridge is visible to the south and Cowiche Mountain is visible to the north.

The proposed reservoir site, Pine Hollow, is located in the middle reach. Pine Hollow is approximately midway between Tampico and Wiley City. Pine Hollow is an asymmetrical valley with a steep north side and a less steep south side. The elevation of the north ridge is approximately 1,840 feet and the south ridge elevation is approximately 1,830 feet. The canyon is vegetated with grasses and scattered poplars. The area is primarily used for grazing, with some residences on the south and west sides.

Johncox Ditch, an irrigation canal, currently flows through Pine Hollow. The diversion point for the ditch is on the lower segment of the North Fork of the Ahtanum Creek. The ditch is approximately 6 feet wide and 2 feet deep. Riparian vegetation has established along the ditch.

4.6.3 Lower Reach

The lower reach of the watershed becomes increasingly flat and more urbanized as the creek flows toward its confluence with the Yakima River. The views in the immediate area are dominated by agricultural fields, housing, and commercial and industrial development. Ahtanum Ridge and Cowiche Mountain are visible, as are the ridge and valley areas to the north and east. Ahtanum Creek flows into the Yakima River just above Union Gap, where the river cuts through Ahtanum Ridge and Rattlesnake Ridge. This gap in the ridges is visible in the lower reach of the watershed.

4.7 Land and Shoreline Use

This section describes current land use, zoning, and comprehensive plan designations in the Ahtanum Creek Watershed, and summarizes relevant land use plans and policies related to the proposed program. In addition, this section briefly describes the implications of the Shoreline Management Act (SMA) (Chapter 173-18 WAC) on the North Fork, South Fork, and mainstem of Ahtanum Creek. To facilitate discussion, the Ahtanum Creek Watershed is separated into three reaches (upper, middle, and lower; see Figure 1-2). The watershed is located in Yakima County, mostly within the County's unincorporated areas. Portions of the watershed's lower reach fall within the jurisdictions of the Cities of Yakima and Union Gap. The southern portion of the watershed falls within the northern part of the Yakama Reservation. Two unincorporated communities, Wiley City and Tampico, are located within in the middle reach of the watershed (Figure 1-2).

Ahtanum Creek forms the northern boundary of the Yakama Reservation (see Figure 1-2). The portion of the watershed north of Ahtanum Creek is located within the Yakama Nation ceded lands. Ceded lands are lands outside the reservation on which the tribe reserves the right to hunt, fish, access and use traditional cultural sites, and gather traditional foods and medicines in all of their "usual and accustomed places." Tribal lands on the reservation are not subject to state or local land use regulations. There are several privately owned parcels, or inholdings, on the reservation, including the portion of the reservation in the Ahtanum Watershed. These lands are subject to county land use regulations.

A variety of sources were used to compile land use information and assess potential impacts. In addition to conversations with local officials, a number of local agencies administer plans that contain land use strategies and policies relating to the proposed watershed project, including the Yakima County *Plan 2015* (Yakima County, 1997), the City of Yakima *Urban Area Comprehensive Plan* (City of Yakima, 1997), and the City of Union Gap *Comprehensive Plan* (City of Union Gap, 1999).

4.7.1 Relevant Plan Goals and Policies

This section summarizes comprehensive plan, zoning, and shoreline designations of the three jurisdictions in the Ahtanum Creek Watershed: Yakima County, City of Yakima, and City of Union Gap.

4.7.1.1 Yakima County

In May 1997, Yakima County adopted *Plan 2015 - A Blueprint for Yakima County Progress* as the County Comprehensive Plan to comply with planning goals established in Washington's 1990 Growth Management Act (GMA). *Plan 2015* provided Yakima County decision-makers, the development industry, and the public with a framework for future development. The main goals of *Plan 2015* include ensuring present and future residents are not burdened by a heavy financial burden and including provisions to protect agricultural, forest, mineral, and open space resources for future generations (Yakima County, 1997).

Yakima County's *Plan 2015* Comprehensive Plan Land Use Map (Figure 4-10) provides the groundwork for zoning designations. That is, the Comprehensive Plan Land Use map depicts the planned land use conditions throughout the County (e.g., Urban), whereas zoning regulates the type of allowed land uses as established in the Yakima County Code (Title 15, Zoning). Together, the County Comprehensive Plan and Zoning Code guide development throughout the Ahtanum Creek Watershed.

Yakima County's *Plan 2015* generally divides existing land use within the County into three major land use categories identified in the 1990 Washington State GMA: urban, rural, and resource. The *Plan 2015* accordingly establishes goals and policies based on each of the three land use categories to guide future land use decisions in Yakima County.

Economic Resource Lands

Areas designated as Agricultural Resource Lands and Forest Resource Lands and zoned Agriculture (AG) and Forest-Watershed (FW), respectively, fall under the Economic Resource Land designation established by Yakima County. The following land use goals and policies of the Agricultural Resource Lands are relevant to the proposed Ahtanum Creek Watershed Restoration Program:

- Maintain and enhance productive agricultural lands and discourage uses that are incompatible with farming activities (Goal LU-ER-AG 1);
- Agricultural practices and supporting activities such as farm worker housing and water resources for irrigation should be included on commercial agricultural lands (Policy LU-ER-AG 1.2); and
- Yakima County will work directly with irrigation districts, the legislature, and other responsible entities to ensure that adequate irrigation water is available for agricultural uses (Policy LU-ER-AG 1.21).

Forest Resource land use goals and policies from the Yakima County *Plan 2015* include:

- Maintain and enhance the conservation of productive forest lands and discourage uses that are incompatible with forestry activities within the Forest Watershed District (Goal LU-ER-F 1); and
- Encourage the conservation of forest lands of long-term commercial significance for productive economic use (Policy LU-ER-F 1.1).

Rural Lands

Rural areas in Yakima County are characterized by a variety of development patterns that are largely determined by the density and type of water and wastewater service provided. Rural properties can range from areas of dispersed 5- to 10-acre ranchettes on private wells and septic systems to more densely settled rural community centers served by public water and/or wastewater systems. Yakima County has established goals and policies to ensure most of the population resides within cities rather than rural areas. By 2010, the County hopes to have 75 percent of the population residing within incorporated cities and only 25 percent outside cities. Some of the objectives adopted to meet this goal include restricting the creation of small lots in rural areas and restricting development outside UGAs so that the density does not necessitate urban level of public services (e.g., water and wastewater).

Yakima County has further separated Rural Lands into four separate land use categories: Rural Settlement, Rural Transitional, Rural Self-Sufficient, and Rural Remote/Extremely Limited Development Potential (Figure 4-10). Rural designations on the County Zoning Map are similar to most land use designation except rural Self-Sufficient lands are zoned as Valley Rural (Figure 4-11).

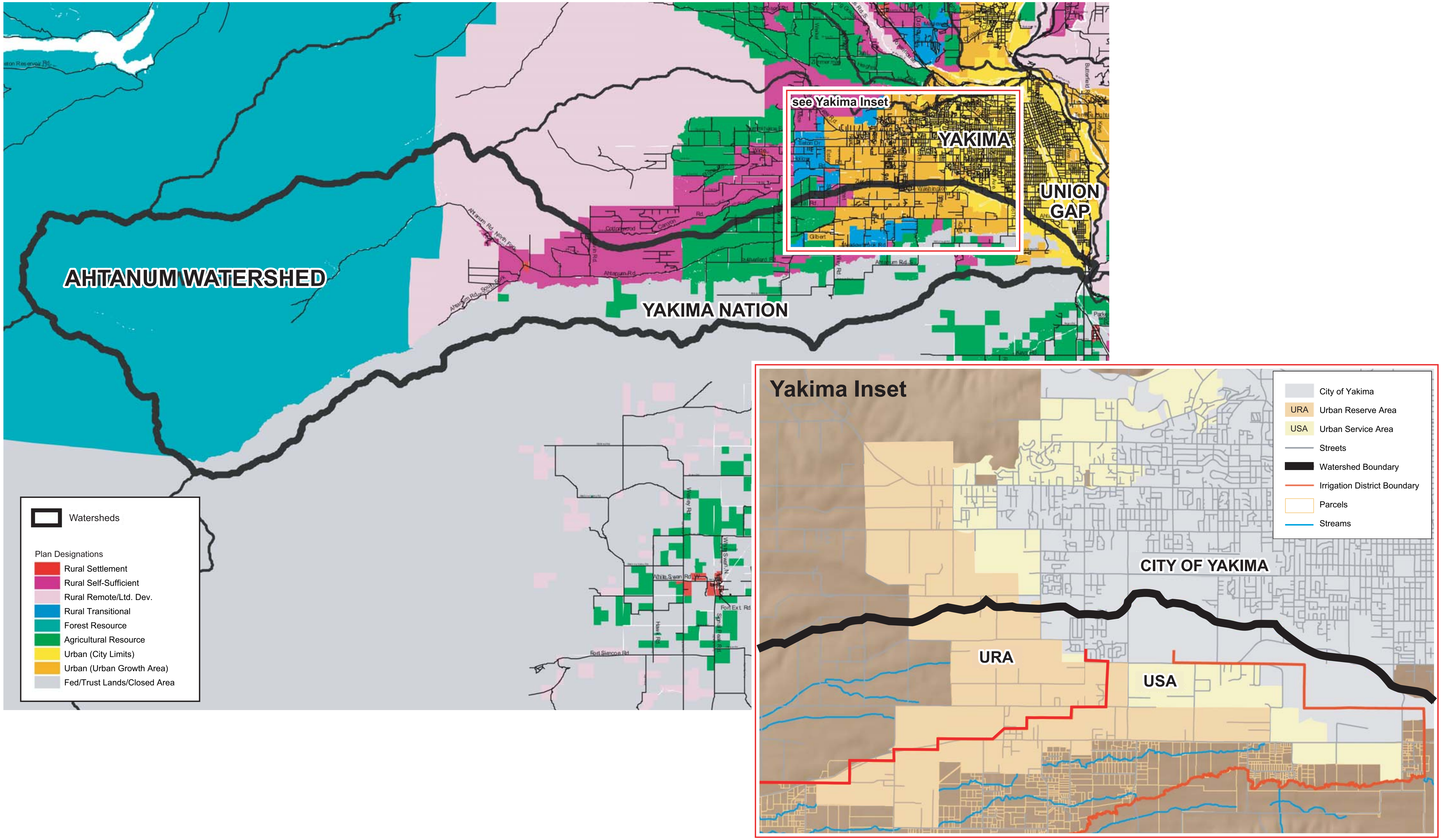
Goals and policies from the Yakima County *Plan 2015* relevant to the proposed project include:

- Promote the use of open space for agriculture, retention of critical area features, forestry for passive recreation, forestry, or passive recreation, using the special tax assessment programs as incentives (Policy LU-R 1.2); and
- Recognize agriculture as an important economic activity within designated rural areas (Goal LU-R 2).

Urban Lands

Yakima County's Urban designation is intended to include land that is characterized by urban growth or will be needed for urbanization, consistent with forecasted population growth and the ability to extend urban services. In accordance with Washington State's Growth Management Act's Planning Goal 1, "Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner," UGAs have been established throughout the County. The cities of Union Gap and Yakima have established their own respective UGA boundaries; however, the County has established goals and policies in the County's *Plan 2015* to separate rural and urban development practices. The UGA designation is intended to establish the area within which each of Yakima County's 14 incorporated cities and towns may grow and annex over the next 20 years. The following Urban Area goal from Yakima County's *Plan 2015* relates to the proposed project:

- Recognize the right to farm and farm use as a legitimate activity within the Urban Growth Area prior to conversion of property to urban use (Goal LU-U 4);
- Allow agriculture and farming operations as a permitted use on existing parcels within the UGA (Policy LU-U 4.1).



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Map data are the property of the sources listed below.
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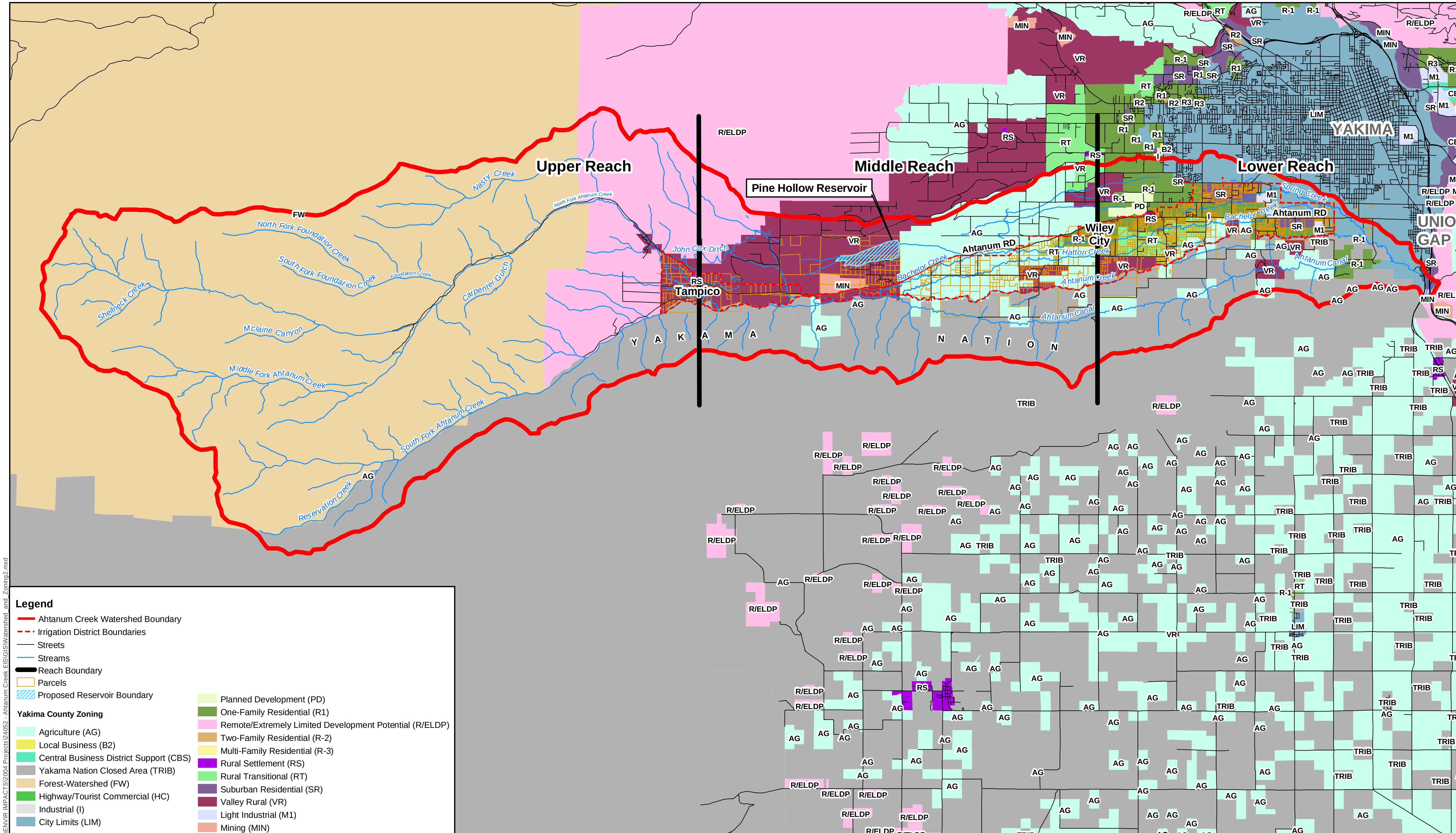
SOURCE: Yakima County GIS, 2004

FIGURE 4-10

YAKIMA COUNTY COMPREHENSIVE PLAN LAND USE DESIGNATIONS

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON



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Date last updated: 01/28/05

SOURCE: SOURCE: Ahtanum EIS, 2004; USGS topographic map, 1995

FIGURE 4-11

ZONING MAP

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON

Yakima County regulates shoreline environments in the Critical Areas Ordinance of the Yakima County Code (Title 16A). Conservancy and Rural designated shorelines of Ahtanum Creek are located within the project area. The Critical Areas Ordinance states that management objectives in Conservancy Environments are oriented toward establishing a balance between sustained-yield natural resource utilization and low density recreational uses in this environment, with restriction of development in hazardous areas. The management objective of the Rural Environment is to protect agricultural land, maintain open space, and provide for recreational uses compatible with agricultural production (YCC 16A.02.357) (Yakima County, 2004).

Yakima County is currently in the process of updating its Critical Areas Ordinance and Shoreline Master Program. The County anticipates adopting a revised Critical Areas Ordinance/Shoreline Master Program in March 2006 (Yakima County Planning Department, 2004). Future development along stream shorelines would be subject to policies and regulations established in the updated County regulations.

4.7.1.2 City of Yakima

The city of Yakima's *Comprehensive Plan* (1997) establishes general goals, policies, and objectives relevant to development. Although the *Comprehensive Plan* acknowledges some of the land within the Yakima UGA is currently used for agriculture, under definitions of the state Growth Management Act, no agricultural lands within the UGA have been designated as agricultural lands of "Long Term Commercial Significance." The city of Yakima UGA also includes an Urban Service Area and Urban Reserve Area (Figure 4-10 insert). The city of Yakima Urban Service Area is composed of 34 square miles and includes a variety of land uses and residential densities. The Urban Reserve Area provides land for phased, future development that will be incorporated into the city of Yakima Urban Service Area. As of the adoption of the current city of Yakima Comprehensive Plan in 1997, detailed land use and facility planning for infrastructure and urban services had not been completed for the Urban Reserve Area. Future land use planning in the Urban Reserve Area will be conducted through coordination between Yakima County and the cities of Yakima and Union Gap (City of Yakima, 1997).

The following general development goals, policies, and objectives from the Action Plan section of the city of Yakima's *Comprehensive Plan* are relevant to the proposed Ahtanum Creek Watershed Restoration Program because they regulate agricultural activity within the City's UGA and call for growth in areas served by existing infrastructure:

- Recognize the right to farm and existing farm use as a legitimate activity within the urban growth area prior to conversion of property to urban use (Policy G5.2);
- Plan for the integration of local water, sanitary sewer, storm sewer, and street infrastructure with metropolitan-wide facilities (Policy G6.2);
- Encourage economic growth which minimizes the public's share of infrastructure costs (Objective G7); and
- Direct development in planned areas where infrastructure is either present or can be easily extended (Policy G7.1).

Several objectives listed in the city of Yakima's *Comprehensive Plan* (1997) relate to the protection of the natural environment, in particular, to surface water features:

- New developments should be encouraged to locate in areas that are relatively free of environmental problems relating to soil, slope, bedrock, and water table (Objective E1);
- Preserve and enhance the City's shoreline areas (Objective E3) and shoreline uses and activities should be located to ensure the preservation and protection of the shoreline (Policy E3.1). The City requires review of flood and zoning ordinances to ensure protection of shoreline areas and resources and that actions meet minimum federal requirements;
- Development patterns and densities on lands adjacent to shorelines should be compatible with shoreline resources, and reinforce the policies of the Shoreline Management Act and City / County Shoreline Master Program (Policy E3.2);
- Native riparian vegetation in shoreline areas should be maintained (Policy E3.3);
- Identify and protect fish and wildlife habitat areas (Policy E4.1);
- Restrict development that is incompatible with protection of wildlife habitat (Policy E4.2);
- Protect water resources from contamination by establishing high standards for sewage treatment, industrial and agricultural practices (Policy E6.1);
- Establish improved watershed surface and groundwater management programs (Policy E6.2);
- Encourage coordination between governmental agencies and other major water providers for better water resource management (Policy E6.4); and
- Ensure development compatibility with the floodplain and frequently flooded areas (Objective E7).

4.7.1.3 City of Union Gap

Similar to Yakima County and the city of Yakima, the city of Union Gap's Comprehensive Plan is intended to guide future decisions related to development, capital facilities, transportation, and utilities. Primary goals related to the proposed project include protecting the environment and ensuring public facilities and services are adequate to serve future development.

The city of Union Gap has established general goals and policies that focus on preserving agricultural land use; protecting sensitive environmental features, including stream habitat and floodplains; and acknowledging the city's desire to explore additional water source options. The following goals and polices from the city of Union Gap *Comprehensive Plan* (1999) are relevant to the proposed project:

- Development outside of Union Gap's urban centers should be compatible with the distinctive features of the Valley's open spaces, orchards, and agricultural establishments (Pol. LU 1.8);

- Preserve the rural landscape of the agricultural uses near Union Gap (Goal AG 1);
- Where possible and compatible, preserve some land for agricultural activities (Pol. AG 1.1);
- Protect and enhance Union Gap's environmental quality, including surface water, wetlands, floodplain, groundwater, and wildlife habitat resources (Goal ES 1);
- Maintain the City's rivers, creeks, and intermittent stream courses in their natural state whenever feasible (Pol. ES 1.1);
- Develop land use controls that establish setbacks along all waterways to retain and enhance the natural vegetation for infiltration, maintenance of wildlife habitat, and retardation of runoff and erosion (Pol. ES 1.2);
- Implement surface water management systems which protect natural features whenever possible (Pol. ES 1.16);
- Implement a public information and involvement program to encourage and promote water resources and stream corridor protection (Pol. ES 1.18);
- Maintain and enhance the natural drainage systems to protect water quality, reduce public costs, and prevent environmental degradation (Pol. ES 1.22); and
- Pursue options for the development of additional water sources, including the potential for joint source development with adjacent water purveyors (Pol. CF 8.5).

4.7.2 Property Acquisition Regulatory Requirements

Irrigation districts are given the authority to acquire property through purchase or condemnation for the purposes of the irrigation district by RCW 80.03.140. Property can be acquired for canals, ditches, and reservoirs. The AID would be responsible for acquiring property for the Pine Hollow Reservoir and any land or right of way needed for water conveyance. Property acquisition would be done in accordance with RCW 8.20 for condemnation by a private corporation. Property acquisition would be done on a case-by-case basis following detailed project design and all necessary environmental documentation. The details of the condemnation process and coordination with other entities in the Ahtanum Creek Watershed, including federal, state, and tribal governments, would be fully examined prior to land acquisition.

The organization formed to coordinate the ACWRP would be established through a Joint Operating Agreement and may not have the authority to acquire property through condemnations. For any conservation or restoration project that would require property acquisition, such as road relocations, the organization would likely have to rely on the condemnation authority of the county or cities with jurisdiction over the area if it does not have that authority itself. In cases where there was no authority for condemnation, the ACWRP organization would have to negotiate for purchase of property.

4.7.3 Generalized Land Use and Shoreline Development

The following section describes the existing land and shoreline use within the Ahtanum Creek Watershed based on the three reaches of Ahtanum Creek shown in Figure 1-2. The upper reach is characterized by managed, forested land owned mostly by seven public and private entities. The middle reach largely includes agricultural use, with some single-family residential uses. Agricultural production in the Ahtanum Creek Watershed, which mostly includes irrigated cropland and non-irrigated pasture and range, combines to account for an estimated 27,199 acres. Approximately 14,000 acres of land are irrigated. The lower reach is characterized by urban areas, including portions of the cities of Yakima and Union Gap. The majority of the approximately 2,730 acres of residential and commercial use in the watershed is located in the lower reach (Golder, 2004). The Yakama Reservation extends throughout the southern portion of the watershed (Figure 1-2).

Yakima County and the cities of Union Gap and Yakima have established general goals and policies to guide future development in compliance with the Washington State Growth Management Act. The cities of Union Gap and Yakima have established UGAs aimed at preserving rural land uses from extensive development. Yakima County establishes similar development goals for unincorporated areas, with a high value placed on the preservation of agricultural uses.

Based on current trends, Yakima County estimates developable space will be available within the western portion of the city of Yakima's UGA through 2025. By 2035, the County estimates the UGA west of the city of Yakima will be subdivided and transformed to urban use. Yakima County estimates there is an approximately 70-year supply of buildable land available throughout the entire county based on current development rates (Hoge, personal communication, 2004).

4.7.3.1 Upper Reach

Land use in the upper reach is generally a mix of managed forest lands, agriculture, and sparse low-density residences. The upper reach of the Ahtanum Creek Watershed is located within unincorporated Yakima County except for the southern portion located on the Yakama Reservation. Seven public and private entities claim ownership to large sections of land throughout most of the upper reach including the AID, WDNR, Plum Creek Timber Company, Boise Cascade, Herke, Layman, and the Bureau of Land Management (BLM). The land ownership pattern in the upper watershed is a checkerboard of alternating public and private land, with most entities owning entire 640-acre sections. The WDNR, which occupies approximately 38 sections (approximately 24,320 acres), owns a majority of the land in the upper reach, followed by Plum Creek Timber Company (approximately 15 sections or approximately 9,600 acres) and Boise Cascade (approximately 13 sections or 8,320 acres). In addition, the Yakama Reservation, located along the southern boundary of the upper reach, occupies approximately 47 percent of the total area in the upper reach. Because ~~state,~~ federal, and tribal jurisdiction supercede local jurisdiction, lands owned by these entities are not subject to Yakima County land use or zoning regulations. State lands are subject to local land use regulations unless used for forest practices under the Forest Practices Act.

The Yakima County *Plan 2015* Comprehensive Plan Map designates the upper reach mostly as Economic Resource Land, comprised of lands designated as Forest and Agricultural Resource Lands (Figure 4-10). Forest Resource Lands are those areas primarily useful for growing trees for commercial purposes and also include areas for stock grazing, farming, recreation, and limited housing and commercial activities. Agricultural Resource Lands are those primarily devoted to or important for the long-term commercial production of horticultural, viticultural (grape cultivation), floricultural, dairy, apiary (bee hive management), vegetable, or animal products, or livestock. ~~In 1982,~~ Yakima County created two zones to protect agricultural lands: Exclusive Ag and General Ag. Generally, lands characterized as Exclusive or General Ag can be considered resource lands of long-term commercial significance (Yakima County, 1997). Various designated zoning and land uses occupy the upper reach, with zoning mostly consisting of Forest Watershed, followed by Remote/Extremely Limited (R/ELDP) and Valley Rural zoning. Parcels zoned Remote/Extremely Limited occupy a minimum of 40 acres whereas parcels zoned Valley Rural may vary in size (Yakima County, 2004). Zoning patterns in Yakima County generally follow the *Vision 2015* Existing Land Use Map designations; however, land use categories show specific types of land uses in the zoning areas. For example, land in the lower reach zoned as R/ELDP is attributed with various land use designations by the County that include State Lands, Agriculture, and Forestry land use designations (Yakima County, 1997).

Several shorelines along Ahtanum Creek within the upper reach of the Ahtanum Creek Watershed are regulated as Shorelines of the State under the SMA: North Fork Ahtanum Creek and a small portion of the South Fork Ahtanum Creek (Figure 1-2). Areas within 200 feet of these streams are designated as Conservancy in the Yakima County Code. The Yakima County Code defines shoreline environments in the Critical Areas Ordinance (Title 16A). A Conservancy shoreline designation is defined as an environment characterized by very low-intensity land uses primarily related to natural resources use and disperse recreational development, relatively low land values, minor public and private capital investment, and/or relatively major biophysical development limitations (YCC 16A.02.357).

According to the Yakima County Planning Department, extensive development is not anticipated in the upper reach (Hoge, personal communication, 2004). The County allows limited single-family development along stream reaches in compliance with the shoreline regulations established in the Yakima County Critical Areas Ordinance (YCC Title 16A).

4.7.3.2 Middle Reach

Similar to the upper reach, land uses in the middle reach of the Ahtanum Creek Watershed generally include large areas of undeveloped forested land, agricultural fields, and pasture land. Only a few small parcels are in public ownership in the middle reach. Rural property owners primarily use the land for individual farming operations. Agriculture in the middle reach is a mixture of livestock grazing and crop production.

The middle reach includes two small communities designated as Rural Settlements in the county Comprehensive Plan: Tampico and Wiley City. The county defines rural settlements as areas that have historically allowed small lot residential development, mixed-use commercial and resource-related industrial use. Rural settlements are generally small, unincorporated areas identified as communities located along State Routes, county collector, or arterial roads (Yakima

County, 1997). Tampico is located along Ahtanum Road at the western boundary of the middle reach and Wiley City, also along Ahtanum Road, falls within the city of Yakima's UGA on the eastern boundary of the middle reach.

The middle reach, similar to the upper reach, includes areas within unincorporated Yakima County (approximately 60 percent) and the Yakama Reservation on the south (approximately 40 percent). Lands within the middle reach are mostly designated as a mix of Forest, Agriculture Resource, and Rural Self-Sufficient lands according to Yakima County's *Plan 2015* (Figure 4-10). Valley Rural and Agriculture-zoned areas occupy most of the middle reach of the Ahtanum Creek Watershed. Other types of zoning in the middle reach include R/ELDP, Mining, Rural Transitional, and Single Family Residential (Figure 4-11).

Similar to the R/ELDP-zoned areas, the areas zoned as Agriculture occupy a minimum of 40 acres. ~~However, Yakima County will allow owners of land zoned for agriculture to subdivide into two properties after 5 years; in another 15 years, the property can be subdivided again.~~Yakima County allows owners to subdivide parcels zoned as agricultural every 15 years, provided a home built on the property to be subdivided has been established at least 5 years. Yakima County may permit modification of existing agricultural lands into ~~ranchettes in the future. Ranchettes are~~ small ranches or hobby farms occupying between 5 to 10 acres (Hoge, personal communication, 2005). However, zoning regulations restrict development outside UGAs by public water supply and wastewater system availability. For example, in Rural Settlement zoned areas (i.e., Wiley City and Tampico), the Yakima County Code permits varying lot sizes and densities based on water and sewer service availability. A lot that uses an individual well and sewage system (e. g., septic systems) with a minimum lot size of 43,560 square feet is permitted a maximum density of 1 unit per acre, whereas a lot serviced by public water and public sewer with a minimum lot size of 7,200 square feet is allowed 4 units per acre (YCC 15.37.030) (Yakima County, 2004).

Yakima County estimates that by 2035, areas zoned as Rural Transitional in the middle reach will become part of the City of Yakima UGA. The Wiley City community, located on the eastern portion of the middle reach, has expressed interest in obtaining wastewater service due to groundwater contamination. As a result of high groundwater levels, septic systems in the area experience a high rate of failure and may be contaminating groundwater (Hoge, personal communication, 2004).

The reach of Ahtanum Creek that extends through the middle reach of the watershed is designated as a Shoreline of the State, with the exception of the shorelines on the south side of the creek on the Yakama Reservation. The shoreline west of the west line of Section 15, Township 12 North, Range 17 East is designated Conservancy. West of this area to Ahtanum Creek's confluence with the Yakima River is designated as a Rural Environment (see Figure 1-2). The County defines Rural Environments as those characterized by intensive agricultural and recreational uses, moderate land values, lower public and private capital investment, and/or some biophysical development limitations (YCC 16A.02.357).

4.7.3.3 Lower Reach

The cities of Yakima and Union Gap and portions of unincorporated Yakima County occupy the lower reach of the Ahtanum Creek Watershed. The lower reach is characterized by considerably more development compared to the upper and middle reaches of the Ahtanum Creek Watershed. The portion of the city of Union Gap within the lower reach is mostly characterized by single-family residential development and pasture. Currently, residential development in Union Gap has reached capacity based on existing zoning. The city of Union Gap anticipates the build-out of industrial-zoned property over the next 10 years (Rathbone, personal communication, 2004). The lower reach portion within Yakima city limits is mostly characterized by single-family residential development. Agricultural lands in the cities of Yakima and Union Gap and their respective UGAs have historically been used for pasture. These lands are currently becoming fragmented by industrial and residential development. The Yakama Reservation occupies approximately 10 percent of the lower reach's total area, south of Ahtanum Creek.

Due to the proximity of the cities of Union Gap and Yakima, Yakima County's *Plan 2015* Comprehensive Plan Land Use Map (Figure 4-10) designates a large portion of unincorporated Yakima County in the lower reach as Urban. A few areas are designated as Agricultural Resource. Urban areas, defined as those portions of the watershed occupied by the cities of Yakima and Union Gap and portions of unincorporated Yakima County, make up approximately 4.9 percent (5,637 acres) and 1.9 percent (2,161 acres) of the lower reach, respectively. Single-family zoned areas occupy a majority of the incorporated areas within the lower reach (City of Union Gap, 1999; City of Yakima, 1997). In addition to residential development, pasture lands also occupy these areas zoned as single-family residential. Zoning designations from Yakima County and the cities of Union Gap and Yakima generally follow comprehensive plan land use map designations previously mentioned. Yakima County's Zoning Map (2004) shows several parcels zoned as Agriculture and Rural Transitional use throughout the unincorporated areas of the lower reach, whereas most parcels located in the cities of Yakima and Union Gap are zoned a mix of Suburban Residential and One-Family Residential (Figure 4-11).

Similar to the upper and middle reaches of the Ahtanum Creek Watershed, the portion of Ahtanum Creek that passes through the lower reach is designated as a Shoreline of the State, with the exception of the south shoreline on the Yakama Reservation. On the north side of Ahtanum Creek, the shoreline in the lower reach is designated as Rural Environment, limiting development to agricultural and recreational uses (Figure 1-2) (YCC 16A.04).

4.8 Transportation

Due to the primarily rural nature of the Ahtanum Creek Watershed and low-density development within the project area, the roadway network is limited outside the city limits of Yakima and Union Gap. Ahtanum Road is the primary road that extends through the entire Ahtanum Creek Watershed connected to a series of Yakima County roads and private roads that are used to access individual properties. Incorporated areas within the lower reach of the Ahtanum Creek Watershed rely on a roadway system that is more extensive and has a higher capacity compared to unincorporated areas of Yakima County. Yakima County is proposing to construct a new road to connect Interstate 82 with Highway 12 that is anticipated to be complete over the next 10 to 20 years (Hoge, personal communication, 2005). This new roadway would extend along the west perimeter of the city of Yakima and would fall within the Ahtanum Creek Watershed.

Yakima County does not currently offer a county-wide transit system. Yakima Transit offers several public bus routes that operate throughout the city of Yakima. Although the city of Union Gap does not currently provide public transit service, since May 20, 2002, the non-profit organization People For People has been operating a community connector transit route between the Yakima Transit Center and the cities of Union Gap and Selah. The transport vehicle conveys passengers from local stops to the Yakima Transit Center. No transit service is provided outside city limits.

4.9 Recreation

Recreation opportunities in the Ahtanum Creek Watershed are limited by the lack of access and limited public lands in the basin. Fishing opportunities in the basin are limited by restricted access to the creek in the lower and middle reaches. The DNR lands in the upper reach are accessible for recreation, but there are no developed recreational facilities. Access to Yakama Reservation lands is restricted to tribal members. The only developed recreational facilities along Ahtanum Creek are the Youth Activities Park and Fulbright Park in Union Gap. The Ahtanum Youth Park is located above the confluence with Bachelor Creek and has a variety of developed recreational facilities, including sports fields and an outdoor equestrian use area and barn. Fulbright Park is located near the mouth of Ahtanum Creek on both sides of the creek. The park has developed recreational facilities as well as a large, natural passive use area.

4.10 Economics

This section describes current economic conditions in the Ahtanum Valley area using available data. County-level data are the only reliable data for most economic variables because little data exist for the immediate project area. The variables discussed focus on population, employment, wages, and income.

4.10.1 Yakima County Population

Yakima County’s population has grown by 60 percent to 225,000 since 1969, based on projections from U.S. Census Bureau calculations (see Section 6.10 for assumptions used to calculate population figures.)

No population data are available for the Ahtanum Watershed study area, but information for Yakima County has been extrapolated to the study area.

4.10.2 Economic Variables

Yakima County is one of the nation's richest agricultural counties and leads the state in apple, pear, peach, and grape production, while other agricultural specialties such as hops and mint also play a major role. Since the 1970s, agriculture has had an increasingly smaller role in the county’s economy, while services, particularly health and government services, have grown markedly. The county’s base in agriculture and extractive industries has shrunk and given way to Yakima’s role as a service provider for the City of Yakima and a large, mostly rural area of eastern Washington consisting of Yakima, Kittitas, Grant, and parts of Franklin counties.

Three primary economic variables are used to describe the county-level base upon which impacts are assessed: employment, wages, and income. Table 4-4 presents total employment, wages, and number of firms in Yakima County. Agriculture and support services produce over 20 percent of the county's jobs but account for only 13 percent of wages. Broadly speaking, like much of the rest of the nation, Yakima's economy is best characterized as a service economy rather than an agricultural or manufacturing economy. The agricultural and manufacturing sectors produce approximately 35,740 jobs, or 38 percent of the total 93,309 jobs in the region. The preponderance of manufacturing jobs is in the food processing industries. The remaining 62 percent of jobs are in a range of services, the largest of which is the 16,250 jobs in the government classification.

The largest sources of wages are, in order: government, health care, agriculture, manufacturing, and retail trade. Major employers in the county are, in order: Yakima School District No. 7; Department of Social and Health Services Division of Vocational Rehabilitation; Tree Top, Inc.; Yakima County Government; Yakima Valley Memorial Hospital; Yakima Regional Medical and Heart Center; the city of Yakima; Washington Beef; and Yakima Community College. In 2004, the average per capita income was $24,972.

Table 4-4. Yakima County Number of Firms, Wages, and Employment, 2004

Industry	Firms	Wages	Jobs
Total	9,054	$2,381,660,620	93,309
Agriculture, forestry, fishing, and hunting	1,443	$314,359,780	18,979
Mining	4	$208,828	9
Utilities	13	$11,698,644	203
Construction	635	$77,102,741	2,730
Manufacturing	249	$306,977,333	9,594
Wholesale trade	257	$117,184,118	3,672
Retail trade	637	$206,898,218	9,240
Transportation and warehousing	196	$58,506,863	2,111
Information	39	$47,193,677	1,267
Finance and insurance	160	$64,554,005	1,637
Real estate and rental and leasing	203	$16,026,098	837
Professional and technical services	267	$50,177,078	1,915
Management of companies and enterprises	19	$26,509,246	537
Administrative and waste services	190	$39,641,585	2,227
Educational services	37	$21,011,041	880
Health care and social assistance	400	$325,157,687	10,596
Arts, entertainment, and recreation	68	$13,177,624	1,062
Accommodation and food services	389	$63,822,945	5,251
Other services, except public administration	3,722	$57,568,588	4,320
Government	135	$563,884,521	16,250

Source: Calculated from Washington State Employment Security, Labor Market and Economic Analysis Data available at: http://www.workforceexplorer.com/admin/uploadedPublications/1889_industry_current.xls

4.10.3 County Revenue

Yakima County receives approximately 46 percent of its total $122 million revenue from intergovernmental revenues, 24 percent from general property taxes, and 11 percent from fees for services. The remaining revenue is derived from a variety of sales and local taxes, other fees, and minor sources, according to information provided by the Washington State Auditor.

County property tax assessments currently average $12.36 per $1,000 of assessed valuation; this assessment is expected to fall in the future due to the restrictions that were imposed by State Initiative 747 (Cook, personal communication, 2004). The current rate of sales taxes collected in the county is 7.9 percent. Disbursement of this 7.9 percent tax rate is as follows: 6.5 percent to the State of Washington; 0.30 percent to Yakima City Transit; 0.85 percent to Yakima City General Fund; 0.15 percent to Yakima County; and 0.10 percent to Yakima City and County Court and Criminal Justice.

4.10.4 Relationship of County Data to the Ahtanum Watershed

As previously noted, economic data at the watershed level do not exist; however, there are still a number of means of qualitatively portraying the affected economic environment in the project area. Most of the land area in the Ahtanum Creek Watershed is currently in agricultural and range use. As noted on the zoning map (Figure 4-11), the majority of the watershed is zoned Agriculture, Rural Transitional, or Valley Rural. The exceptions are: 1) 2,162 acres of the watershed (1.9 percent) within the city limits of Union Gap; 2) 4.9 percent of the watershed within the planning jurisdiction of the City of Yakima; and 3) existing residential development in Tampico, Ahtanum, Wiley City, and rural parts of the watershed.

Table 4-5 presents the current cropping pattern of the 11,000 acres potentially impacted by the reservoir-related alternatives (Alternatives 2 and 4). Less than a quarter of the project area is currently in orchard production. Hay production accounts for a quarter of use. The remainder of the potentially affected land, except for the 83 acres of sweet corn, is in pasture. Irrigators have chosen pasture over higher value crops because of the lack of reliable water supply (Golder, 2004). Much of the area's hay harvest is limited to two cuttings because of the unreliability of the water supply.

Table 4-5. Current Cropping Pattern in the Ahtanum Watershed

Crop	Acres
Apple	1,898
Sweet cherry	260
Pear, bartlett and winter	484
Hay, alfalfa and other	2,916
Pasture	5,460
Sweet corn	83
Total	**11,101**

Source: Golder, 2004.

4.11 Cultural Resources

For this analysis, the study area for cultural resources is defined as the proposed construction footprint of any ground-disturbing activities that would be associated with the conservation or restoration projects or the reservoir and related facilities. Cultural resources that could potentially be present within the study area could be expressed by any of a number of physical property types and landscape elements directly associated with past and present human behavior. These property types could include buried archaeological deposits and above-ground, built features such as rock cairns; landscape characteristics important to traditional Native American subsistence, spiritual, and religious practices; structures related to recent historic agricultural and industrial developments; and other features that are potentially significant to the construction of a social group's ethnic identity.

Archaeological deposits could potentially range in age from the early Holocene (the last 11,000 years) to about 1800 and include pre-modern historic features. Based on existing data for this region, the types of archaeological materials that might be present and visible on the ground surface could include lithic (stone tool) scatters and evidence of seasonal camps and trails or similar features that could represent a range of residential, hunting, plant gathering, and ceremonial activities. Historical archaeological resources could include intact elements of historic buildings and engineering structures, such as orchard workers' cabins and irrigation canals.

The project area is part of a larger Mid-Columbia and Plateau subregion that is the traditional territory of speakers of the Sahaptin language family (Teit, 1928). It lies within the ceded lands of the Yakama Nation, which is composed of members of 14 bands and tribes. Ethnographic (e.g., Ray, 1936; Spier, 1936) and archaeological (e.g., H. I. Smith, 1910) studies conducted in the first half of the twentieth century documented the history and endurance of Yakama and Mid-Columbia Indian traditions in an era of increased stresses of acculturation.

Yakama villages prior to the reservation era may have typically consisted of 5 to 15 multifamily lodges or longhouses (Schuster, 1998). Many Yakama villages were located in the region of the modern city of Yakima (Schuster 1998:329), and the fishery at the junction of Wenas Creek and the Yakima River was reputed to be one of the largest in the area (Lothson, 1994). Spier (1936) indicated that a Yakama band known as *Ä'tănŭm-'lĕma* lived along Ahtanum Creek in the vicinity of the project area.

Traditional land use within the general vicinity of the project area may have included hunting of large and small game such as deer, elk, and mountain sheep, and root collecting during seasonal occupation at optimal locations. Specialized fishing for salmon and steelhead, using platforms, traps, prongs, and dip nets was done in the Yakima River (Hunn et al., 1990); scaffolds were still in use in the Yakima River in the 1990s near Union Gap (Schuster, 1998). Anadromous fish found in creeks would likely have been taken using weirs and willow and stone traps. In the more recent historic era, Indian families used grasslands in the valley to pasture herds of cattle and horses.

Euro-American settlement in the general project area began in the early nineteenth century as explorers and traders traversed the Yakima River region. Miners, sheepherders, and missionaries migrated through the area by the mid-1800s. By the early 1840s, Yakama families had obtained longhorn cattle from the Hudson's Bay Company. A Catholic mission was founded between 1849 and 1852 in the middle reach along Ahtanum Creek. The missionaries purposely situated the chapel near the summer campgrounds of Yakama leader Kamiakin. Originally known as Sainte-Croix d'Ahtanum, the mission and its resident priests were "instrumental in helping the Yakima [sic] adapt to the changes rapidly taking place around them" (Lentz, 1976). Following its establishment, many Yakama obtained seeds and plants from the Ahtanum mission, as well as from the Hudson's Bay Company, and began to cultivate gardens, raising foods such as potatoes, squash, and barley (Schuster, 1990). Kamiakin was reputed to have one of the largest gardens of the Yakama and is known as the first to dig extensive irrigation ditches from the creek to water the gardens (Schuster, 1990; Splawn, 1980). Treaties that had been negotiated during the first half of 1855 between a confederation of Yakama leaders and the federal government supporting passage and settlement in the area were in dispute later the same year. The original mission buildings were destroyed by troops of the Puget Sound and Oregon Volunteers during the "Indian War" of 1855; the present day log chapel building was built in 1869 and thereafter known as Saint Joseph's Mission.

In the 1850s, several skirmishes were fought between the Yakama and the U.S. Army. By the early 1860s, many Yakama had been relegated to the newly created reservation lands. The first permanent white settlers arrived in Yakima County between 1861 and 1862. Grasslands used by the Yakama as forage for their horses and cattle were appropriated by recent immigrants for their own homesteads and herds; these immigrants soon realized the economic potential of the climate and soil. Hops were grown by 1872 and interest in this crop matched the interest in growing fruit orchards. During the winter of 1880-1881, over 100,000 and possibly as many as 150,000 cattle in the Yakima Valley froze to death or starved. Thereafter, the future of the Valley's economy belonged to the farmer and orchardist (Splawn, 1980).

The population of Yakima County as recorded by the United States Census in 1870 was 132 persons, and by 1880 this number had grown to 2,811 (Hellend, 1983). By the early 1880s, news of the coming Northern Pacific Railroad inspired speculation and growth in the little settlement of Yakima City (present-day Union Gap). But in 1884, railroad officials announced that they intended to build a station and new town four miles north of the town. In 1885, the Northern Pacific land commissioner convinced many businesses to relocate to the new site, called North Yakima (present-day Yakima). By 1890, arrival of the Northern Pacific Railroad had enabled Euro-American settlement and irrigation in much of the Yakima Valley. Residential and urban settlement was concentrated near the expanded railroad line, while the Ahtanum Valley west of Yakima remained largely used for agriculture and sheep pasture. The floodplain contributed to the high potential for agriculture in the area, but also threatened the stability of permanent structures in its path. From the beginnings of Euro-American settlement in the Ahtanum Valley, frequent high water in the creeks and in the Yakima River damaged and eroded bridges, cemeteries, and structures. By the mid twentieth century, local employment was concentrated in fruit, agriculture, lumber, and manufacturing industries. By the mid-1970s, the cities of Yakima and Union Gap were able to annex large tracts west of their city limits, attracting businesses such as meat packing and industrial manufacturing to the area.

Ancient land use in the project area may have consisted primarily of subsistence activities such as hunting, plant gathering, fishing, and, more recently, horse and livestock husbandry. Lithic procurement areas (areas where stone was gathered for tools) might be present in the general area where the appropriate rock deposits and landforms are located. The creeks in the Ahtanum Creek Watershed might have supported opportunities for fishing using weirs and stone traps, although it is likely that such efforts were concentrated along larger channels. Later periods of riverine settlement would have seen continued use of wetland environments along the creek, although settlement and main activity areas would likely have been located outside of lands prone to flooding. Historic maps and primary and secondary sources suggest that the project area was not densely settled and was used generally for pasture and agriculture since the initial period of Euro-American settlement.

As of November 2004, few archaeological or historical sites have been recorded in the immediate vicinity of the project area. Most archaeological sites nearer to the Yakima River have been identified as a result of specific projects and regulatory-driven surveys; and few such projects have been conducted along the Ahtanum Creek watershed. Two recorded historic properties are in the general vicinity of the proposed Pine Hollow Reservoir and are listed on the National Register of Historic Places. Saint Joseph's Mission (45YA362) and Kamiakin's Gardens (45YA363H) are located in the middle reach of the Ahtanum Creek Watershed.

A very limited effort at identifying potential cultural properties that may be present in the proposed reservoir location has occurred (Yakama Nation Cultural Resources Program, 1999). In 1999, the Yakama Nation Cultural Resources Program conducted a pedestrian survey of the proposed Pine Hollow Reservoir site, included in the technical assessment of the reservoir (Dames and Moore, 1999a). Ground surface visibility did not permit archaeologists to attain the desired level of survey coverage. Additionally, the planned engineering redesign of the nearby Johncox Ditch, from which the new facility was to be filled, was not available at that time, and so this proposed ditch alignment was not located or surveyed.

The survey noted that one historic property listed on the National Register of Historic Places (NRHP) is located the project area. Kamiakin's Gardens is located approximately 2.9 miles from the reservoir. This site represents the location of domestic cattle operations and pasturage in the Ahtanum watershed begun by Kamiakin within an area that is traditional homeland to families of native Yakamas. The broad spectrum of subsistence activities at the site included diverting springs by ditch to irrigate gardens, as well as retaining water to support seasonal salmon runs; and, "as an anadromous fish bearing stream, this tributary held importance as a weir bearing or aboriginally dammed stream that attracted early non-Indians to the area who wrote about its capacity to supply fish." It was then noted that Indian allotments dating from the nineteenth century are leased to non-Indians today, "although until recently successful Indian cattle and horse operations were resident in the basin" (Yakama Nation Cultural Resources Program, 1999).

4.12 Public Services and Utilities

This section discusses existing public services and utility providers in the Ahtanum Creek Watershed. Public services include educational facilities, fire and police protection, emergency medical response services, religious and social institutions, military facilities, and public transit. Utilities discussed include water, wastewater, solid waste, electricity, and natural gas services. Information was gathered from local jurisdictions' comprehensive plans and Yakima County's online GIS mapping service.

4.12.1 Public Services

Since four~~three~~ separate jurisdictions occupy the Ahtanum Creek Watershed (Yakima County, the Yakama Nation, City of Yakima, and City of Union Gap), there are numerous public service providers in the watershed. Table 4-6 identifies public service providers for Yakima County and the cities of Yakima and Union Gap~~each jurisdiction~~ in the Ahtanum Creek Watershed. Police, fire, and emergency response services sometimes respond to emergency calls outside their jurisdiction because Yakima County and the cities of Yakima and Union Gap are members of the Yakima County Mutual Aid System that allows nearby jurisdictions to assist in emergencies. Three schools are located within the Ahtanum Creek Watershed: Ahtanum Valley Elementary School, West Valley High School, and West Valley Junior High School. These three schools are located within the Yakima city limits. Public transportation services are further described in Section 4.8, Transportation.

Table 4-6. Public Service Providers in the Ahtanum Creek Watershed[1]

Jurisdiction	Service Provided	Public Service Providers
Yakima County	Fire and Emergency Medical	Yakima Fire District No. 12 and Washington State Department of Natural Resources (Fire response only)
	Police	Yakima Sheriff's District No. 2
	Public Schools	West Valley School District and Wapato School District
	Public Transportation	None
City of Yakima	Fire and Emergency Medical	Yakima Fire Department
	Police	Yakima Police Department
	Public Schools	Yakima School District
	Public Transportation	Yakima Transit
City of Union Gap	Fire and Emergency Medical	City of Union Gap Fire Department
	Police	City of Union Gap Police Department
	Public Schools	Union Gap School District
	Public Transportation	People for People

[1] In addition, the Yakama Nation and United States government provide services to reservation lands in the watershed. No schools or other services other than transportation are located on the portion of the Reservation in the watershed.

4.12.2 Utilities

Similar to public services, since the Ahtanum Creek Watershed Basin encompasses four~~three~~ separate jurisdictions, several utility providers offer service in the project area. As shown in Table 4-7, utility providers may overlap in certain jurisdictions.

Irrigation water in the watershed is provided by the AID, WIP, and private systems (see Sections 1.1 and 3.2 for additional information). The Yakima-Tieton Irrigation District extends into the Ahtanum Creek Watershed but diverts its water from the Tieton River, outside the watershed.

Water and wastewater lines are generally concentrated in the incorporated areas of the cities of Yakima and Union Gap. In unincorporated areas, water and sewer systems are private wells and on-site sewage systems. As discussed in Section 4.7, the availability of water and sewer systems is a limitation on residential density in the county.

Table 4-7. Utility Providers in the Ahtanum Creek Watershed

Jurisdiction	Service Provided	Utility Provider
Yakima County	Water	Nob Hill Water Association; individual private wells
	Sewer	On-site systems (e.g., septic tanks and drain fields)
	Solid Waste, Recyclable	Yakima Waste Systems, Inc.; the Yakima Nation has a separate contract with Waste Management, Inc. for solid waste collection
	Flood Control and Stormwater	Yakima County
	Electricity	Pacific Power and Light
	Natural Gas	Cascade Natural Gas
City of Yakima	Water	City of Yakima
	Sewer	City of Yakima
	Stormwater	City of Yakima
	Solid Waste, Recycling	Yakima Waste Systems
	Flood Control and Stormwater	Yakima County
	Electricity	Pacific Power and Light
	Natural Gas	Cascade Natural Gas
City of Union Gap	Water	City of Union Gap
	Sewer	City of Yakima
	Stormwater	City of Union Gap
	Flood Control and Stormwater	Yakima County
	Solid Waste, Recycling	City of Union Gap
	Electricity	Pacific Power and Light
	Natural Gas	Cascade Natural Gas

4.13 Existing Water Rights

This section describes the status of key water rights held in the Ahtanum Creek Watershed that could be affected by the implementation of the ACWRP. The legal framework of water rights is more generally described in Chapter 3 and Appendix B.

Both surface water rights and groundwater rights are used in the Ahtanum Watershed. The surface water rights are currently the subject of a water rights adjudication in Yakima County Superior Court. The groundwater rights have not been adjudicated (see Section 3.2.1.5 for additional information on the adjudication process).

An adjudication is a statutory proceeding in which the extent, validity, and relative priority of the water rights in a defined area are determined (RCW 90.03.110-.245) (see Section 3.2.1.5). The Yakima Adjudication, which was begun in 1977, is a major undertaking in which all rights to surface water in the entire Yakima Basin are being adjudicated. The case has been divided into four pathways, including a Major Claimant Pathway for large entities and a Subbasin Pathway for individuals and smaller entities. At the end of the adjudication, Ecology will issue water right certificates for those water rights confirmed by the court. Water rights not confirmed by the court will be extinguished. The Ahtanum Watershed is one of 31 subbasins within the adjudication, and the court is considering the surface water rights of the major claimants and the subbasin claimants in the Ahtanum Watershed in a single subproceeding.

The Yakima County Superior Court issued a Report of the Court Concerning the Water Rights for Subbasin No. 23 (Ahtanum Creek), Ahtanum Irrigation District, Johncox Ditch Company and United States/Yakama Nation on January 31, 2002 (Report of the Court). The court subsequently issued a Memorandum Opinion Re: Ahtanum Creek Threshold Legal Issues (Memorandum Opinion) prior to holding an exceptions hearing on its Report of the Court. The exceptions hearing, during which the parties presented arguments on their objections to the Report of the Court and its Memorandum Opinion, was conducted between January 26 and February 27, 2004. The parties filed post-hearing, response, and reply briefs from July to October 2004. It is anticipated the court will issue a Supplemental Report of the Court in Spring 2005 in which the court will issue its decisions on the objections raised by the parties. Unless the court allows the parties to file further objections to its rulings, the court will issue a Conditional Final Order regarding the water rights in the Ahtanum Subbasin. The Conditional Final Order can be appealed to the state Supreme Court when it is issued by the Yakima County Superior Court or, arguably, at the conclusion of the adjudication when the court issues its order integrating all the water rights in the Yakima Basin.

The following discussion of existing surface water rights begins with background information on previous legal proceedings addressing the water rights in the Ahtanum Watershed, followed by a summary of the current status of the issues before the Adjudication Court. The discussion concludes with a consideration of the effect the court's ruling on the issues may have on a proposed storage project.

4.13.1 Previous Legal Proceedings in the Ahtanum Creek Watershed

The combination of water right claimants and the history of legal proceedings in the Ahtanum Creek Watershed create a complex scenario. The primary water right claimants are designated Southside water users and Northside water users. The Southside water users include the Yakama Nation, who claim a tribal federal reserved right to water for irrigation of the reservation lands to the south of Ahtanum Creek and who also share that water on a pro-rata basis with tribal allottees of land on the reservation and non-tribal successors to the lands of allottees. The Northside water users include the AID, Johncox Ditch Company, and individual water right holders. All water rights for out-of-stream uses are junior to the Yakama Nation's treaty right for fish and other aquatic life which has a priority date of time immemorial.

Water rights in the Ahtanum Watershed have been the subject of federal and state proceedings since 1908. As the court noted in its Report of the Court, quoting the Trial Brief of AID, "[t]he Ahtanum area has produced more litigation per gallon of water involved, than any other irrigation district in the State of Washington, maybe the United States" (Report at 35). In 1908, the Chief Engineer of the Bureau of Indian Affairs, W.H. Code, fashioned an agreement between the United States on behalf of the Yakama Nation, and the non-tribal landowners on the north side of the creek (the Code Agreement). The agreement called for the Northside water users to have 75 percent of the flow of Ahtanum Creek and the Yakama Nation to get 25 percent of the flow. In the mid-1920s, a state adjudication was conducted, *State of Washington v. Annie Wiley Achepohl, et al.* (*Achepohl),* to adjudicate the rights in the Ahtanum area under state law. In 1947, the United States, on behalf of the Yakama Nation, filed a lawsuit in federal court attempting to undo the 1908 Code Agreement and assert a right to more than 25 percent of the flow. The case was heard in federal District Court and was the subject of two opinions from the U. S. Ninth Circuit Court referred to as Ahtanum I (*United States v. Ahtanum Irrigation District,* 236 F.2d 321 (9th Cir. 1956)) and Ahtanum II (*United States v. Ahtanum Irrigation District,* 330 F.2d 897 (9th Cir. 1964)) (also known as the Pope Decree).

The court in the ongoing Yakima Adjudication considered all of the historical proceedings and concluded that to receive a senior water right (a senior water right has an older priority date and receives its full irrigation allotment prior to water rights holders with a newer or "junior" priority date) in the current adjudication, a claimant must show that 1) a predecessor who owned the water right was a signatory to the Code Agreement; 2) a predecessor had the water right confirmed in *Achepohl;* and 3) the right was confirmed again in Ahtanum II. If all three of these factors are not satisfied, the claimant may still be confirmed a junior right (a junior water right has a newer priority date and only receives irrigation water when the allotments of all senior water rights holders have been met). The court has determined that it will award a junior right to a claimant who is a successor to a signatory to the Code Agreement and is in compliance with the *Achepohl* decree, but who was not properly included as a defendant in Ahtanum II.

Ever since the 1908 Code Agreement, a primary question regarding the water rights in the Ahtanum Watershed is how the available water in the creek is split between the Southside water users and the Northside water users. The key ruling on this issue is in Ahtanum II and reads as follows:

> [I.] b. To plaintiff [United States], for use on Indian reservation lands south of Ahtanum Creek, twenty-five percent of the natural flow of Ahtanum Creek, as measured at the north and south gauging stations; provided that when that natural flow as so measured exceeds 62.59 cubic feet per second, all the excess over that figure is awarded to plaintiff, to the extent that such water can be put to beneficial use.
>
> ***
>
> II. After the tenth day of July in each year, all the waters of Ahtanum Creek shall be available to, and subject to diversion by, the plaintiff for use on Indian Reservation Lands south of Ahtanum Creek, to the extent that said water can be put to beneficial use (330 F.2d 897, 915).

The primary issues remaining in the Ahtanum proceeding center on the interpretation of the quoted language from Ahtanum II. For a more complete discussion of the water rights legal issues, see Appendix B. How the court resolves each of the issues has potential implications for construction and operation of a storage reservoir.

Several central water rights issues involve excess water. The court defines excess water as water that exists prior to July 10 when the flow in Ahtanum Creek exceeds 62.59 cfs and 1) the on-Reservation water users are not using that excess water, and 2) the excess water is not being used to maintain fish life. The issues regarding excess water are whether it exists; if so, how it is to be calculated and who gets to use it. The issue of junior water rights is directly tied to that of excess water. Under the court's analysis, the water rights to the excess water would be junior to the Southside and Northside water users, whose water rights were confirmed in Ahtanum II.

The resolution of these issues bears directly on the Yakama Nation's water right for irrigation. The court has stated that the Yakama Nation's water right is for 3,306.5 historically irrigated acres plus 1,840.35 future acres for a Practically Irrigable Acreage (PIA) total of 5,146.85. The court has established a water duty, the amount of water necessary to irrigate an acre of land, of 4.4 acre-feet/acre. The total annual quantity of water to irrigate the PIA is therefore 22,646.13 acre-feet. The PIA total is based on the capacity of the WIP as designed in 1915, and the United States and the Yakama Nation assert there is no excess water because there is not enough water to irrigate all of the PIA. Further, they maintain that if the court awards the Northside water users a right to water in excess of that needed to meet project capacity, the United States must be allowed to make a claim to enlarge the PIA beyond the project capacity. The final quantity of water confirmed to the Yakama Nation and the Northside water users will affect how much water from storage will be available for additional water rights.

The Yakama Nation's water right for fish was previously confirmed by the Adjudication Court. The right is unquantified but is described as the minimum instream flow necessary to maintain fish life in Ahtanum Creek in light of prevailing conditions. This water right has a priority date of time immemorial and must be met before any other water rights are satisfied. If a storage reservoir is built, the prevailing conditions in Ahtanum Creek would change from those that presently exist, thus creating different conditions for determining the Nation's instream flow right for fish and other aquatic life.~~the natural flow regime. This could raise the issue of what minimum flow would be necessary to maintain fish life in light of the new conditions.~~

The Adjudication Court has also ruled that there is a non-diversionary stockwater right, which requires 0.25 cfs to be retained in the streams when naturally available. The U.S. and Yakama Nation assert that to keep 0.25 cfs in Bachelor and Hatton Creeks would require a diversion of 5 cfs from Ahtanum Creek and would shorten the Yakama Nation's irrigation season by 2 to 4 weeks. Resolution of this issue will have implications for how the proposed Pine Hollow Reservoir would be operated.

The fact that the surface water rights in the Ahtanum Subbasin have not yet been confirmed by the Adjudication Court creates uncertainty regarding the quantity of water from a new storage project that would be available for new water rights. The primary uncertainty is with respect to the extent of the Yakama Nation's water right for irrigation and the right of junior water right holders to excess water not currently used by the Yakama Nation. Resolution of these issues will clarify how much water the Yakama Nation and the junior users are entitled to and will affect how much of the water in the proposed reservoir is already appropriated. The unquantified nature of the Yakama Nation's water right for fish also creates uncertainty. This will not be resolved in the adjudication. Additional information on the adjudication is located in Appendix B.

4.13.2 Groundwater Rights

Estimating groundwater rights is more difficult than surface water rights. As with surface water rights, anyone who acquired a groundwater right prior to adoption of the Groundwater Code (Chapter 90.44 RCW) in 1945 has been required to file a water right claim, which is on record with Ecology. While helpful to a certain extent, these claims represent only what a water right user asserts is their water right; the rights have not been adjudicated and confirmed by a court. For groundwater rights acquired after 1945, Ecology has a record of certificates granted. For rights not yet perfected, Ecology has a record of permits issued. The core problem in adequately quantifying and cataloging existing groundwater rights is the statutory exemption discussed in Section 3.2.1.1 While anyone who constructs a well must file a construction notice with Ecology, there is very little information regarding the use of the exempt wells. Some exempt wells may no longer be used, and the amount of groundwater being withdrawn by those wells still in use is unknown.

The relationship between groundwater and surface water is important to managing the water resources and making decisions regarding potential impairment of existing rights by new rights. In areas where there is hydraulic continuity (an exchange of water) between a groundwater system and a surface water body, pumping groundwater may potentially reduce groundwater discharge into surface water, or in extreme cases, divert surface water into a groundwater system, thereby reducing flows in surface waters. This could affect surface waters with established water rights to the surface water source and instream flows for fish. In the few areas where hydraulic continuity does not exist, groundwater may be withdrawn with no effect on surface waters. Management of surface waters can also affect the groundwater supply. In areas where irrigation occurs, part of the return flow percolates into the ground and recharges the aquifers. If conservation measures are implemented, this may reduce the amount and/or location of recharge to groundwater. According to the *Ahtanum Creek Watershed Assessment* (Golder, 2004), data from 2002 suggest stream/shallow aquifer interaction throughout Ahtanum Creek, with variable exchange of groundwater and surface water between the shallow aquifer and streams.

According to the Ecology Water Rights Application Tracking System (WRATS) database, there are active groundwater rights to 58,221 acre-feet/year in the Ahtanum Basin, which equates to 50 million gallons per day (mgd) or 80 cfs year-round (Golder, 2004). The majority of the wells are located downstream of the AID and WIP diversions in the eastern portion of the watershed. Within the AID service area, it is estimated there are groundwater rights totaling 23,280 acre-feet. It is thought that only a small fraction of the wells are likely withdrawing directly from the alluvial aquifer; most use is from the deeper sedimentary and basalt aquifer systems (Golder, 2004).

In 1999 Ecology, Reclamation, and the Yakama Nation agreed to study the groundwater resources in the Yakima River Basin. The study is intended to better describe the groundwater-surface water link, help determine the potential impact on existing water rights when making water right decisions, support efforts to improve instream flows, and estimate when/where/how much groundwater pumping affects stream flows. Until the study is completed, Ecology is withholding permits on groundwater applications for new water rights. Ecology may make exceptions for transfers and changes of groundwater rights, public health and safety emergencies, and domestic use from exempt wells (Ecology, 1999).

CHAPTER 5.0 SHORT-TERM IMPACTS AND MITIGATION MEASURES

This chapter describes the short-term impacts of the proposed alternatives for the ACWRP. Possible mitigation measures for the impacts are also discussed. Because this is a Programmatic EIS and the details of construction and project implementation are not known, short-term impacts are discussed in general terms. Alternatives or components of alternatives may be required to undergo additional environmental review to identify specific short-term impacts.

The scale of short-term impacts would vary depending on the alternative implemented. Water conservation measures such as the installation of on-farm conservation improvements and fish screens would have limited impacts over short periods of time. Impacts would largely be confined to the property where the construction is occurring. Larger scale conservation projects such as piping conveyance lines would require more construction time and could cause impacts to the surrounding area. Habitat restoration projects could also range in scale and potential impacts. Small riparian vegetation restoration projects would have limited impacts, largely confined to the site. Larger streambank restoration projects that would require heavy equipment would generate more off-site impacts. Conservation and restoration projects would likely require permits and some may require separate environmental review.

The most extensive short-term impacts would be associated with construction of a storage reservoir and associated conveyance facilities. A reservoir would be a major construction project requiring road construction for access roads, operation of heavy equipment, the import of large quantities of fill material for the earthen dam, and pouring of concrete for the dam spillway. Off-site impacts such as noise and increased traffic on area roadways would occur.

5.1 Earth

5.1.1 Alternative 1 – No Action

Short-term earth-related impacts under Alternative 1 would be minimal because no major construction is proposed. Construction associated with the individual water conservation and habitat restoration projects would disturb the ground and expose soils, resulting in the potential for erosion and delivery of sediments to Ahtanum Creek; however, impacts would likely be minor. These projects would not be part of a coordinated watershed restoration program.

5.1.2 Alternative 2 – Watershed Restoration Program with Storage

The greatest short-term impacts associated with Alternative 2 would be related to the construction of the reservoir. Construction would result in excavation of the reservoir area and development of new roads to access the site, all of which would disturb the ground and expose soils, resulting in the potential for erosion and delivery of sediments to Ahtanum Creek. Many of the soils in the proposed reservoir area have high erosion potential (Dames and Moore, 1999a). Since the proposed reservoir site is not located on or adjacent to Ahtanum Creek, the potential for the delivery of sediments is less than if the site were on the creek or a tributary;

however, sediment transport could still occur. According to preliminary designs (Dames and Moore, 1999c), reservoir construction would require the import of 4 to 5 million cubic yards of materials for the earthen dam. The fill materials would be from an approved source and would meet the requirements of the state Model Toxics Control Act (RCW 70.105D).

Construction associated with the water conservation and habitat restoration projects could also pose short-term impacts to soils. This could result in the potential for erosion and delivery of sediments to Ahtanum Creek. The habitat restoration projects would generally be located adjacent to the creek. New roads could be required to access canals for lining or piping.

This alternative would result in the highest level of construction and associated earthwork, and therefore presents the greatest potential for short-term impacts to earth.

5.1.3 Alternative 3 – Watershed Restoration Program without Storage

Impacts under Alternative 3 would be similar to those of the water conservation and habitat restoration projects described in Alternative 2. No reservoir would be constructed, so there would be no reservoir-related impacts. Therefore, there would be substantially lower short-term impacts.

5.1.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts of Alternative 4 would be similar to those of Alternative 2 with the reservoir construction. Because no coordinated habitat restoration measures would be implemented, existing streambank erosion would continue in places similar to Alternative 1.

5.1.5 Mitigation Measures

Contractors would be required to implement construction best management practices to minimize sediment production and delivery to stream channels. Best management practices could include the use of straw bales or silt fending to trap sediments. Temporary Erosion and Sedimentation Control plans in accordance with Yakima County and/or Ecology requirements would be developed for construction projects. The dam for Pine Hollow Reservoir would be designed to prevent erosion and would be planted with native grasses or constructed with a rock face, as appropriate. Requirements for erosion control would be defined for each project through review by state and local regulatory agencies. The larger the construction project, the more significant the mitigation measures that would need to be implemented.

Pine Hollow Reservoir would undergo further design and geotechnical review and additional project level environmental review prior to construction to assess the suitability of the site for a reservoir. The dam would be designed in accordance with Ecology dam safety guidelines (see Section 6.12.2.3 for additional information).

5.2 Surface Water

Construction activities that require earthwork near surface water channels may result in a temporary increase in localized erosion as noted in Section 5.1, Earth. A temporary increase in erosion would add to the sediment being transported in surface waters and increase turbidity. The level of impact on the quality of surface water would vary, depending on the volume of earthwork, proximity to a water body, condition of surrounding vegetation, and the mitigation measures implemented.

Construction activities may also result in short-term impacts on irrigation water supply. These impacts would include interruptions in water supply that might be needed to move water from an existing distribution or irrigation facility to a newly constructed facility. The level of impact would vary based on the scheduling and duration of interruptions. It is anticipated that interruptions could be limited to a few days or a few hours.

5.2.1 Alternative 1 – No Action

No direct short-term impacts to surface water are anticipated under the No Action Alternative. Any construction activities associated with individual water conservation or habitat improvement projects could result in increased erosion and sedimentation and interruptions in water supply as described above.

5.2.2 Alternative 2 – Watershed Restoration Program with Storage

In addition to the construction associated with water conservation and habitat restoration projects, Alternative 2 would require construction of the Pine Hollow Reservoir. Because the reservoir site is not adjacent to Ahtanum Creek, the potential for increased turbidity in the stream would be limited. There would be a potential for increased turbidity in Ahtanum Creek when the diversion channel connecting the reservoir to Ahtanum Creek is constructed, however. The habitat restoration projects would be located adjacent to the stream and have more potential to cause increased stream turbidity. Construction of new conveyance lines could require short-term disruptions in water supply.

5.2.3 Alternative 3 – Watershed Restoration Program without Storage

Short-term surface water impacts from Alternative 3 would be similar to those from Alternative 2 without the storage reservoir. Coordinated water conservation and habitat restoration projects could result in increased erosion and sedimentation to Ahtanum Creek and disruptions in water supply.

5.2.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts to surface water associated with Alternative 4 would be similar to Alternative 2, except there would be no coordinated habitat restoration projects near Ahtanum Creek, similar to Alternative 1.

5.2.5 Mitigation Measures

Mitigation for short-term impacts to surface water from construction activities would be similar to those described in Section 5.1.5. To mitigate any short-term interruptions in surface water irrigation supply due to construction activities, the AID and WIP would coordinate with water users and construction personnel to ensure that construction activities are scheduled to minimize interruptions. To the extent possible, conveyance construction would be done outside the irrigation season.

5.3 Groundwater

5.3.1 Alternative 1 – No Action

Short-term impacts associated with the No Action Alternative would reflect current management conditions in the project area. No short-term impacts to groundwater are likely.

5.3.2 Alternative 2 – Watershed Restoration Program with Storage

Short-term impacts associated with Alternative 2 would include temporary, localized impacts to groundwater quality and quantity related to the groundwater monitoring system installation, or potentially abandonment of existing wells. Construction dewatering, if required, would temporarily reduce groundwater levels and availability in the alluvial aquifer and/or sedimentary aquifer system.

No short-term impacts to groundwater are likely from construction of water conservation or habitat restoration features. No short-term impacts to groundwater are likely from surface water or groundwater right transfers.

5.3.3 Alternative 3 – Watershed Restoration Program without Storage

No groundwater impacts are likely from construction of water conservation or habitat restoration features under Alternative 3.

5.3.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Short-term impacts associated with Alternative 4 could include those related to reservoir construction and groundwater monitoring activities similar to those described for Alternative 2. No groundwater impacts are likely from construction of water conservation features.

5.3.5 Mitigation Measures

For all alternatives, impacts to groundwater could be mitigated by conducting appropriate hydrogeological studies prior to construction. The degree of study required would depend on the type of construction being undertaken. Construction of a reservoir would require the highest level of study. Conservation projects such as canal lining would require study to determine the effects on groundwater recharge. Habitat restoration projects, such as those that only require vegetation planting or repairs to streambanks would not require hydrogeologic studies. These studies could identify activities that could impact groundwater so that those activities could be avoided. Construction and abandonment of monitoring wells would be done according to Chapter 173-160 WAC to minimize impacts to groundwater resources.

5.4 Plants and Wildlife

5.4.1 Alternative 1 – No Action

The No Action Alternative would not result in direct impacts to plants or terrestrial wildlife in the Ahtanum Creek Watershed. Some of the individual construction projects for water conservation or habitat restoration projects could require removal of vegetation or could result in temporary displacements of wildlife.

5.4.2 Alternative 2 – Watershed Restoration Program with Storage

Construction of the Pine Hollow Reservoir would require the removal of vegetation in the dam area. Because the existing vegetation in the reservoir area consists primarily of grasses, it is unlikely that any vegetation removal would be required. Vegetation would likely have to be removed along conveyance lines, including along Johncox Ditch. Construction of water conservation or habitat restoration projects could result in temporary impacts to existing vegetation. Habitat restoration projects would likely include the removal of non-native vegetation.

Any existing wildlife in the reservoir area, such as birds and small mammals, would be displaced by construction. Wildlife in the vicinity of the project would likely be temporarily displaced by the noise and construction activities. The restored riparian areas should provide improved habitat for non-fish wildlife species.

5.4.3 Alternative 3 – Watershed Restoration Program without Storage

Alternative 3 would result in similar impacts to vegetation and terrestrial wildlife as Alternative 2, but the reservoir site would not be impacted. There would be no displacement of wildlife due to reservoir construction.

5.4.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts under Alternative 4 would be similar to those under Alternative 2, but no coordinated habitat restoration projects would be undertaken. Impacts of habitat restoration projects undertaken by individual agencies or entities would be similar to Alternative 1.

5.4.5 Mitigation Measures

Habitat restoration projects are expected to be an overall benefit to vegetation and wildlife. Where possible, vegetation that is removed for construction would be replanted. No mitigation is proposed for the temporary displacement of wildlife because this is expected to be a minor impact and wildlife is likely to return following construction, except at the reservoir site.

5.5 Fish

5.5.1 Alternative 1 – No Action

Under the No Action Alternative, conservation or restoration projects, including fish passage and screening improvements, shoreline bank stabilization projects, and riparian restoration actions, could impact fish habitat in the short-term. These activities, along with new residential development projects, could require clearing along stream banks, grading of soils, and diverting water within the work area. Soils disturbed by grading could increase sedimentation if not properly stabilized following the restoration activity.

Sedimentation is a concern because it can degrade fish spawning habitat, increase stream channel scour potential, degrade rearing habitat, and alter riparian vegetative structure. Turbidity does not cause direct salmonid mortality unless extremely high levels occur (NOAA Fisheries, 1999). However, moderately increased turbidity and sedimentation may cause some downstream displacement of juvenile salmon because they instinctively avoid turbid water. The removal of trees and other vegetation along stream banks would result in a reduction of stream shading that could adversely impact stream temperature and shading habitat used by fish.

Larger-scale watershed improvement projects may require temporary dewatering of stream channels, which could potentially have an adverse impact on fish habitat if not properly conducted. For example, fish in a dewatered stream section could die if not moved or could be harmed during removal. These types of projects would be subject to environmental review on an individual basis; all review would be conducted by the entity proposing the activity.

Although not likely, accidents such as spills of hazardous materials (e.g., cement, fuel, or hydraulic fluid) could occur that would degrade water quality and/or be toxic to fish.

5.5.2 Alternative 2 – Watershed Restoration Program with Storage

Short-term impacts associated with Alternative 2 would be similar to those described for the conservation and restoration project described for Alternative 1. In addition, Alternative 2 would require excavation in the Ahtanum Creek channel to accommodate the diversion canal that would connect the reservoir to Ahtanum Creek. Short-term pulses of turbid water would occur as excavation occurs directly within the Ahtanum Creek channel. These turbidity pulses could adversely affect fish habitat several hundred feet downstream of the construction site in the same manner as described for the No Action Alternative.

Reservoir construction would require significant amounts of soil disturbance as described in Sections 5.1 and 5.2. Since the reservoir location is not on or adjacent to Ahtanum Creek, the potential for sedimentation in Ahtanum Creek would be reduced.

5.5.3 Alternative 3 – Watershed Restoration Program without Storage

Short-term construction impacts associated with Alternative 3 would be less than those discussed for Alternative 2 because construction-related impacts associated with reservoir construction would be eliminated.

5.5.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Short-term impacts associated with Alternative 4 would be similar to those discussed for Alternative 2. Similar to Alternative 2, the greatest potential impact to fish habitat would be associated with construction in the Ahtanum Creek stream channel to construct the canal that would connect the stream to the reservoir. The short-term impact of construction related to habitat restoration would be similar to Alternative 1.

5.5.5 Mitigation Measures

Mitigation measures to minimize impacts to fish would include measures to reduce erosion and sedimentation as described in Sections 5.1.5 and 5.2.5. In addition, projects would meet all permit requirements, including appropriate fish windows for construction dates. Spill control plans would be developed to identify emergency measures to be employed in case of any spills of hazardous materials.

If stream dewatering were required, fish would be removed from the stream section prior to dewatering in accordance with WDFW guidelines.

5.6 Scenic Resources and Aesthetics

Impacts to scenic resources and aesthetics in the Ahtanum Creek Watershed that could result from construction activities include increased noise and dust from construction equipment.

5.6.1 Alternative 1 – No Action

Under Alternative 1, there would be no impacts to scenic resources or aesthetics.

5.6.2 Alternative 2 – Watershed Restoration Program with Storage

Construction of the reservoir under Alternatives 2 would have the greatest potential short-term impacts to scenic resources and aesthetics in the watershed. Reservoir and conveyance line construction would generate dust and noise that would affect the aesthetics of the construction area. Impacts are not anticipated to be significant, however, because of the limited number of people who view the site and the lack of uniqueness associated with the scenic resource.

5.6.3 Alternative 3 – Watershed Restoration Program without Storage

Alternative 3 would result in minimal impacts to scenic resources in the Ahtanum Creek Watershed. There would be no reservoir construction, and impacts associated with watershed restoration measures would be minor.

5.6.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Under Alternative 4, impacts to scenic resources and aesthetics would be generally the same as those described for Alternative 2.

5.6.5 Mitigation Measures

Specific mitigation measures would be developed for individual construction projects within the Ahtanum Creek Watershed. The projects would comply with local noise ordinances and meet the dust control requirements of the Yakima Regional Clean Air Authority.

5.7 Land and Shoreline Use

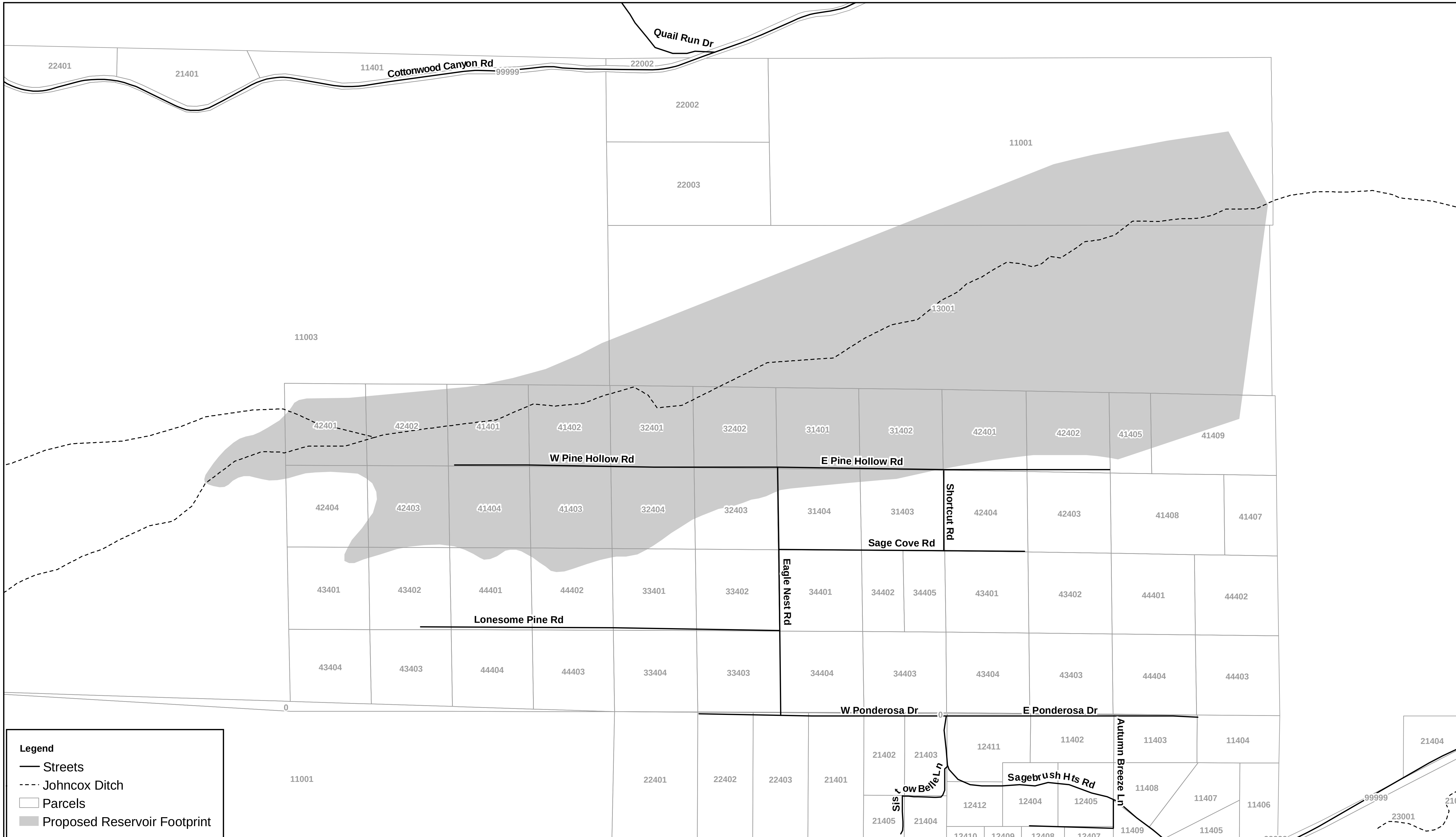
5.7.1 Alternative 1 – No Action

No direct short-term impacts to land use within the Ahtanum Creek Watershed are anticipated from implementation of the No Action Alternative. Any individual water conservation or habitat restoration projects undertaken would be consistent with local land use plans and regulations.

5.7.2 Alternative 2 – Watershed Restoration Program with Storage

Under Alternative 2, the coordinated water conservation project and habitat restoration projects would be consistent with local land use plans and regulations and would not result in any short-term impacts to land use. The proposed Pine Hollow Reservoir would fall within unincorporated Yakima County in an area zoned as Valley Rural (VR). Table 15.18 in the Yakima County Code designates allowable development by each zoning type in unincorporated areas. Utility services, including reservoirs, are permitted in areas zoned as Valley Rural.

Construction of the reservoir would result in the conversion of land currently occupied by pasture and residences into a dam and reservoir site. The exact number of parcels that would need to be acquired for dam and reservoir construction are not currently known. Figure 5-1 shows which parcels would be impacted under the maximum footprint of the reservoir. Additional properties may be required for dam construction and access.



File name: Fig5-1.pdf
Created/last edited by: DNE
Date last updated: 1/31/05

Map data are the property of the sources listed below.
Inaccuracies may exist, and Adolfson Associates, Inc. implies no warranties or guarantees regarding any aspect of data dipiction.
SOURCE: Ahtanum EIS, 2004; USGS topographic map, 1995

Scale: 1:9,000
1 inch equals 750 feet

0 375 750 1,500 Feet

FIGURE 5-1

PINE HOLLOW RESERVOIR AND COUNTY PARCEL DATA - MAXIMUM FOOTPRINT

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON

In addition, right-of-way may be required for conveyance lines. Property acquisition would be conducted on a case-by-case basis, with negotiations occurring between the AID and the individual property owners according to state law. These uses are primarily grazing and residential. The exact number of residential displacements is not known at this time. There are approximately 15 houses in the reservoir area. Displaced residents would be provided with relocation assistance. The economic impact of these relocations is discussed in Section 6.10.

5.7.3 Alternative 3 – Watershed Restoration Program without Storage

The coordinated water conservation and habitat restoration projects under Alternative 3 would be consistent with local land use plans and policies. The construction of lined or piped conveyance systems could require acquisition of right-of-way, which would be undertaken in accordance with Washington state law as described for Alternative 2.

5.7.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Short-term land use impacts under Alternative 4 would be similar to those described for Alternative 2, except there would be no coordinated habitat improvement projects similar to Alternative 1.

5.7.5 Mitigation Measures

All property acquisitions in the Ahtanum Watershed would be in accordance with the Washington State law covering property acquisition by a private corporation (Chapter 8.20 RCW). Property acquisition would be negotiated with each property owner on a case-by-case basis, and every attempt would be made to minimize adverse impacts to property owners. Further property acquisition procedures would be coordinated with other appropriate entities in the Ahtanum Creek Watershed, including the United States and Washington State.

5.8 Transportation

5.8.1 Alternative 1 – No Action

There would be no short-term impacts to transportation in the Ahtanum Creek Watershed associated with implementation of Alternative 1.

5.8.2 Alternative 2 – Watershed Restoration Program with Storage

Alternative 2 represents the greatest potential short-term impacts to transportation of the alternatives considered because it would result in the most significant level of construction. Based on preliminary designs, 4 to 5 million cubic yards of material would be required to construct the earthen dam. This would require a range of 200,000 to 425,000 dump truck trips to deliver the earth material, depending on the final size of the dam and whether pony (trailer) trucks are used. This number of truck trips would be a significant impact to traffic on Ahtanum

Road and result in occasional localized traffic congestion and delays during the duration of the construction period. Reservoir construction is estimated to last approximately 2 years, but traffic impacts would not last the full length of the construction period. Proposed habitat enhancement measures include potential roadway relocations and/or drainage improvements, which could result in localized detours and accompanying delays. If this alternative were to be selected for implementation, additional site-specific studies would be conducted to ensure that access is maintained and avoidable delays are minimized throughout the construction period.

5.8.3 Alternative 3 – Watershed Restoration Program without Storage

Under Alternative 3, potential short-term traffic impacts would result if roadway relocations occur associated with proposed habitat enhancement. All relocations would be coordinated closely with the roadway manager or owner, depending on whether the roadway is public or private.

5.8.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts to traffic under Alternative 4 would be similar to those described for Alternative 2. Impacts associated with road relocations would not occur because no relocations are planned under Alternative 4.

5.8.5 Mitigation Measures

Construction traffic would be routed through the project areas in the Ahtanum Watershed in accordance with applicable requirements imposed by Yakima County. Any roadway relocations would be conducted following site-specific evaluation and compliance with all applicable roadway design requirements, including stormwater management requirements.

5.9 Recreation

Short-term impacts to recreation in the Ahtanum Creek Watershed would generally be the same for all alternatives evaluated. There would be minimal impact to recreation opportunities associated with construction of any of the alternatives; therefore no mitigation would be required.

5.10 Economics

All of the alternatives include some construction that would result in increases in construction employment and expenditures in the region. These increases would be largest for Alternatives 2 and 4, which include reservoir construction. Potential impacts to the local economy are discussed in Section 6.10. No short-term adverse impacts to socio-economics are anticipated; therefore, no mitigation would be required.

5.11 Cultural Resources

5.11.1 Alternative 1 – No Action

Under the No Action Alternative, water conservation and habitat restoration projects would be undertaken independently without coordination. Identification of potential cultural resources in the Ahtanum Creek Watershed would probably not occur in a coordinated manner and could reduce the opportunity for inter-government and interagency (e.g., Yakama Nation, WDFW) consultation regarding any resources that could be present in the ACWRP project areas.

5.11.2 Alternative 2 – Watershed Restoration Program with Storage

Ground disturbance activities could result in short-term impacts to cultural resources under Alternative 2 . Impacts to any cultural resources that may be present could occur at the location and in the vicinity of the construction site for the reservoir and any new conveyance systems, as well as any staging areas. Ground-disturbing impacts could also occur at locations of riparian and floodplain restoration and enhancement, streambank stabilization, and on any new properties acquired. Possible impacts could occur to any historic structures that might be present on acquired properties.

5.11.3 Alternative 3 – Watershed Restoration Program without Storage

Impacts to cultural resources under Alternative 3 would be similar to the Alternative 2 watershed restoration components,.

5.11.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Short-term impacts associated with Alternative 4 would be similar to those described for the reservoir construction activities under Alternative 2. Impacts from habitat restoration measures would be similar to Alternative 1.

5.11.5 Mitigation Measures

The construction of the Pine Hollow Reservoir would require additional environmental review, after which the exact mitigation measures would be developed in coordination with the OAHP Yakama Nation. Mitigation measures could include archaeological monitoring during construction. Construction contracts would require that if any archaeological material is encountered during construction, construction activities in the immediate vicinity would halt, and the OAHP and a professional archaeologist would be contacted for further assessment prior to resuming construction activity in that area.

5.12 Public Services and Utilities

Construction associated with any of the alternatives could result in short-term disruptions to public services and utilities in the Ahtanum Creek Watershed. Potential impacts would be greatest under Alternatives 2 and 4 because of the substantial amount of construction required. Utility lines could require relocation. Construction activities would be coordinated with public services and utilities providers to identify the location of all utilities prior to construction and ensure that disruptions would be minimized.

5.13 Existing Water Rights

No short-term impacts to water rights are anticipated as a result of any of the Watershed Restoration Program alternatives. As discussed in Section 5.2, construction activities could result in short-term disruptions to water supplies, but these disruptions are not expected to last long enough to impact water rights. The AID and WIP would coordinate with water users and construction personnel to ensure that construction activities are scheduled to minimize interruptions to water deliveries.

CHAPTER 6.0 LONG-TERM IMPACTS AND MITIGATION MEASURES

This chapter discusses the long-term impacts that could result from the proposed ACWRP alternatives. Long-term impacts are those that would occur as a result of implementing the selected alternatives. This chapter also includes a discussion of mitigation measures for the potential impacts, cumulative impacts, and significant unavoidable impacts.

6.1 Earth

This section describes the long-term impacts to earth resources associated with each of the alternatives. Because earth resources vary in each of the three reaches of the watershed, the potential impacts to each reach are described.

6.1.1 Alternative 1 – No Action

6.1.1.1 Upper Reach

If Alternative 1 is selected, future land use development within the upper reach of the Ahtanum Creek Watershed would remain largely consistent with current development conditions and land use management. Roads associated with forest management and housing access would continue to have the potential to generate and deliver sediments to stream channels.

6.1.1.2 Middle Reach

Under the No Action Alternative, it is likely that agricultural lands that are not currently in active production or adequately serviced by irrigation would come under additional pressure to be converted to residential development. Increased development would result in ground disturbance within and near housing sites and the development of new access roads. Construction of new housing and associated roads would disturb the ground and expose soils, resulting in the potential for erosion and delivery of sediments to Ahtanum Creek and tributary streams. Increased sediment would be caused by ongoing road drainage and a reduction in riparian vegetation. A reduction in riparian vegetation through increased housing development could also impact streambank stability, leading to increased bank erosion and channel instability along Ahtanum Creek and tributary streams.

6.1.1.3 Lower Reach

Under the No Action Alternative, future development could accelerate in unincorporated areas in Yakima County and the UGAs of the cities of Yakima and Union Gap as agricultural lands that are not currently in active production or adequately serviced by irrigation are converted to residential development. Refer to Section 6.7, Land Use, for a discussion of anticipated land use impacts under the No Action Alternative. All of these actions would lead to earth-related impacts similar to those discussed above for the middle reach of the watershed, including chronic increased sediment production and delivery to stream channels due to ongoing road drainage and reduction in riparian vegetation.

6.1.2 Alternative 2 – Watershed Restoration Program with Storage

6.1.2.1 Upper Reach

The proposed watershed restoration measures under Alternative 2 could potentially reduce sediment transport to Ahtanum Creek. If Alternative 2 is implemented, future land use development within the upper reach would remain generally consistent with what would occur under Alternative 1, resulting in roughly comparable potential to generate sediment within the upper reach. Roads associated with forest management and housing access would continue to have the potential to generate and deliver sediments to stream channels. Watershed restoration actions such as plantings on exposed streambanks and improving drainage culverts would counter and minimize the current and future generation and delivery of sediment to stream channels

6.1.2.2 Middle Reach

The primary earth-related impact from Alternative 2 in the middle reach would result from the construction of the Pine Hollow Reservoir and the associated improved irrigation system. There is the potential for some long-term increases in sediment associated with drainage from the new access roads to the reservoir and operation of the reservoir; however, these increases would be expected to be minor because the road would be constructed with provisions to minimize sediment transport. The flushing of deposited sediment on the reservoir bed could potentially deliver sediment to Ahtanum Creek over more concentrated time periods than currently.

With improved irrigation, the pressure to convert agricultural land to residential land would likely be reduced, thereby reducing the potential for increased sedimentation from roads, housing construction and reduced riparian vegetation associated with development. Refer to Section 6.7 for a discussion of land use impacts. Conversion of pasture lands to higher value orchards or other crops would also reduce sediment delivery associated with grazing activity in pasture areas, particularly for those areas in proximity to stream channels. Watershed restoration actions would further reduce future generation and delivery of sediment to stream channels. These restoration activities would occur within both the middle and upper reaches, where land use activities can generate sediment that is routed through stream channels into lower reaches of Ahtanum Creek.

6.1.2.3 Lower Reach

Under Alternative 2, future development within Yakima County and the UGAs of the cities of Yakima and Union Gap would likely occur as projected in adopted land use plans and policies, with a reduced pressure for the conversion of agricultural lands to residential development. Irrigation improvements would slow or reduce the amount of agricultural lands converted to other land uses, thus reducing the potential for increased sediment delivery associated with housing construction and roads. Restoration actions that emphasize decreased sediment production in the upper, middle, and lower portions of the watershed would substantially reduce sediment routing and deposition in the lower reaches of Ahtanum Creek.

6.1.3 Alternative 3 – Watershed Restoration Program without Storage

6.1.3.1 Upper Reach

If Alternative 3 is implemented, future land use development within the upper reach would remain consistent with that described for Alternative 1. Roads associated with forest management and housing access would continue to have the potential to generate and deliver sediments to stream channels. Watershed restoration actions would reduce the generation and delivery of sediment to stream channels similar to Alternative 2.

6.1.3.2 Middle Reach

As with Alternative 1, roads associated with increased housing development and access would continue to have the potential to generate and deliver sediments to stream channels in the middle reach of the watershed. Watershed restoration actions would reduce the generation and delivery of sediment to stream channels similar to Alternative 2.

6.1.3.3 Lower Reach

Under Alternative 3, development could accelerate in Yakima County and the UGAs of the Cities of Yakima and Union Gap as agricultural lands that are not currently in active production or adequately serviced by irrigation are converted to residential development. Accelerated development in the lower reach of the watershed would lead to increases in sediment production and delivery to stream channels due to increased road drainage and a reduction in riparian vegetation. Watershed restoration actions that emphasize decreased sediment production in the upper, middle, and lower portions of the watershed would significantly reduce sediment routing and deposition within the lower reach of Ahtanum Creek similar to Alternative 2.

6.1.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

6.1.4.1 Upper Reach

Long-term impacts under Alternative 4 would be similar to those discussed for Alternative 1 in the upper reach.

6.1.4.2 Middle Reach

Long-term impacts in the middle reach of the watershed would be similar to those discussed for Alternative 2. Ongoing watershed restoration measures would continue to minimize sediment production and delivery to stream channels, but the benefits would not be as significant as under

Alternative 2 without the coordinated habitat restoration effort. Implementation of irrigation conservation measures (e.g., development of conservation plans and on-farm system improvements) would reduce some sedimentation impacts.

6.1.4.3 Lower Reach

Long-term impacts in the lower reach of the watershed would be similar to those discussed for Alternative 2; however, a lack of reliable irrigation supply could result in land development pressures to convert agricultural lands to residential development. Ongoing watershed restoration actions would continue to minimize sediment production and delivery to stream channels, but the impacts would not be as significant as under Alternative 2 without the coordinated habitat restoration effort. Implementation of irrigation conservation measures would reduce some sedimentation impacts.

6.1.5 Mitigation Measures

Mitigation measures to reduce sediment production and delivery from new roads and residential development would include proper design of new roadways, enforcement of stream buffer requirements in the local Critical Areas Ordinance, and compliance with stormwater requirements. Proper road construction would include appropriate spacing of drainage. Proper culvert placement can minimize sediment delivery to the stream system. When culverts are properly located and spaced at regular intervals along the roadside drainage ditch, sediment is reduced by dispersing sediment laden water onto vegetated slopes that filter the water before it reaches the stream. Enhancement of riparian vegetation could also reduce sediment delivery to streams.

6.1.6 Cumulative Impacts

Cumulative earth-related impacts from any of the ACWRP alternatives would include the potential for increased sediment production and delivery from new roads and residential development.

6.1.7 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse earth-related impacts were identified.

6.2 Surface Water

The potential impacts to surface water from implementation of the ACWRP are described in this section. Evaluation of the impacts associated with reservoir operation under Alternatives 2 and 4 required modeling, the results of which are described in Appendix D.

6.2.1 Alternative 1 – No Action

Alternative 1 does not include a coordinated restoration program for the watershed but does include continued conservation and habitat restoration efforts by individual entities and agencies that have jurisdiction over portions of the Ahtanum Creek Watershed. These efforts may be coordinated to some degree under other programs or processes but would not be subject to a coordinated watershed-wide implementation effort. However, for the purposes of this programmatic evaluation, it is assumed that implementation of this alternative would not have a significant impact on surface water supply and stream flows.

Problems that affect the beneficial uses of surface water, such as insufficient flow for fish habitat and unreliable water supply for irrigation, will continue until significant conservation and habitat restoration efforts are implemented.

It is assumed that the current level of surface water use would continue and that there would be no effect on Ahtanum Creek flow entering the Yakima River or TWSA (the amount of water available for Reclamation to allocate to its water users). If trust water rights were created and dedicated to instream flow, there could be an increase in water in Ahtanum Creek that could increase the TWSA.

6.2.2 Alternative 2 – Watershed Restoration Program with Storage

Alternative 2, which includes the construction of a 24,000 acre-foot surface water reservoir at Pine Hollow, is intended to increase the reliability of surface water supply and supplement instream flows in the mainstem of Ahtanum Creek. If implemented, this alternative would result in the most significant long-term impacts to surface water supply and stream flows of all the alternatives. Implementation of Alternative 2 would result in the storage and distribution of approximately 15,000 acre-feet (on average) of surface water annually to meet irrigation demand and augment instream flows. Alternative 2 represents an improvement in irrigation reliability, most significantly because it would provide these flows after July 10. This alternative, however, still would not provide an adequate irrigation supply for the entire AID and WIP. Secondary water sources would still be required.

Operation of a reservoir for Alternative 2 was evaluated using the flow routing model developed for the *Ahtanum Creek Watershed Assessment* (Golder, 2004). The model and analysis are described in Appendix D of this EIS. The model included the operational conditions described in Section 2.4. The model assumed that instream flow targets would be met using water from the reservoir. These instream flow targets were based on input from the Ahtanum Core Group and are shown in Table D-1 of Appendix D. The temperature output of the reservoir was also modeled as shown in Figure D-4. The modeling indicates that implementation of Alternative 2 would have the following long-term impacts on surface water supplies in the Ahtanum Creek Watershed.

- Improvements in efficiency resulting from conservation measures, including installation of a piped distribution system and more efficient on-farm irrigation systems, could reduce the total amount of water needed annually to approximately 33,100 acre-feet. This represents a reduction of approximately 29 percent from the “current” annual demand, of

46,400 acre-feet, which was estimated in the *Ahtanum Creek Watershed Assessment* based on 2002 cropping and irrigation data. This also represents an increase in on-farm efficiency from approximately 70 percent to 82 percent, and an increase in conveyance efficiency from approximately 75 percent to 95 percent. More efficient conveyance and irrigation systems would require that less water be diverted from the stream and withdrawn from wells to deliver the same amount of water to the crops. However, implementation of conservation measures would also reduce seepage from the canals and streams currently used to convey irrigation water, which may impact local groundwater recharge.

- For the purpose of the reservoir analysis done for this EIS, it was estimated that approximately 19,600 acre-feet of the total 33,100 acre-feet of water needed for irrigation would be supplied by surface water. Pine Hollow Reservoir would have the capacity to meet the surface water demand and supplement stream flows to meet instream flow targets with a reliability of approximately 72 percent. The reservoir would supply 15,000 acre-feet per year, on average, to augment instream flows and meet irrigation demands.
- Pine Hollow Reservoir would permit both the AID and the WIP to divert water for irrigation between April and October directly from the reservoir. However, the ability of the reservoir to deliver surface water in the late summer and early fall would be limited during average and drier than average years.
- On average, the reservoir would be able to augment instream flows and provide surface water to meet most of the demand for surface water in the AID and the WIP during the spring and early summer. During the late summer and early fall, the reservoir would be drawn down and would not be able to supply as much of the irrigation demand. Groundwater or other water sources would still be needed to meet demands in late summer and early fall.
- During a wet year, the reservoir would remain nearly full and would supply all surface water demands. Very little supplementation of natural instream flows would be required to meet instream flow targets.
- During a very dry year, the reservoir would not be able to fill because water would be left in the stream to meet instream flow targets on the North Fork. As a result, the reservoir would remain drawn down throughout most of the year and would have little capacity to meet irrigation demands or supplement instream flows. If the dry year were preceded by an above average year, some water could be available from the reservoir to provide irrigation water and instream flows. A detailed analysis of instream flow targets was not performed for this programmatic EIS, but should be included as part of a project-level EIS (if Alternative 2 or 4 is selected as the preferred alternative) to optimize the distribution of surface water, particularly during dry conditions.

Implementation of Alternative 2 would also result in the following long-term impacts on the flow of surface water through the Ahtanum Creek Watershed.

- Flows in the lower portion of the North Fork and in the mainstem of Ahtanum Creek would generally decrease during the winter and spring, when flow would be diverted to fill the reservoir. The number of days with flows exceeding the minimum channel-forming flow (350 cfs) would be reduced. However, the diversion would be operated to maintain channel-forming flows when appropriate conditions exist.

- The diversion constructed to divert water from the North Fork to the proposed reservoir would be set up with controls so that established instream flow targets on the North Fork would be met. The evaluation indicates that implementation of instream flow targets equal to those outlined in Appendix D would reduce the number of days with average flows less than 20 cfs on the North Fork of Ahtanum Creek to match natural flow conditions. Use of the reservoir to augment instream flows in the mainstem of Ahtanum Creek would also reduce the number of days with average flows less than 20 cfs on Ahtanum Creek to more closely match natural flow conditions.
- Piping of the AID irrigation water conveyance and distribution facilities, along with the elimination of direct diversions from Ahtanum Creek, would divert surface water that is currently present in Bachelor and Hatton Creeks. As a result, flows in Bachelor and Hatton Creeks would mostly be reduced to runoff and return flows. If instream flows were maintained in Bachelor and Hatton Creeks, it would be to the detriment of flows in the mainstem of Ahtanum Creek. Flows in the mainstem downstream of the current diversion to Bachelor and Hatton Creeks would be reduced by any diversion needed to maintain instream flows in Bachelor and Hatton Creeks.
- Temperature modeling indicates that water released from the reservoir would exceed 16°C, the temperature standard for salmon and trout spawning, during August and September. The reservoir temperature analysis is included in Appendix D.

An analysis of the potential effect on TWSA indicates that Alternative 2 would result in an increase of approximately 2,700 acre-feet for average flow conditions and a loss of 600 acre-feet in a dry year such as 1977 (see Appendix B for the details of the TWSA analysis). The potential effect on TWSA would be very small (much less than 0.1 percent) and would not be measurable by Reclamation. In addition, most of the flow reduction would occur during the time that the Yakima Project is not on storage control and flows from July through October would be increased under all alternatives.

An analysis of the potential effect on Reclamation operations outside of the irrigation season was performed. Reclamation operates the Yakima Project on a year-round basis to provide irrigation water supply, fisheries flow, power generation and carryover storage. Modeling performed indicates Alternative 2 would cause a slight and not measurable reduction of flow in the Yakima River during winter (November to February) for average water years. During dry water years when Yakima River flows are much less, Alternative 2 would slightly increase flow during winter.

Water from unregulated tributaries not captured by Reclamation is used as a water supply prior to the time when contract obligations are met out of TWSA (April). That water, called flood water, is used to prime canals and provide frost water and some early season water to irrigators. The irrigation districts with flood water claims located downstream of Ahtanum Creek are the Sunnyside Division and the Wapato Irrigation Project. Alternative 2 would cause a slight and not measurable reduction of flow in the Yakima River during average water years during the March time period. During dry water years when Yakima River flows are much less, the alternative would slightly increase flow.

6.2.3 Alternative 3 – Watershed Restoration Program without Storage

The impacts on surface water supply described for Alternative 2 relating to conservation measures would be the same under Alternative 3. These impacts would include increased efficiency, reduced demand for surface and groundwater supplies, and increased reliability of these supplies. The biggest difference between Alternatives 2 and 3 is that Alternative 3 would not substantially improve irrigation reliability after July 10 each year. Since no reservoir would be constructed, this alternative would not affect TWSA.

A reduction in the demand for surface water supplies would also result in improved instream flows. This alternative assumes that the AID and WIP would continue to divert surface water for irrigation directly from the mainstem of Ahtanum Creek. Reducing surface water demand due to improved efficiency would result in reduced diversions and more water remaining in the stream for instream flows.

However, improved efficiency may cause some users to convert from groundwater to surface water diversions since more surface water would be available to meet crop water demand. Therefore, diversions from the creek would not necessarily be reduced as a result of conservation measures.

6.2.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

The long-term impacts on surface water supply and flows that were described for Alternative 2 would apply to Alternative 4 as well. The effects of Alternative 4 on TWSA would be the same as described for Alternative 2.

6.2.5 Mitigation Measures

6.2.5.1 Alternative 1 – No Action

The most significant impact of Alternative 1 is that it offers no coordinated watershed-wide plan to improve current conditions. The best long-term mitigation measure would include coordination of surface water conservation and habitat restoration activities under other plans or programs.

6.2.5.2 Alternative 2 – Watershed Restoration Program with Storage

Implementation of Alternative 2 is expected to benefit surface water resources over the long term and is considered to function as mitigation for current water supply problems. It is important that the reservoir function efficiently to address water supply issues. The following measures are recommended to ensure that operation of the Pine Hollow Reservoir would achieve the anticipated results.

- Consistent review of the operation and management of the proposed reservoir by the AID and WIP or an oversight group composed of water users and fisheries agency representatives to optimize the multiple uses of storage, while giving priority to maintenance of instream flow targets and channel-forming flows.
- Detailed, coordinated water conservation planning, carried out in accordance with Ecology or Reclamation standards to address the continued problem of surface water supply shortages during drought years.
- To reduce elevated temperatures in water discharged from the reservoir, the water could be infiltrated to allow cooling before recharging Ahtanum Creek.
- The reservoir and ditches would be patrolled periodically to prevent unauthorized diversions.

6.2.5.3 Alternative 3 – Watershed Restoration Program without Storage

Alternative 3 is expected to benefit surface water resources, although not to the same level as Alternative 2. No mitigation measures are proposed beyond the habitat restoration measures included in the alternative. In order to maximize the benefits from conservation measures, detailed, coordinated conservation planning should be conducted to address the continued problem of surface water supply shortages during periods of low stream flow. Conservation planning should lead to a coordinated approach regarding maintenance of instream flows to ensure that some of the water savings resulting from conservation efforts is retained in the stream to enhance instream flows.

6.2.5.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

The mitigation measures associated with Alternative 4 and long-term impacts on surface water supply and flows would be the same as described for Alternative 2. Additional measures would be required to address flow elements relating to fish habitat.

6.2.6 Cumulative Impacts

6.2.6.1 Alternative 1 – No Action

The continued lack of reliability of surface water supply and low seasonal flows are likely to result from the No Action Alternative. The No Action Alternative may result in agricultural properties that are not productive being developed as residential property, as discussed in Section 6.7.

6.2.6.2 Alternative 2 – Watershed Restoration Program with Storage

The reservoir would not have the capacity to provide reliable surface water supply to all agricultural properties within the AID and WIP. The cost of constructing conveyance facilities and distribution laterals, in combination with the size and priority of water rights, would likely prevent some properties from accessing surface water from the reservoir. Those properties would likely be of less value for agriculture and may be more likely to develop as residential property as urbanization extends west into the Ahtanum Creek Watershed.

6.2.6.3 Alternative 3 – Watershed Restoration Program without Storage

Implementing the ACWRP without storage would likely improve the efficiency of surface water use. However, land owners with agricultural lands that are not producing sufficient income may decide that implementation of conservation measures would not add value to their land, especially if they are required to fund a portion of those improvements. As a result, the value of the land for potential residential uses may become more attractive.

6.2.6.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

The cumulative impacts resulting from Alternative 4 would be similar to those listed for Alternative 2.

6.2.7 Significant Unavoidable Adverse Impacts

With any of the alternatives, groundwater use would still be required to meet crop water demands. None of the alternatives would significantly reduce flooding, and drought would still impact instream flows and water supply and reliability.

6.3 Groundwater

This section describes the potential impacts to groundwater resources in the Ahtanum Creek Watershed from implementation of the ACWRP alternatives.

6.3.1 Alternative 1 – No Action

Under Alternative 1, future groundwater demands for out-of-stream (primarily irrigation) uses might not be met in the Ahtanum Creek Watershed. With regard to water quantity, taking no action would leave many resource management concerns unanswered for the sustainability and future availability of groundwater withdrawal from deep aquifers and ineffective management of groundwater resources. Groundwater declines were apparent in the 1950s, 1970s, and 1980s. No data are available to conclusively attribute long-term changes in deep aquifer groundwater levels to climate trends or to changes (reductions) in groundwater withdrawal rates. Suburbanization of the Ahtanum Creek Watershed could lead to a proliferation of exempt wells with consequential overuse of groundwater. The magnitude of potential groundwater impacts would depend on current aquifer recharge, the existing quantity and pattern of groundwater use, future population growth, and the effectiveness of existing water management efforts.

6.3.2 Alternative 2 – Watershed Restoration Program with Storage

Each of the components of Alternative 2 would have different impacts on groundwater. The impacts of these components, such as the reservoir, water conservation, and transferring water rights, are described separately.

6.3.2.1 Pine Hollow Reservoir

Of the alternatives evaluated, Alternative 2 has the greatest potential to redistribute groundwater recharge patterns in the Ahtanum Creek Watershed. The storage of surface water in the reservoir and implementation of conservation measures could reduce potential recharge to the shallow alluvial aquifer, resulting in localized impacts.

Implementation of this alternative could significantly increase groundwater levels near the reservoir. The magnitude of this potential impact would depend on the size, depth, and permeability of the reservoir and on the properties of the soil and underlying aquifers. To comply with dam safety regulations, an inspection program would be required to monitor seepage near the reservoir. This activity, which would occur over the life of the structure, would involve the installation and maintenance of permanent and temporary piezometers, observation wells, and seepage galleries, as well as geotechnical soil and rock borings and excavated test pits. Based on a soil permeability estimate of 1×10^{-6} centimeters per second (cm/sec) (Dames & Moore, 1999b), the annual leakage from the reservoir is estimated as 100 acre-feet/year, which would recharge groundwater under and near the reservoir. Assuming that the reservoir would lie on or near the groundwater divide between Ahtanum Creek and Cottonwood Canyon, one-third to one-half of this leakage could potentially discharge to the north into the Cottonwood Canyon basin and out of the Ahtanum Creek watershed. Dames & Moore (1999b) estimated that approximately 300 acre-feet/year of the stored water in the reservoir could evaporate during the year and be lost from the watershed. The water lost to evaporation and leakage out of the watershed would be diverted during the winter, spring, and summer. This diverted and lost water would otherwise flow in Ahtanum Creek and potentially recharge the alluvial aquifer.

Groundwater quality could be affected if the reservoir is built at a location where local soils and/or geology contain contaminants that could leach to groundwater. These contaminants could have been introduced to the groundwater system through past land use practices, such as agricultural chemical applications or septic tanks, for example. The impact would depend on the amount of potential contaminants, the ability of underlying soil and aquifer materials to absorb contaminants, and the hydraulic connection with underlying aquifers. Potential contaminants include natural elevated concentrations of salts, agricultural chemicals (pesticides, fertilizers, petroleum products), and domestic or agricultural wastes (onsite sewage systems, disposal pits, manure). Changes in water quality could potentially impact domestic water use near the reservoir and surface water quality at the point of groundwater discharge to streams. Mixing and dilution of impacted groundwater within the aquifers before discharge could naturally mitigate any surface water impacts.

A secondary impact to groundwater relates to the potential for mitigating the impact of stream flow augmentation. If the water released from the reservoir is determined to be too warm for stream augmentation, the warm water could be cooled by infiltration before it enters the stream.

This mitigation approach could potentially flood areas or create new wetlands at the infiltration location.

6.3.2.2 Water Conservation

Section 6.2, Surface Water Impacts, indicates a potential reduction in demand of 13,300 acre-feet through efficiency improvements. A portion of this 13,300 acre-feet of water is currently lost through evaporation and infiltration to groundwater. Implementation of Alternative 2, therefore, could decrease artificial recharge to groundwater along reaches of canals and ditches that currently leak irrigation water to the subsurface or in inefficiently irrigated areas. Reducing or eliminating leakage would lower water tables near currently leaking structures, thereby potentially reducing groundwater availability in the alluvial aquifer. A secondary impact could include a reduction in groundwater discharge back into streams along the lined canal. In particular, lining the WIP canal would reduce leakage that currently drains back to the Ahtanum Creek mainstem and could reduce baseflows in the creek. The location and magnitude of water table decline would depend on the location of improvements, the hydrogeologic conditions underlying the structures, the number and size of irrigation canals and ditches, the percent reduction of leakage, the depth to the water table, and the rates of groundwater withdrawal. Magnitudes of groundwater decline would range from one to several feet, which could potentially reduce baseflow in streams during low flow periods. The potential impact to base flow to the stream would be offset by the reduction of diversion from stream flow due to increasing water use efficiency

Some of the leakage is currently taken up by phreatophytes (plants with roots deep enough to reach the water table), a portion of which would die and no longer withdraw soil moisture and groundwater along the leaking structures. The reduction in phreatophyte consumption would offset some of the groundwater level decline. In addition, lining and piping the irrigation conveyance system would reduce the current evaporative losses from open canals and ditches, resulting in a general increase in total water in the watershed.

Installing, operating and maintaining water quantity monitoring devices such as meters and gauges would improve the management of surface water and groundwater resources to the extent that groundwater consumption could potentially shift in duration, magnitude, or timing. A better understanding of water use could reduce waste through leakage and improve irrigation application efficiency. The impacts of efficient water use would potentially affect the distribution of groundwater recharge and discharge and, subsequently, the amount of baseflow discharging to streams. An awareness of use patterns and identification and reduction of delivery system losses could reduce groundwater demand and subsequently increase the groundwater levels availability, primarily in the deeper aquifers. Reductions in deep aquifer withdrawal likely would not significantly impact groundwater distribution in the watershed. However, by improving irrigation efficiency, infiltration to groundwater would decline and groundwater levels in the alluvial aquifer could decrease, thus resulting in decreased discharge to streams.

Reducing irrigation supply leakage to the alluvial aquifer would decrease the amount of seasonal storage that accumulates in the aquifer during the irrigation season. The reduction in storage would create an indirect or secondary impact by proportionally reducing groundwater discharge from the alluvial aquifer to streams in the lower reach of the watershed.

It is likely that changes in water chemistry due to leaching of natural compounds from soil would dissipate over time as the soil and aquifer materials reach a new equilibrium with stored water.

6.3.2.3 Transferring Surface Water Rights

Transferring the beneficial use of existing out-of-stream water rights by changing the point of diversion or place of use would alter the current distribution of groundwater recharge from streams in the service area. Changing the location and timing of groundwater recharge potentially would increase or decrease the groundwater levels at the point of diversion and/or use depending on the location and magnitude of change. No out-of-basin transfers are included in Alternative 2; therefore, in-basin transfers are not expected to significantly change the watershed water balance.

Available stream gauge data suggest that the lower reach of the North Fork of the Ahtanum Creek above the North and South Forks confluence and the mainstem just below the confluence would lose water by seepage into the alluvial, sedimentary, and basalt aquifers. Flow in the North Fork would be diverted to fill the reservoir during the winter and spring, when the rate of stream loss is at maximum levels. Consequently, reducing the stream flow along these losing reaches would reduce groundwater recharge in these areas. Conversely, applying transferred water onto areas currently not irrigated could adversely impact groundwater by raising groundwater levels to unacceptable levels.

Reducing or eliminating creek diversions within the reservoir service area would potentially raise alluvial aquifer groundwater levels along reaches downstream of diversions. The additional water flowing in the creeks would either recharge groundwater along these reaches or reduce the amount of groundwater discharging to these reaches.

6.3.2.4 Transferring Groundwater Rights

A more reliable surface water supply could result in a reduced use of privately held groundwater wells. Transferring the beneficial use of existing groundwater rights by reducing groundwater withdrawals for irrigation use in exchange for receiving reservoir water would alter groundwater levels at the larger irrigation wells. Most groundwater used for irrigation derives from the sedimentary and basalt aquifers. A small percentage (less than 10 percent) of groundwater used for irrigation derives from wells tapping the alluvial aquifer. Reducing groundwater withdrawal from deep wells will ~~primarily~~ increase the groundwater levels in the deeper aquifers and alter the vertical groundwater gradient~~. The impact of rising groundwater levels may potentially increase vertical groundwater flow from~~ between the deeper aquifers and~~to~~ the alluvial aquifer. The resulting change in groundwater flow between the aquifers will depend on the amount of the reduction of the withdrawal and the vertical permeability of geologic units separating the deeper and alluvial aquifers near the deep wells.~~, although it is not likely that this impact would be significant; the small increase in vertical gradient would likely be widely distributed around the area surrounding the off-line irrigation wells.~~

It could be perceived that reducing groundwater withdrawal would increase the availability of groundwater for other uses. However, long-term groundwater level data suggest that groundwater levels in the deeper aquifers have declined over the last several decades. Reducing groundwater withdrawal for irrigation may reduce, halt, or reverse this decline, depending on the amount of reduction.

6.3.2.5 Stream Flow Augmentation

The Ahtanum Creek Watershed currently has been effectively closed to new appropriation of groundwater ~~from the alluvial aquifer~~ while the hydraulic continuity between the aquifer and Ahtanum Creek is being studied (see Section 4.13.2). ~~Groundwater development is therefore restricted to deep aquifers that are not directly connected hydraulically to surface water.~~ Using reservoir water to augment stream flows would essentially transfer a portion of surface water flow from winter to summer. ~~A secondary impact of this transfer would include changing the natural pattern to groundwater recharge at the point of diversion (Johncox Ditch) in the winter and spring and changing groundwater discharge at the point of augmentation from the reservoir.~~ Using reservoir water to augment stream flows diverts a portion of winter surface water flow into storage. This diversion reduces the amount of water in the stream available to recharge groundwater at the point of diversion near Johncox Ditch. The augmentation to the stream would increase stream flow and potentially increase alluvial aquifer recharge at the point of augmentation. A change in the groundwater recharge-discharge patterns would impact groundwater levels and local availability of groundwater in the alluvial aquifer. The magnitude of impacts would depend on the timing, location, and magnitude of the diversion and augmentation, the local hydraulic characteristics of the stream, the local hydrogeologic characteristics of the underlying alluvial aquifer, and the local groundwater demand. The magnitude of the impact would not likely be significant; streams that would benefit from augmentation would not lose water at rates sufficient to impact groundwater.

6.3.2.6 Habitat Restoration

Under Alternative 2, in-channel habitat improvement projects (modification of stream topography, roughness, and vegetation) would reduce surface water flow velocity. Out-of-channel habitat improvements could include expansion of floodplains and creation of side channels or ponds. These actions potentially would create infiltration basins that could promote groundwater recharge of the alluvial aquifer. The magnitude of this effect would depend on the relative area of additional floodplain created by the relocation of the dikes and the degree to which surface water from this area would infiltrate to groundwater.

In the lower (gaining) reach of the watershed, the increased area of surface water alterations could potentially promote and increase the rate of groundwater discharge to surface water where construction of the new areas expose the surface waterbodies to high permeability zones of the alluvial aquifer. Alternatively, additional ponds and side channels could detain stormwater and reduce flooding potential.

6.3.3 Alternative 3 – Watershed Restoration Program without Storage

The potential impacts under Alternative 3 would be the same as those components of Alternative 2 associated with water conservation and habitat restoration components. No reservoirs would be constructed so there would be no reservoir-related impacts.

6.3.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

The potential impacts under Alternative 4 would be the same as the reservoir and conservation components described for Alternative 2.

6.3.5 Mitigation Measures

6.3.5.1 Alternative 1 – No Action Alternative

The No Action Alternative assumes that groundwater quantity would continue to be managed through the existing framework of federal, state, local, and tribal programs, and water user practices. There would be no direct impacts to groundwater; therefore, no mitigation is proposed.

6.3.5.2 Alternative 2 – Watershed Restoration Program with Storage

Similar to the impacts section, the mitigation measures for the individual components of Alternative 2 are discussed separately.

Pine Hollow Reservoir

Potential unacceptable changes in groundwater levels as a result of the Pine Hollow Reservoir could be avoided by conducting appropriate hydrogeological studies to predict any adverse effects prior to final design and construction. In cases where such impacts would be likely, the location, depth, size, and design of the storage facility could be modified as needed. The hydrogeologic studies would include monitoring well construction in the alluvial aquifer and sedimentary aquifer system along the Ahtanum Road south of the reservoir. Changes in seepage to Bachelor Creek could be monitored at the Bachelor Creek gauge at Carson Road.

A potential reduction in groundwater quality beneath the reservoir caused by leaching and migration of natural or artificial contaminants could be avoided by assessing and removing manmade sources of contamination (if present) before filling the reservoir. Assessing the chemistry of reservoir site soils (and determining the likely groundwater flow from the reservoir) would indicate the potential for natural contamination sources such as increased salinity or dissolved solids in groundwater. Natural mixing and dilution of groundwater may sufficiently mitigate changes to groundwater quality.

Water Conservation

To mitigate for any potential decrease in groundwater levels resulting from the lining of irrigation canals and ditches, appropriate hydrogeological studies could be conducted to predict any adverse effects prior to construction. If any adverse groundwater effects were predicted as a result of the studies, then construction or design of the canals could be adjusted to reduce the effects. Available water level data are not sufficiently detailed and precise to assess the current amount of leakage from irrigation canals and ditches, the artificially elevated groundwater levels due to leakage, and the artificially elevated groundwater discharge to streams resulting from increased alluvial aquifer storage. These studies would include measuring surface water and groundwater levels in and next to the open irrigation structures before lining to determine the current leakage rate, then estimating the potential change in groundwater level decline with the loss of leakage. In areas where undesirable impacts could occur, lining activities could be avoided or limited, while other measures, such as artificial recharge, could be considered.

Increased water efficiency would locally reduce groundwater recharge to the alluvial aquifer, reduce groundwater levels, and reduce stream baseflow downstream of leaky irrigation canals or inefficiently irrigated areas. Adverse decreases in groundwater levels could be avoided by conducting appropriate hydrogeological studies to estimate the impact of irrigation reduction on groundwater levels. The studies would include seasonal monitoring of current groundwater levels near areas of significant irrigation. The monitoring results would be used to estimate the impacts of changes in water use on groundwater levels. For areas where declining groundwater levels would reduce baseflow or impair habitat (wetlands), the timing or magnitude of the decrease in groundwater levels could be avoided or other measures such as artificial recharge could be considered.

Transferring Surface Water Rights

Negative impacts to groundwater recharge patterns from change in water use or diversion could be avoided by conducting appropriate hydrogeological studies to predict any adverse effects prior to implementation of the changes; this would allow the implementation of appropriate mitigation measures. At present, available water level data are not sufficiently detailed, continuous, and precise to assess the current amount of recharge and discharge along the reaches of streams.

Hydrogeological studies would include seasonal monitoring of current groundwater levels near current and anticipated points of water diversion and use. The monitoring results would be used to estimate the impacts of changes in use or diversion on groundwater levels. For areas where groundwater level would be impacted, the timing or magnitude of the changes in water use could be avoided or other measures, such as artificial recharge or withdrawal, could be considered.

Transferring Groundwater Rights

Reducing groundwater withdrawals would cause an increase in groundwater levels, which is considered a benefit to the groundwater system with no significant impacts; therefore, no mitigation is warranted.

Stream Flow Augmentation

Potential negative impacts on groundwater from stream flow augmentation could be mitigated through the measures described above for water conservation and transferring surface water rights. Hydrogeologic characterization and hydrologic monitoring would provide data to estimate the potential impact on groundwater levels and availability.

Habitat Restoration

Mitigation of any unacceptable modification of groundwater recharge and discharge, with associated changes in water levels, caused by habitat restoration projects would involve characterizing hydrogeologic conditions and analyzing the hydrology of modified areas in order to estimate potential changes in groundwater exchange with surface water. Hydrogeologic studies would resemble those described above under the Pine Hollow Reservoir and Water Conservation mitigation subsections; the studies would estimate the magnitude of potential impacts based on the hydrogeologic characteristics of modified streambeds and floodplains. The projects could be modified to reduce impacts to groundwater.

6.3.5.3 Alternative 3 – Watershed Restoration Program without Storage

The mitigation of potential groundwater impacts under Alternative 3 would the same as described for the Alternative 2 conservation and habitat restoration components.

6.3.5.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

The mitigation of potential groundwater impacts under Alternative 4 would be the same as those described for Alternative 2, except without the habitat restoration measures.

6.3.6 Cumulative Impacts

6.3.6.1 Alternative 1 – No Action

Under Alternative 1, the cumulative impacts of taking no action on groundwater management could lead to further decline or uncertainties in availability of groundwater.

6.3.6.2 Alternative 2 – Watershed Restoration Program with Storage

Operating a new reservoir would result in permanent changes to local groundwater recharge and groundwater elevations in the alluvial aquifer near the reservoir. These changes would depend on reservoir operations that affect the rate and timing of irrigation water transfer and stream augmentation, and hydrogeologic characteristics of the alluvial aquifer and sedimentary aquifer system underlying the reservoir and areas receiving irrigation or stream augmentation water.

Implementation of Alternative 2 may result in permanent reductions to stream flow in the upper and middle reaches of Ahtanum Creek where water is diverted to fill the reservoir. The stream flow reduction consequently would decrease groundwater levels in the aquifers near the points of diversion and downstream of the diversion due to loss of recharge. Implementation of Alternative 2 may affect shallow groundwater withdrawal near streams. However, if appropriate mitigation measures are implemented for each diversion and transfer of water, cumulative impacts and significant unavoidable adverse impacts on groundwater levels are unlikely.

Lining/piping irrigation distribution systems and repairing leaky structures in the watershed may reduce groundwater recharge along the structures and gradually lower the water table in the alluvial aquifer. The decline in groundwater recharge is not expected to impact shallow irrigation well operation, except for dug wells constructed next to canals. Dug wells may experience declines sufficient to dry up the wells. Secondary long-term cumulative impacts may include the costs associated with deepening shallow dug wells.

Water use efficiency would reduce groundwater recharge and may have a cumulative, unavoidable, adverse impact by reducing groundwater levels in irrigated areas. The cumulative and significant unavoidable adverse impacts on water resources would be changes to local groundwater levels and recharge rates.

Implementation of Alternative 2 could reduce irrigation demand, improve groundwater availability, and potentially reverse the current declining trend of water levels in deeper aquifers. Implementation may increase stream baseflow if groundwater withdrawn from the alluvial aquifer for irrigation is transferred in exchange for use of reservoir water.

Habitat restoration could have a cumulative impact by raising groundwater levels in the alluvial aquifer along reaches of Ahtanum Creek where infiltration is increased at ponds and side channels. In some areas, this could be an adverse impact, but in other areas, depending upon land use, it could be a beneficial impact.

6.3.6.3 Alternative 3 – Watershed Restoration Program without Storage

Cumulative impacts for Alternative 3 would be similar to Alternative 2, except for the impacts related to the reservoir.

6.3.6.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Cumulative impacts under Alternative 4 would be similar to those of Alternative 2, except no habitat restoration would be undertaken.

6.3.7 Significant Unavoidable Adverse Impacts

As noted in Section 6.3.6, unavoidable adverse impacts could include localized reductions in groundwater levels, thus resulting in increased costs associated with deepening wells.

6.4 Plants and Wildlife

This section describes the potential impacts to plants and wildlife that could result from implementation of the alternatives proposed for the ACWRP.

6.4.1 Alternative 1 – No Action

No direct impacts to plants or terrestrial wildlife are anticipated under the No Action Alternative. It is expected that various agencies and entities would continue habitat restoration actions that could include riparian vegetation improvements. However, these measures would not be conducted on a comprehensive, watershed-wide basis. The improvements would likely include removal of non-native vegetation and planting with native plants. Improved riparian vegetation could improve habitat for birds and terrestrial species.

6.4.2 Alternative 2 – Watershed Restoration Program with Storage

Habitat restoration measures under Alternative 2 would include improvements to riparian vegetation. The riparian restoration projects would be similar to those described for Alternative 1, but would be coordinated as part of the overall watershed restoration plan. Improved riparian habitat could increase wildlife numbers in riparian areas.

Construction of the storage reservoir in Pine Hollow would result in flooding of the grassy vegetation and replacing that area of disturbed shrub-steppe vegetation with an artificial lake. The reservoir would be drawn down during the summer, leaving exposed mud flats at the upstream end of the reservoir. It is likely that a mix of native and non-native vegetation, including smartweed (*Polygonum sp.)* and cocklebur (*Xanthium sp*.), would colonize the mud flats during the summer. The dam would be earthen and initially be exposed soil. The dam would be planted with native vegetation. Insects, including mosquitoes could breed in the mud flats areas. The mosquitoes could carry diseases, including the West Nile virus.

The reservoir would likely provide habitat for waterfowl species, especially during spring and fall migration. Shorebirds may be attracted to the mud flat areas during fall migration.

The riparian vegetation that has established along the Johncox Ditch would be removed when the ditch is widened to accommodate diversions into the reservoir. The diversion would be lined or piped and therefore it would be unlikely for vegetation to reestablish along the ditch. Lining or piping conveyance lines would deprive phreatophytes of their water source and the plants would die and not be able to reestablish. This would result in less protective vegetation cover for prey species such as small mammals, birds, and reptiles. The movement of small mammals and reptiles could also be blocked or altered by the new access roads and pipelines.

6.4.3 Alternative 3 – Watershed Restoration Program without Storage

Alternative 3 would result in improvements to riparian vegetation similar to those described for Alternative 2. No reservoir would be constructed, so there would be no disturbance to vegetation in the Pine Hollow area. Irrigation system improvements could include the construction of conveyance pipes that would require removal of existing vegetation.

6.4.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts under Alternative 4 would be similar to those under Alternative 2. However, there would be no coordinated habitat restoration program. Riparian restoration measures would likely be conducted as described for Alternative 1.

6.4.5 Mitigation Measures

The riparian restoration programs that would be implemented under Alternatives 1, 2, and 3 are expected to result in an overall improvement in riparian functions in the Ahtanum Creek Watershed and would not require mitigation. For Alternatives 2 and 4, construction of the reservoir and accompanying conveyance systems would impact vegetation. The earthen dam would be planted with native vegetation to control erosion and replace lost vegetation in the area. Areas surrounding the reservoir that are disturbed during construction would be planted with native vegetation. A noxious weed and insect control program would be developed to control mosquitoes and any noxious weeds that could establish in the reservoir area. No mitigation is proposed for areas that would be inundated by the reservoir.

6.4.6 Cumulative Impacts

The habitat restoration projects, especially the coordinated projects under Alternatives 2 and 3, would improve riparian conditions and could increase the occurrence of local wildlife.

6.4.7 Significant Unavoidable Adverse Impacts

Under Alternatives 2 and 4, the reservoir area would be flooded, which would result in a permanent loss of vegetation and related habitat in the Pine Hollow area.

6.5 Fish

Potential impacts to fish from implementation of the ACWRP are discussed in this section. The results of the EDT model are included for each of the alternatives.

6.5.1 Alternative 1 – No Action

Alternative 1 would not include a coordinated restoration program for the watershed but would include continued conservation and habitat restoration efforts by individual entities and agencies that have jurisdiction over portions of the Ahtanum Creek Watershed. These efforts may be coordinated to some degree under other programs or processes but would not be subject to a coordinated watershed-wide implementation effort. However, for the purposes of this EIS, it is assumed that implementation of this alternative would not have a significant impact on stream habitat or instream flows.

To evaluate potential salmonid fish population impacts under Alternative 1, all habitat-related impacts to fish production were quantitatively assessed with the EDT model (Lestelle et al., 1996). For bull trout, the QHA (Qualitative Habitat Analysis) tool was used to diagnose environmental limiting factors instead of the EDT model. Unlike the EDT model, quantitative analysis of the impact of the actions is not possible in QHA. However, QHA was used to qualitatively discuss the relationship of the alternatives to the environmental factors that currently limit bull trout population performance in the Ahtanum Creek Watershed. QHA does not predict future biological performance, but only diagnoses limiting factors.

For the EDT model simulation, it was assumed that the major factor affecting fish production and fish habitat under Alternative 1 would be continued residential development. In review of adopted land use plans and discussions with the Ahtanum Core Group, it was determined that other forms of development (e.g., agriculture or forestry) were unlikely to change significantly in the immediate future and that their current impacts could be expected to continue. The time horizon for estimating impacts under existing policies was set at 30 years. Thirty years was selected based on three of the major limiting factors for fish in the Ahtanum Watershed: excessive sediment/bank instability, riparian vegetation, and excessive water temperature. Thirty years is sufficient time for locally native trees (black cottonwood and various species of willow) to reach a size capable of providing ample shade for a stream as small as Ahtanum Creek, thereby lowering water temperature and also filtering sediment from the stream and providing structural integrity to the streambanks. It is also a long enough time period to allow for significant fish population growth.

For the No Action Alternative (or scenario, in EDT terms), the EDT modeled environmental conditions over a 30-year time period from the present, assuming that current land use and management policies and practices would remain consistently in effect. This scenario includes three specific elements: 1) negative impacts associated with growth, 2) positive elements deriving from the enforcement of existing regulations, and 3) positive impacts attributable to "long-maturing" restoration projects. Recently implemented restoration projects were used for projecting impacts into the future. These actions included recently completed riparian fencing and side channels recently reconnected to Ahtanum Creek. Habitat restoration projects of this type require considerable time (approximately 30 years) before they are capable of yielding meaningful environmental benefits. For example, it takes a number of years for riparian vegetation to respond to fencing, and longer for fish populations to respond to the improved environment (e.g., decreased water temperatures and reduced sedimentation). For a full description of the assumptions used to develop the restoration scenarios, see Table C-11 in Appendix C.

Recently completed enhancement projects were included in the No Action Alternative, including roughly 6 miles of recent riparian exclosures and 0.8 mile of newly reconnected side channel (Rogers, personal communication, 2004). Of the riparian exclosures, 4.7 miles are distributed throughout the mainstem and 1.3 miles are in the South Fork of Ahtanum Creek. It was assumed they would contain trees 40 to 45 feet tall after 30 years. The shade these trees would produce was assumed to restore about 11 percent of the historical/normative maximum water temperature to affected areas (see below and Appendix C for details of rationale). The same magnitude of benefit was assumed for fish pathogens and predation risk since they increase along with temperature. The trees in these exclosures were also assumed to restore 22 percent of the historical value for riparian function and to filter out enough sediment to restore sediment ratings by 18 percent relative to the historical inputs (see Appendix C for details of rationale).

The restored side channels included in the No Action Alternative are located in the upper Ahtanum Creek mainstem between the upper WIP diversion and the confluence of North and South Forks. The constructed side channels were conceived as having fully vegetated banks (from riparian plantings) after 30 years, and to contain optimal quantities of large woody debris (LWD) installed after construction. The benefits of reconnecting these side channels included an absolute increase in habitat area of 10.5 percent and a 10.5 percent restoration of the historical quantities of LWD. Finally, the net confinement in the reach caused by human actions was assumed to decrease by 19 percent, which represents the relative length of the side channels in the reach.

The impacts specifically attributable to land use development in the Ahtanum Creek Watershed were addressed as follows. Because the major impact expected over this time period is residential growth, existing zoning regulations play a major role. The lower 6.8 miles of Ahtanum Creek fall within the UGA for Yakima County, while the rest of the watershed falls within a mixture of agricultural and rural classifications that generally restrict residential growth and/or subdivision. Therefore, the conditions predicted for the portion of the watershed within the UGA differ significantly from those further upstream. In accordance with adopted land use plans and policies, over the 30 years, residential growth within the UGA is estimated to be much higher than growth in the upper reach of the watershed. Refer to Section 6.7, Land and Shoreline Use, for additional discussion of projected growth in the watershed.

Reasonably predictable relationships exist between the degree of residential development and the specific impact on environmental variables for fish (May et al., 1997). The relationships described in May et al. were used, with modifications appropriate to an eastern Washington setting, to predict the impact of development on key aquatic habitat parameters. Zoning regulations were also used to predict specific environmental trends over time, some of which can be favorable even in the face of substantial growth. For example, current and future zoning regulations are assumed to result in improved riparian vegetation over time. On the other hand, sediment delivery to stream channels is expected to increase with increased development over time. The impact of development and zoning regulations on major environmental variables in the Ahtanum Watershed is summarized in Table 6-1. These relationships were the foundation for the EDT model simulations of the land use element of the No Action Alternative.

Table 6-1. Expected Impact of Residential Development on Major Environmental Variables in the Ahtanum Watershed

Attribute	Degradation Percent Relative to Percent Development	Comments
Anthropogenic Confinement	100% above UGA, 30% improvement within UGA	Expect 30% improvement in UGA, but 1:1 degradation above
Flashy Flow Impacts	10%	Minimal impacts because most drainage systems designed for infiltration
Harassment	100%	Harassment always directly correlated with population density.
Backwater Pools	100%	Residential development usually reduces log jams, the source of backwater pools
Beaver Ponds	100%	Flooding from beaver dams usually results in beaver relocation
Off-channel Habitat	100%	Moot; very little off-channel habitat to speak of except for Spring Creek
Heavy Metals	100%	Expected consequence of increased population density
Miscellaneous Toxicants	100%	Expected consequence of increased population density
Nutrient Enrichment	50%	Not worse because conversion is from agriculture to residential
Upwelling/Springs/Seeps	0%	No impact expected
Large Woody Debris	100%	Expected given current practices regarding perceived "flood hazards"
Benthic Production and Diversity	100%	Expected consequence of increased population density
Riparian Function	100% above UGA, 30% improvement within UGA	Expected 30% improvement in UGA, but 1:1 degradation above
Primary Pools	0%	No impact because additional channel straightening not anticipated anywhere in drainage
Fine Sediment, Embeddedness and Turbidity	10% in UGA, 25% above	For fines, embeddedness and turbidity, assume 10% of development increase within UGA, but 25% above UGA
Fish Pathogens	20%	Mainly temperature-based
High Temperature	10% improvement within UGA, no change above	Assume a 10% improvement from current conditions within UGA and no change above because conditions have already come to equilibrium at their worst possible state
Low Flow Impacts	No impact within UGA, 10% above	No impact in UGA, but an impact 10% of the growth rate expected upstream
Peak Flow Impacts	0%	No meaningful impacts anywhere in drainage because road density already as high as it is likely to get

The results of the EDT model simulation of the No Action Alternative are summarized in Table 6-2, which presents a summary of the performance of coho, spring Chinook, and steelhead populations in terms of life history diversity, productivity, carrying capacity, and mean abundance. The population performance parameters are summarized under current conditions, the No Action Alternative (30 years into the future with current land use trends and the implementation of current restoration projects), and historical conditions scenarios. For clarification, the column labeled Diversity Index in Table 6-2 denotes the proportion of life history patterns that are self-sustaining (result in at least one returning adult per spawner), while the Productivity column denotes the maximum number of returning adults per spawner. The Capacity column denotes the maximum number of adults the stream can support, and the Abundance column denotes the expected average number of returning adults.

Table 6-2. Predicted Impacts of the No Action Alternative on Production of Coho, Steelhead, and Spring Chinook Populations in the Ahtanum Creek Watershed

Population	Scenario	Diversity Index	Productivity	Capacity	Abundance
Ahtanum Coho	Current without harvest	1%	1.5	188	59
	No Action	1%	1.5	192	67
	Historic potential	98%	5.0	3,830	3,065
Ahtanum Spring Chinook	Current without harvest	4%	1.3	118	26
	No Action	6%	1.6	151	56
	Historic potential	100%	8.8	2,653	2,353
Ahtanum Steelhead	Current without harvest	2%	1.30	753	174
	No Action	2%	1.26	758	157
	Historic potential	97%	10.1	5,672	5,113

The results are derived from the EDT simulation

In general, there will be relatively little change in fish populations if current policies are continued for 30 years while existing restoration projects mature (Table 6-2). The small net change in fish population performance over time with the No Action Alternative is probably due to offsetting trends in watershed conditions. Improvements in aquatic and riparian habitat from current restoration and land management regulations are countered by impacts from future residential development. The productivity for all three species listed in Table 6-2 remains low under the No Action Alternative, ranging from 1.26 to 1.6 returning adults per spawner. These are very low productivity values, indicating that the populations have a low probability of persisting into the future (see Section 4.5). In terms of mean abundance, the steelhead population is predicted to fall by 9.7 percent while the coho and spring Chinook populations increase by 13 and 115 percent, respectively. In assessing the benefits to coho and spring Chinook abundance, it is essential to bear in mind that these values apply to populations with current estimated productivities of just 1.5 and 1.6, respectively. It is also important to note the extremely low life history diversity values for the three species, both under Current and No Action scenarios. These figures range from 1 to 6 percent, indicating that from 94 to 99 percent of all biologically possible life history patterns are not self-sustaining in the habitat available.

Alternative 1 is expected to have generally, but not exclusively, negative impacts on bull trout populations. Continued development of the Ahtanum Creek Watershed and expanded urbanization would likely add to the pollutant problems identified as a limiting factor for bull trout. Habitat diversity is expected to decline further due to the removal of large wood and additional confinement of the channel. However, a small improvement is expected in the reduction of high summer water temperatures, especially in the urbanized lower reaches, resulting from riparian restoration and improved management practices over time.

6.5.2 Alternative 2 – Watershed Restoration Program with Storage

Alternative 2 would consist of a coordinated attempt to restore aquatic habitat limiting factors in critical reaches combined with the operation of the Pine Hollow Reservoir.

6.5.2.1 Comprehensive Watershed Restoration Impacts

The habitat restoration component of Alternative 2 would address the major identified fish population limiting factors. It is assumed that restoration actions would be focused in the most critical reaches—the reaches with the greatest restoration potential in terms of the EDT analysis outlined in Section 4.5. The factors most responsible for limiting the production of salmon and steelhead in the Ahtanum Creek Watershed are fine sediment, excessive temperature, a lack of key habitat (especially pools and off-channel habitat), channel instability, a lack of habitat diversity associated with very low quantities of in-channel LWD, and fish passage barriers. Accordingly, the restoration actions incorporated into the EDT model simulation for the evaluation of Alternative 2 included the following measures intended to address these specific limiting factors:

- Riparian planting (improves shading/temperature, riparian function, and related variables);
- Road relocation and related measures to reduce sediment delivery to streams (reduces sediment input to stream channels within the upper watershed);
- Engineered channels with meanders and graded, bioengineered banks (reduces sediment input to middle and lower reaches of the watershed, while increasing bank stability and decreasing bed scour);
- Addition of large wood to stream channels (adds habitat diversity and key habitat, especially pools);
- Removal of barriers to valuable, cool-water habitat in the lower drainage (lower Bachelor and Spring Creeks); and
- Reconnection of historical side channels (decreases bed scour, increases channel stability, and adds habitat diversity).

In general, operation of the proposed Pine Hollow Reservoir would not significantly affect the limiting factors for fish in the Ahtanum Watershed, particularly in the short term. These factors would be more effectively addressed through implementation of comprehensive watershed restoration measures. However, overall trends over the long term associated with implementation of Alternative 2 appear to be positive. Appendix C provides detailed information on the restoration actions used for the EDT simulation. Following is a discussion of projected impacts associated with Alternative 2, based upon EDT results. As with all modeling, results are based upon assumptions used to build the model and should be considered a "snapshot" of input factors and conditions used in the model.

Riparian Planting

The primary objective of riparian planting under Alternative 2 is to provide more shade over stream channels and thereby lower water temperatures. Additional benefits would include a reduction in sediment input to stream reaches and improvements in riparian function, particularly long-term inputs of large wood. Minor benefits were hypothesized for in-channel large wood, bed scour, pool frequency, and off-channel habitat as well.

A large proportion of the watershed is targeted for riparian plantings. Targeted areas include the North Fork of Ahtanum Creek, from its mouth to Foundation Creek; the South Fork from its mouth to the steelhead access limit (RM 6.3); Bachelor Creek from its mouth to Spring Creek; and the mainstem of Ahtanum Creek from its mouth upstream to the confluence of the North and South Forks (Ahtanum Creek Reaches 1 to 7 on Figure 4-9).

The water temperature impacts of riparian plantings were estimated by applying the Stream Segment Temperature Model (SSTEMP) (Bartholow, 1997) to the targeted reaches. It was assumed that the cooling effect of 30 years of tree growth would be attributable exclusively to increased shading. The SSTEMP model accounts for the water-cooling impact of riparian shading by incorporating values for vegetation height, crown diameter, distance from the stream margin, and percent vegetation coverage. On the basis of published accounts of growth rates of black cottonwood and various willow species, it was conservatively estimated that successfully established willows and cottonwoods would reach a height of 40 to 45 feet and have a crown diameter of 30 to 35 feet after 30 years of growth. Distance from the stream margin was assumed to be 2 feet, and coverage density was assumed to be 100 percent (i.e., all of the streambank was assumed to be covered by trees)[1].

The SSTEMP model was used to estimate total shade levels (83 percent in the mainstem and 85 percent in the lower North Fork) and mean water temperatures (15.6^{o}C in the mainstem, 12.6^{o}C in the lower North Fork) for the month of August under the future, fully shaded scenario just described. The model was then used to estimate *current* stream temperatures (18.5^{o}C in the mainstem, 15.2^{o}C in the lower North Fork) given *existing* shade levels (33 percent mainstem, 37 percent lower North Fork). Existing shade levels were estimated from 1996 aerial photographs, and shade estimation protocols developed by the Washington State Timber, Fish and Wildlife group (WDNR, 1997b). The relative values of the mean temperature estimates ("future shaded scenario" to "current poorly shaded scenario") provided the basis for the assumed water-cooling effect of riparian growth[2]. For the EDT model simulation, it was assumed that successful riparian plantings along the targeted reaches would result in a 29 percent restoration of historical August temperatures in the mainstem, and a 7 percent restoration of historical August temperatures in the lower North Fork and South Fork.

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[1] The SSTEMP model includes other parameters not described in this report. In an attempt to explain the essential features of the temperature modeling process, only the key parameters were described. For a full description see Bartholow (1997).

[2] The bi-hourly temperature observations for the years 2001 to 2004 were multiplied by a fraction represented by the ratio of future-shaded to the current mean August temperatures. The adjusted temperature dataset was then re-rated for the EDT maximum temperature index value.

The assumptions for the other (non-thermal) aquatic habitat benefits of riparian plantings were as follows. The percent restoration of historical/normative conditions for fish pathogens and predation risk were the same as temperature (29 percent and 7 percent for the mainstem and the North and South Forks, respectively). Pathogens and predation increase with increasing water temperatures. Percent restoration for riparian function and fine sediment was set at 40 percent and 20 percent, respectively. Minor benefits (5 percent restoration) were assumed for large wood in the channel, bed scour, pools, and off-channel habitat.

Road-related Actions

Sediment reduction activities in the upper watershed (South Fork, North Fork, and North Fork tributaries) would focus on reducing the delivery of road-generated fine sediment to stream channels. Sediment delivery would be reduced through improved road management and selective road relocation. Improved road management would include measures such as placement of road drainage structures (e.g., culverts) and other actions such as limiting road access during wet weather. The road relocation element consists of relocating (moving upslope) and obliterating selected heavily used roads within 200 feet of the lower and middle North Fork, the lower and middle South Fork, the lower Middle Fork, and lower Foundation Creek. Again, the primary purpose of road relocation is to reduce fine sediment input to the upper Ahtanum Watershed (North and South Forks and several North Fork tributaries).

The rationale for road relocation is as follows. The Ahtanum Watershed Analysis (WDNR, 1997a) included estimates of background sediment input, road-related sediment input, sediment input attributable exclusively to stream crossings, and total sediment input. These estimates were made for the middle and lower North Fork, Foundation Creek, and the lower Middle Fork. It was estimated that roads within 200 feet of an active channel cause sediment input to exceed background levels by 83 percent in the lower North Fork, 66 percent in the middle North Fork, 55 percent in Foundation Creek, and 67 percent in the Middle Fork. With one exception, these were the assumptions incorporated into the EDT model to estimate the impact of road relocation and other sediment control practices on fish production in the upper reaches of the Ahtanum Watershed. The South Fork was the exception. Although no analysis of sediment sources could be found, roads run parallel and close to the South Fork for much of its length. Therefore, it was assumed that streamside roads are also the major source of sediment for the South Fork, and that the mean figure for the North Fork and its tributaries (71 percent) could be used to represent the percent restoration of background sediment levels that would be achieved by road relocation and other sediment control practices along the South Fork.

Engineered Channels (Constructing Meanders and Regrading Banks)

Biologists familiar with Ahtanum Creek determined that approximately 5.5 miles of the mainstem have channelized stream segments that are subject to a substantial degree of incision and are contributing major quantities of sediment from bank sloughing. These unstable segments extend from a half-mile reach paralleling Fulbright Park, near the confluence with the Yakima River, to another half-mile reach between the Johncox Ditch and Shaw Knox diversions on the lower North Fork.

For the purpose of the EDT model simulation, it was conservatively assumed that constructing meanders and regrading the banks of the unstable stream segments would result in a 40 percent restoration of the historical fine sediment values in reaches below the Bachelor-Hatton Diversion. In addition, it was assumed that these benefits would propagate downstream at a diminishing rate, such that the reach immediately downstream of a targeted reach would have a 30 percent restoration value, the reach below it would have a 20 percent restoration value, and so on. The benefits of remeandering and regrading were not assumed to be so pronounced for the mainstem between the Bachelor-Hatton Diversion and the confluence of the North and South Forks, because a portion of the deposited sediment in this area is "imported" from upstream sediment sources. In this section of the mainstem (Ahtanum Reaches 6 and 7) (see Figure 4-9), the sediment-related benefits of constructing meanders in targeted reaches was estimated to be 20 percent of historical values.

Constructing meanders in of the creek channel was also assumed to have benefits unrelated to sediment inputs. Adding meanders to the channel would increase pool frequency and reduce bed scour. It was assumed that the reengineered stream reaches would include the historical quantity of pools, so the percent restoration for pool frequency in targeted reaches was established at 100 percent. A relatively minor benefit of 10 percent restoration was used for bed scour in targeted reaches.

Addition of Large Woody Debris

With the exception of the handful of reaches already relatively well stocked with large wood (the North Fork from the Middle Fork to the access limit for anadromous fish; the Middle Fork; and the South Fork from RM 2.0 to the access limit), the restoration simulation included adding large wood to most of the channels in the watershed. The stocking rate for each reach was one piece per channel width, with the exception of the mainstem between the upper WIP diversion and the confluence of the North and South Forks, which would receive two pieces per channel width because of its high-priority ranking for restoration potential.

Removing Barriers

Under Alternative 2, removing fish passage barriers is proposed to increase the quantity of good spawning and rearing habitat, with a particular focus on areas with relatively cool summertime water temperatures. The only candidate areas for this treatment are lower Bachelor Creek and its tributary, Spring Creek. This action would consist of moving the Bachelor Creek rack upstream to a point immediately above the Spring Creek confluence.

Reconnecting Side Channels

Under Alternative 2, reconnecting streamside channels would address a lack of habitat diversity, insufficient quantity of pools, limited rearing habitat, and excessive bed scour. The action would consist of creating 1.3 miles of new side-channel habitat in addition to the side channels just created and described under the No Action Alternative. The additional side channels are also located in the Ahtanum Creek mainstem between the upper WIP diversion and the confluence of the North and South Forks, Reach 7 (see Figure 4-9). Except for their relatively greater length, these additional side channels are functionally identical to the side channels described in the No

Action Alternative.

The projected benefits of reconnecting and engineering 1.3 miles of side channel in the targeted reach are as follows. The total fish rearing area would increase by 22.9 percent, and in-channel large wood loading would be restored to 22.9 percent of historical levels. Because the side channels would be engineered to contain 50 percent pool habitat, overall pool quantity in the reach would increase by 49 percent. In addition, channel confinement caused by human actions would decrease by 27 percent (the lineal proportion of side channel in the reach), and bed scour would be restored to 22.9 percent of historical values (within the proportion of the reach consisting of side channel).

6.5.2.2 Pine Hollow Reservoir Storage Impacts

Under Alternative 2, the evaluation of potential fisheries impacts from operating the Pine Hollow Reservoir was based on three considerations and assumptions. First, because seasonal stream flows are highly variable in a natural setting, it is difficult to model fish population performance under different flow regimes and develop conclusions about future status with a high degree of certainty. In unregulated watersheds, summertime stream flows, which are the most limiting to fish populations, are inherently variable, fluctuating widely from dry to wet years. For the purpose of the EDT model simulation, modeled stream flows, which represent what stream flow would have been between 1947 and 1984 under the estimated 2002 irrigation demands, were used as the baseline for comparison.

Second, according to flow simulations discussed in Section 5.2, the Pine Hollow Reservoir was assumed to cause a slight decrease in mean monthly flows in the mainstem (below the upper WIP Diversion) during the period of reservoir refilling (generally November to April) and during the months of June and August as well. When averaged over September and October, the two months of lowest mean flow, mean discharge between the reservoir intake and discharge points (Johncox Diversion on lower North Fork and Upper WIP Diversion on upper mainstem, respectively), would be approximately 1.3 cfs lower than current values. By contrast, mean discharge below the release point over this same time period would be from 0.7 to 3.4 cfs higher than under current conditions.

Finally, although these changes in stream flows are small, they not trivial. However, the wetted widths that would be associated with these new flows differ from current widths by 1 percent to 2 percent or less. Accordingly, the impact of Pine Hollow Reservoir operation was modeled exclusively in terms of the changes to baseflow and not wetted width. The assumed impacts to stream base flow are summarized in Table 6-3.

Based on these assumptions, a slight positive impact on the modeled fish populations results from Pine Hollow Reservoir operations for all reaches below the release point, while a slight negative effect would occur between the points of reservoir intake and release.

Table 6-3. Reach-Specific Impacts of Pine Hollow Reservoir Operation: Mean September and October Flows in Ahtanum Creek

Reach	Baseflow (percent change from Current)
Ahtanum Creek, mouth to Goodman Road	~~16.7~~14.1%
Ahtanum Creek, Goodman Road to Bachelor return	~~16.7~~20.8%
Ahtanum Creek, Bachelor return to 42nd Avenue	~~13.5~~13.9%
Ahtanum Creek, 42nd Avenue to Hatton return	~~13.5~~13.9%
Ahtanum Creek, Hatton return to lower WIP diversion	~~-13.0~~13.0%
Ahtanum Creek, Lower WIP Diversion to American Fruit Road	~~3.7~~13.0%
Ahtanum Creek, American Fruit Road to Marks Road	~~3.2~~3.7%
Ahtanum Creek, Marks Road to Bachelor-Hatton Diversion	~~3.2~~3.5%
Ahtanum Creek, Bachelor-Hatton Diversion to Upper WIP Diversion	~~-2.7~~3.0%
Ahtanum Creek, Upper WIP Diversion to forks	**-4.4%**
North Fork Ahtanum, Mouth to RM 2.0	**-5.7%**

The temperature of the water released from the reservoir to maintain instream flows was initially considered a potential issue in evaluating the impacts of reservoir operations. The temperature of the water released into Ahtanum Creek is not, however, an issue relative to fish response because so little water is actually released. The projected releases for the months of June through October are 1.8 cfs, 0.1 cfs, 0.0 cfs, 0.02 cfs, and 0.1 cfs, respectively. Estimated flow in Ahtanum Creek during these same months is at least 64 times the flow spilled into the creek. Moreover, the estimated temperature of water released during this period is not unusually high, ranging from 5.7°C in June to 21.4°C in September.

6.5.2.3 Combined Watershed Restoration with Storage Impacts

Table 6-4 summarizes the results of the Alternative 2 EDT simulation for the combined impact of watershed restoration and the operation of Pine Hollow Reservoir on Ahtanum coho, spring Chinook, and steelhead populations. The estimated impact of Alternative 2 clearly benefits the production potential of Ahtanum Creek Watershed fish populations. The mean abundance of coho and steelhead would nearly triple, while spring Chinook mean abundance would increase more than 700 percent. Perhaps more importantly, the productivity and life history diversity values of all populations would also increase substantially. Estimated productivity for both coho and steelhead is 1.9 returning adults per spawner, while life history diversity values are 20 percent and 29 percent, respectively.

Although these values represent major improvements over baseline conditions, they still suggest limited population resilience and stability. Nearly 70 percent of the possible life history patterns for steelhead are not self-sustaining, as are 80 percent of the life history patterns for coho. These numbers project that the survival of the population depends on a relatively limited number of reaches that fish must have access to at specific times. Similarly, the fact that the maximum reproductive rate (productivity) is only 1.9 returning adults per spawner means that relatively modest increases in mortality could cause the population to decline precipitously. Because of low productivity, these populations would recover fairly slowly from inevitable environmental fluctuations.

Table 6-4. Predicted Impacts of Alternative 2 on Production of Coho, Steelhead, and Spring Chinook Populations in the Ahtanum Creek Watershed

Population	Scenario	Diversity Index	Productivity	Capacity	Abundance
Ahtanum Coho	Current without harvest	1%	1.5	188	59
	Watershed Restoration and Pine Hollow Reservoir	21%	1.9	341	163
	Historic potential	98%	5.0	3,830	3,065
Ahtanum Spring Chinook	Current without harvest	4%	1.3	118	26
	Watershed Restoration and Pine Hollow Reservoir	36%	2.9	316	205
	Historic potential	100%	8.8	2,653	2,353
Ahtanum Steelhead	Current without harvest	2%	1.3	753	174
	Watershed Restoration and Pine Hollow Reservoir	29%	1.9	981	455
	Historic potential	97%	10.1	5,672	5,113

The results are derived from the EDT simulation

Spring Chinook are assumed to be restricted primarily to the mainstem of Ahtanum Creek, where most of the habitat restoration activities would occur. It is thus not surprising that spring Chinook would be the largest beneficiary of the proposed restoration actions. With a productivity of nearly three returning adults per spawner and 36 percent of the possible life history patterns being self-sustaining, it is likely that Ahtanum Creek could once again support a population of spring Chinook. However, the population would be small and precarious, dependent on a limited number of spawning reaches and outmigration patterns.

Based upon the QHA evaluation, the implementation of Alternative 2 would have the following positive impacts on the Ahtanum Creek bull trout populations:

- Improved riparian vegetation and cover from restoration actions would provide shade to reduce high water temperatures and would, over time, supply large wood to stream channels, thus increasing aquatic habitat diversity.
- Reducing road-related sediment would reduce pollutant levels and sediment inputs, both significant factors limiting bull trout populations.
- Engineering channels with meanders would improve aquatic habitat diversity and provide summer and winter rearing habitat for bull trout in the lower reaches of Ahtanum Creek.
- Adding large wood to channels would increase habitat diversity and increase pool habitat needed for juvenile rearing and adult holding.

- Reconnecting side channels would provide important summer and winter rearing habitat, thereby increasing juvenile bull trout survival.
- Decreased summertime flows in the lower North Fork and upper mainstem resulting from the reservoir could have negative impacts on the bull trout populations. These impacts would probably be minimal because there is very little summer use of the affected reaches by bull trout.

6.5.3 Alternative 3 – Watershed Restoration Program without Storage

Alternative 3 would be the same as Alternative 2 except that the Pine Hollow Reservoir would not be included. Table 6-5 summarizes the benefits of Alternative 3 on spring Chinook, coho, and steelhead populations, based on the EDT model simulation. Compared to Alternative 2, Alternative 3 would result in a slight decrease in the performance of these fish populations. While it is difficult to gauge the full impact of the proposed reservoir based on the EDT model simulation, the model clearly demonstrates that comprehensive watershed restoration has direct and lasting beneficial impacts on fish population performance.

Table 6-5. Predicted Impacts of Alternative 3 on Production of Coho, Steelhead, and Spring Chinook Populations in the Ahtanum Creek Watershed

Population	Scenario	Diversity index	Productivity	Capacity	Abundance
Ahtanum Coho	Current without harvest	1%	1.5	188	59
	Watershed Restoration	20%	1.9	333	159
	Historic potential	98%	5.0	3,830	3,065
Ahtanum Spring Chinook	Current without harvest	4%	1.3	118	26
	Watershed Restoration	32%	2.9	290	193
	Historic potential	100%	8.8	2,653	2,353
Ahtanum Steelhead	Current without harvest	2%	1.3	753	174
	Watershed Restoration	29%	1.9	972	452
	Historic potential	97%	10.1	5,672	5,113

The results are derived from the EDT simulation

6.5.4 Alternative 4 – Watershed Storage Program without a Habitat Restoration Component

Table 6-6 summarizes the benefits of Alternative 4 on spring Chinook, coho, and steelhead populations, based on the EDT model simulation. There would be essentially no difference in fish population performance between Alternative 4 and the No Action Alternative. This finding, and the conclusions from EDT model simulations and QHA findings for Alternatives 2 and 3, indicate that the reservoir alone would, within the uncertainties inherent in the model, have a slight positive impact on the coho, spring Chinook, and bull trout populations. There would be a small negative impact on steelhead population performance under Alternative 4. Significant benefits to all fish populations would accrue from the addition of the comprehensive habitat restoration component under Alternatives 2 and 3.

Table 6-6. Predicted Impacts of Alternative 4 on Production of Coho, Steelhead, and Spring Chinook Populations in the Ahtanum Creek Watershed

Population	Scenario	Diversity Index	Productivity	Capacity	Abundance
Ahtanum Coho	Current without harvest	1%	1.5	188	59
	Pine Hollow Only	1%	1.5	200	64
	Historic potential	98%	5.0	3,830	3,065
Ahtanum Spring Chinook	Current without harvest	4%	1.3	118	26
	Pine Hollow Only	6%	1.6	173	64
	Historic potential	100%	8.8	2,653	2,353
Ahtanum Steelhead	Current without harvest	2%	1.3	753	174
	Pine Hollow Only	2%	1.3	769	160
	Historic potential	97%	10.1	5,672	5,113

The results are derived from the EDT simulation

6.5.5 Mitigation Measures

None of the proposed program alternatives are expected to have an adverse impact on fish; therefore, no mitigation measures would be required. The ACWRP is proposed as mitigation for existing degraded habitat conditions.

6.5.6 Cumulative Impacts

The cumulative impacts of restoration projects and increased target flows from reservoir operations should be a benefit to fish in the Ahtanum Creek Watershed.

6.5.7 Significant Unavoidable Adverse Impacts

No significant unavoidable impacts to fish were identified under any of the alternatives.

6.6 Scenic Resources and Aesthetics

This section describes the potential impacts to scenic resources and aesthetics that could result from implementation of the alternatives proposed for the ACWRP.

6.6.1 Alternative 1 – No Action

The No Action Alternative is not expected to affect scenic and aesthetic resources. Irrigation conservation programs that could be implemented under the No Action Alternative could improve irrigation efficiency and change cropping patterns from primarily pasture to orchard or other crops, thus altering the view of agricultural areas in the middle and lower reaches of the Ahtanum Creek Watershed. Similarly, watershed restoration programs could increase riparian vegetation and change views of the creek. If no conservation or restoration programs were implemented, scenic and aesthetic resources in the watershed would remain largely unchanged. Additional agricultural lands in the lower reach of the watershed could be converted to housing development, altering views of those areas.

6.6.2 Alternative 2 – Watershed Restoration Program with Storage

The irrigation conservation and watershed restoration projects that would be implemented under Alternative 2 would result in similar changes to views of agricultural lands and the riparian area as the No Action Alternative.

Construction of the Pine Hollow Reservoir would alter the appearance of the Pine Hollow area. A portion of the grassy, rocky canyon area would be converted to a reservoir with an earthen dam at the eastern~~western~~ end. The earthen dam is expected to be approximately 180 feet tall and nearly 0.5 mile long. The dam would be angled back to the west on the north and south ends to contain the reservoir. The dam would be planted with native vegetation and could resemble a rolling hill. The dam would block views from the surrounding ridges down Pine Hollow.

The reservoir would be approximately 1.5 miles long, narrowing from the dam to the western end. When full, the reservoir would resemble a lake that would contrast with the surrounding arid area. The reservoir would be filled starting in late winter or early spring and be drawn down for irrigation starting in April. The reservoir would be expected to reach its driest point in August and September. At that time, the reservoir size would be reduced and the areas covered by the reservoir during full pool would be exposed. On the steep north and south sides of the reservoir, a “bathtub ring” would develop. This ring would consist of a band of white mineral deposits on the side of the reservoir. On the upstream (western) end of the reservoir, mud flats could be exposed. The reservoir, bathtub ring, and mud flats would be visible to residents in the Pine Hollow area until the reservoir is refilled in late winter/early spring.

The appearance of the Johncox Ditch area would also be altered by the reservoir. The ditch would be used to fill the reservoir and would need to be widened to convey adequate flows to fill the reservoir. Widening would likely require removal of most of the vegetation along the ditch. The conveyance system for the reservoir water would be piped; therefore, pipes would be constructed from the reservoir to the irrigated lands. These pipes would be visible on the landscape. In addition, the WIP canal that provides water to irrigate lands on the Yakama Reservation would be piped. This would result in a visible pipe running along the lower portion of Ahtanum Ridge.

6.6.3 Alternative 3 – Watershed Restoration Program without Storage

The irrigation conservation and watershed restoration programs that would be implemented under Alternative 3 would result in similar changes to views of agricultural lands and the riparian area as the No Action Alternative. Since no reservoir would be constructed, there would be no aesthetic impacts to the Pine Hollow area. Agricultural conservation improvements could include piping portions of the irrigation systems, resulting in similar visual impacts to Alternative 2.

6.6.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts to scenic resources and aesthetics would be the same under Alternative 4 as described for Alternative 2. Since no coordinated habitat restoration component would be included in this alternative, the condition of riparian vegetation is unlikely to improve and views of the creek area would not be changed.

6.6.5 Mitigation Measures

Alternatives 1 and 3 are not expected to result in impacts to scenic and aesthetic resources in the Ahtanum Creek Watershed. Construction of the reservoir under Alternatives 2 and 4 would result in aesthetic impacts to the Pine Hollow area. The earthen dam would be planted with native vegetation to help blend it into the surrounding area. No mitigation is proposed for the scenic impacts of the reservoir. Conveyance pipes would be located to minimize their visibility from public areas such as Ahtanum Road.

6.6.6 Cumulative Impacts

No cumulative impacts to scenic resources or aesthetics are anticipated in the Ahtanum Creek Watershed as a result of any of the proposed alternatives.

6.6.7 Significant Unavoidable Adverse Impacts

Construction of the reservoir would permanently alter the aesthetics of the Pine Hollow area by replacing the open shrub-steppe area with a dam and reservoir.

6.7 Land and Shoreline Use

The potential impacts of the ACWRP to land and shoreline use are discussed in this section. The impacts to the three watershed reaches are discussed separately because of the different land uses in the reaches.

6.7.1 Alternative 1 – No Action

With selection of the No Action Alternative, existing agricultural properties in the Ahtanum Creek Watershed that do not have a reliable irrigation supply would likely come under additional pressure to be converted to residential uses. This trend toward conversion of agricultural land to residential land is already occurring, and is likely to continue to occur regardless of irrigation availability, but the continued lack of reliable irrigation would likely contribute to the trend. Refer to Section 6.10, Economics, for additional discussion of this potential trend. Continued or accelerated conversion from agricultural to residential development would not be consistent with the local comprehensive plan goals and objectives listed in Section 4.7.2 developed to preserve and enhance agricultural properties.

Although a coordinated watershed planning process would not occur with the No Action Alternative, individual watershed management efforts would continue to occur. Individual agencies or entities would continue to undertake individual conservation or restoration actions or programs. These programs would be carried out in compliance with local plans, policies, and permit requirements. The lack of a coordinated watershed restoration program would likely result in less improvements to the reliability of the water supply since the actions undertaken would be done on an individual basis.

6.7.1.1 Upper Reach

If the No Action Alternative were selected, future land use development within the upper reach would be expected to occur in a pattern consistent with current development conditions. Forest management practices and logging operations would continue to occur in areas within the upper reach, and single-family housing development would occur along streams in the lower portion of the upper reach, in accordance with regulations established in the Yakima County Code. Table 15.18, Allowable Land Uses, in the Yakima County Code indicates that various types of single-family residential development are permitted in areas zoned Remote/Extremely Limited Development Potential and Agricultural (Yakima County, 2004).

6.7.1.2 Middle Reach

Under the No Action Alternative, it is likely that agricultural lands that are not currently in active production or adequately serviced by irrigation would be converted to residential development in accordance with adopted land use plans/zoning (e.g., Yakima County Code, Table 15.18). Increased residential development would also occur in the Wiley City community, which is located within the city of Yakima's Urban Reserve Area (inside the UGA). Yakima County is proposing to extend wastewater service to Wiley City to solve existing sewer problems. This action would be consistent with city of Yakima *Comprehensive Plan* (1997) Policy G10.4: "Through land use controls, prevent conversion of land in the urban reserve area to uses/densities that cannot be urbanized [by]…requiring connection to public water and sewer systems where available, including interim systems or facilities where feasible." The new sewer system would accommodate future residential development. Neither the Yakima County nor city of Yakima comprehensive plans discuss the possibility of extending public water or sewer service to Tampico in the near future.

6.7.1.3 Lower Reach

Future development in unincorporated areas of Yakima County would occur in a pattern similar to conditions described for the middle reach in accordance with adopted land use plans and policies. The lower reach has the highest level of existing developmental density, and would be expected to continue to increase in density as in-filling of properties occurs.

Future expansion of the city of Union Gap in the watershed is limited (City of Union Gap, 1999). In 1992, the city of Union Gap established five potential annexation areas that could be included in the Union Gap's UGA based on the draft Yakima County Countywide Planning Policy. Two of the identified UGAs were annexed by the city of Yakima, two of the UGAs fall within the Yakama Reservation, and most of the fifth UGA extends into the Urban Reserve Area identified by the city of Yakima, limiting future expansion by the city of Union Gap. However, the city of Union Gap may consider proposing incorporation of some of the long-term deeded lands (inholdings) on the Yakama Reservation (Rathbone, personal communication, 2004).

With the availability of land and expected increase in population anticipated in the city of Yakima and its associated UGAs, new development is anticipated in the lower reach portion of the Yakima city limits and UGB, as designated in the city of Yakima, *Yakima Urban Area Comprehensive Plan* (City of Yakima, 1997). Currently, the western portion of the city of Yakima, which occupies the lower reach, is the fastest growing area within city limits. The city of Yakima expects that agricultural lands that are not currently productive and not serviced by irrigation would be converted to new development first. The city of Yakima's Urban Reserve Area (URA), which extends west of the city limits within the city UGA, is expected to reach development capacity between the years 2020 to 2040, assuming the wastewater system extends to at least 50 percent of the URA (Leung, personal communication, 2004).

6.7.2 Alternative 2 – Watershed Restoration Program with Storage

The greatest potential long-term land use impact associated with Alternative 2 would result from operation of the Pine Hollow Reservoir located in the middle reach. Improved irrigation reliability would result in reduced uncertainty for agricultural practices in the area, and could contribute to continued agricultural land uses, thereby adhering to local comprehensive plans' agricultural preservation goals listed in Section 4.7.2. Refer to Section 6.10 for additional discussion of economic considerations associated with Alternative 2.

Impacts associated with property acquisition and displacements that would result from the reservoir are described in Short-Term Impacts, Section 5.7.

6.7.2.1 Upper Reach

Development in the upper reach would be unaffected by the reservoir since water stored in the reservoir would not be available to property owners in the upper reach. Future development in the upper reach as a result of Alternative 2 would be similar to conditions described in the upper reach discussion for Alternative 1.

6.7.2.2 Middle Reach

The new reservoir would be constructed on privately owned property, resulting in property acquisition of approximately 30 parcels in the middle reach of the Ahtanum Watershed Basin (Figure 5-1). Impacts of the reservoir on private property are discussed in Section 5.7.

The new reservoir would result in an overall improved irrigation system in the AID. By improving irrigation in the area, agricultural fields currently occupied by open pasture or otherwise not currently productive could be converted into orchards or used for cultivation of other higher value crops. The improved reliability of irrigation could be expected to reduce pressures to convert agricultural land to residential land, because of potential for improved economic viability associated with agriculture. This development would be consistent with Yakima County Comprehensive Plan goals and policies described in Section 4.7.2 that emphasize the importance of maintaining and enhancing agricultural lands. The reservoir could permit the irrigation of more acreage within the AID than currently occurs. This new irrigation would take place on lands that are zoned for agriculture.

6.7.2.3 Lower Reach

The lower reach would experience the same level of urbanization as described under the No Action Alternative discussion on the lower reach; however, Alternative 2 could reduce the pressure for increased conversion of agricultural land to other land uses. The lower reach is likely to be subject to the highest level of pressure to convert agricultural lands to residential or higher density uses, because it is closest to the urban centers of Union Gap and Yakima. Land designated for residential use would experience continued residential development.

6.7.3 Alternative 3 – Watershed Restoration Program without Storage

Land use impacts for Alternative 3 would be similar to those discussed for Alternative 1 except that the watershed conservation and restoration programs would be coordinated throughout the watershed. The coordinated ACWRP would be more likely to improve irrigation reliability through a coordinated water conservation program; however, irrigation reliability improvements would not be as substantial as those achieved under Alternative 2. The improved irrigation reliability would reduce the potential for agricultural lands to be converted to residential uses to the extent that it continues to provide adequate irrigation supplies.

6.7.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

With the development of a reservoir, land use impacts associated with Alternative 4 would generally be similar to those discussed for Alternative 2. However, Alternative 4 would not include coordinated habitat restoration measures. Pine Hollow Reservoir would improve the reliability of the irrigation water supply and potentially reduce the pressure for conversion of agricultural lands to residential uses.

6.7.5 Mitigation Measures

Selection of either Alternative 2 or 4 would result in construction of a reservoir and subsequent property acquisition to accommodate the new facility. Property acquisition would occur in accordance with Title 8.20 of the RCW for property condemnation by a private corporation as discussed in Section 5.

Individual projects undertaken in the Ahtanum Creek Watershed based on this EIS would be required to follow local, state, and federal approvals and permit conditions prior to initiation.

6.7.6 Cumulative Impacts

There are currently no other large-scale watershed related projects proposed in the Ahtanum Creek Watershed, that when combined with the proposed action, would result in cumulative impacts to land and shoreline use. Land use trends within the watershed will largely occur in accordance with adopted land use plans and policies. A long-term lack of irrigation reliability could contribute to increased pressure to convert agricultural lands to residential or other uses.

6.7.7 Significant Unavoidable Adverse Impacts

Construction of the reservoir would result in a change of land use in the Pine Hollow area. However, a reservoir is a permitted land use in that area.

6.8 Transportation

The potential impacts to transportation resources are included in this section, including the potential impacts associated with roadway relocations to improve stream habitat.

6.8.1 Alternative 1 – No Action

Under the No Action Alternative, existing and proposed improvements to roadways in the Ahtanum Creek Watershed would continue as currently planned.

6.8.2 Alternative 2 – Watershed Restoration Program with Storage

Construction of a Pine Hollow Reservoir would require the construction of an access road to the reservoir and service roads along the new irrigation conveyance lines. Access to the service roads would be restricted to AID personnel. The access road would be gated to prevent access to the dam area. None of the alternatives are expected to generate significant amounts of new traffic and would not impact any roads in the area.

Some of the habitat enhancement measures that could be constructed under Alternative 2 could affect local public and private roadways. These measures could include localized roadway relocation, improved culverts and drainage systems, and roadway modifications to reduce sediment transport in runoff. Any proposed roadway modifications would be undertaken following coordination with property owners or jurisdictions to ensure that access is maintained.

Some enhancement measures may result in changes to roadway maintenance practices, which would involve close coordination with maintenance providers relating to funding, implementation, and long-term maintenance practices.

6.8.3 Alternative 3 – Watershed Restoration Program without Storage

Impacts to transportation under Alternative 3 would be similar to those for the watershed enhancement measures described for Alternative 2. No reservoir would be constructed under this alternative; therefore, no access roads would be required.

6.8.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts to transportation under Alternative 4 would be similar to those for Alternative 2 except no coordinated roadway improvements would be undertaken.

6.8.5 Mitigation Measures

The new reservoir access road and service roads constructed for either Alternatives 2 or 4 would be designed in accordance with roadway design standards for Yakima County and the *Stormwater Management Manual for Eastern Washington* (2004). Access to the service road would be restricted to AID personnel. Any modifications to existing private or public roads associated with proposed watershed enhancement measures would comply with all applicable design standards for roadway design and construction as well as stormwater facilities.

6.8.6 Cumulative Impacts

None of the proposed alternatives are anticipated to cause cumulative impacts to transportation in the Ahtanum Creek Watershed. For Alternatives 2 and 4, cumulative construction-related traffic impacts would depend on the timing of other individual transportation projects that may occur in the vicinity of the proposed reservoir access road. The reservoir would not result in an increase in vehicle traffic because residents currently use local roads to access the area.

6.8.7 Significant Unavoidable Adverse Impacts

No significant unavoidable impacts to transportation were identified for any of the alternatives.

6.9 Recreation

Potential impacts to recreational resources are described in this section.

6.9.1 Alternative 1 – No Action

No direct impacts to recreation in the Ahtanum Creek Watershed are anticipated as a result of the No Action Alternative.

6.9.2 Alternative 2 – Watershed Restoration Program with Storage

Under Alternative 2, construction of Pine Hollow Reservoir would have an impact on available recreation. The plans for recreational use of the reservoir are not known at this time; however, it is expected that non-motorized boat use would be allowed on the reservoir and the reservoir may be stocked with fish to allow for recreational fishing. The AID, in cooperation with the Yakama Nation, WIP, and WDFW, would decide about access and operational conditions at the reservoir. It is anticipated that these entities would develop a Joint Operating Agreement to establish operational protocols, including public access and use of the reservoir. Boating and fishing activities would be subject to water availability and generally be permitted during spring and early summer. A gravel parking lot and boat launch would be provided adjacent to the reservoir. The boat launch facility would be accessed from the reservoir access road. The restriction of non-motorized boating and the limited facilities at the reservoir are expected to limit the number of people using the reservoir and the related impacts of traffic, noise, and littering.

6.9.3 Alternative 3 – Watershed Restoration Program without Storage

No impacts to recreation are anticipated under Alternative 3. No reservoir would be constructed under this alternative.

6.9.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts to recreation would be similar to those described for Pine Hollow Reservoir under Alternative 2.

6.9.5 Mitigation Measures

No negative impacts to recreational resources would occur in the Ahtanum Watershed under any of the alternatives; therefore, no mitigation would be required.

6.9.6 Cumulative Impacts

The ACWRP would have no cumulative impacts on recreational facilities or resources. Recreational use of the reservoir could increase traffic, littering, and related impacts in the area. However, restricting the reservoir to non-motorized boats and limiting access should limit these impacts.

6.9.7 Significant Unavoidable Adverse Impacts

No significant unavoidable impacts to recreation were identified resulting from the ACWRP.

6.10 Economics

This section describes the economic impacts of the proposed ACWRP alternatives. While not an element required under SEPA, this analysis is included in this EIS to provide a general understanding of the potential economic impacts of the watershed restoration alternatives being considered. More detailed economic evaluations would be conducted when an alternative is selected for implementation, including a cost benefit analysis on a reservoir if either Alternatives 2 or 4 are selected. This analysis is intended to describe the general types of impacts that could result, how these impacts differ among the alternatives considered, and the potential range of impacts.

6.10.1 Economic Modeling

The first step in the evaluation process was to develop a baseline model, which is a projected portrayal of the economy of the potentially affected area as it would develop without the project. The baseline model is described below in Alternative 1, the No Action Alternative. This dynamic baseline is, in turn, used as a backdrop to describe changes to economic factors resulting from implementation of other project alternatives. Baseline projections at a county level were constructed from projections made by the Washington State Labor Market and Economic Analysis Branch (Washington State Auditor, 2005). Those projections were modified to develop a baseline for the Ahtanum Creek Watershed. The impacts of the alternatives, described below, were then compared by sector to the baseline model to give a measure of relative impact.

There are three types of economic impacts that could result from the proposed program: direct, indirect, and induced. Each of these types of impacts captures one facet of change in regional economic activities. Direct impacts refer to the initial expenditures or purchases within an economy that result from project activities. Direct impacts of the ACWRP would include expenditures stemming from construction, operation, and maintenance associated with each of the action alternatives. Indirect impacts refer to the production and sales of goods and services that result from direct impacts requiring inputs from other business sectors. The changes in employment in industries that experience both direct and indirect impacts result in changes in income that are spent in the region to purchase consumer goods and services. This income effect is the source of induced impacts. The total economic impact is determined by considering all three levels of impact for each sector of the local economy.

To estimate direct, indirect, and induced impacts to a region’s economy, input-output models can be used. An input-output model simulates the relationships of an economy and is used to evaluate changes in inter-industry flows of goods and services and resulting changes in output, employment, and income. For this evaluation, the US Forest Service IMPLAN (Impact Analysis for Planning) model was used, with data derived in the analysis of a similar project in Yakima County (Mack and Robison, 1995; Bruckner et al., 1987). A more complete discussion of the input-output model, along with model results, is included in Appendix E.

As explained in Section 4.10, economic data do not exist at the watershed level. Therefore, direct quantification of impacts must be based on county-level effects. However, there are a number of ways to broadly and qualitatively portray the economic impacts of the alternatives on the immediate watershed environment. The most relevant would be how the different alternatives would affect the productivity and value of agricultural lands, which in turn would affect the conversion of lands from agricultural to residential uses.

6.10.2 Alternative 1 – No Action

Under the No Action Alternative, there would be no direct economic impacts. Economic development in the region would proceed in accordance with factors independent from watershed restoration enhancements and improved irrigation reliability; therefore, other factors would determine regional growth.

6.10.2.1 Population Projections

Yakima County population has increased by 60 percent since 1969. Population projections are provided in Table 6-7 for 2005 and at 10-year intervals between 2010 and 2040, covering the 30-year timeframe for analysis in this EIS. Population projections are based on calculations from the U.S. Census Bureau and Washington State. Assumptions used to calculate Yakima County population include:

- Major growth, both in terms of numbers and rates, will occur through expansion within the city of Yakima and its UGA.
- The growth rate within the city of Yakima's UGA is twice that of the surrounding county in Model 2 (see discussion of Model 2 in the following paragraph).
- Expansion will likely occur along existing and future infrastructure alignments, such as major roads and sewer lines, and their service areas.
- Zoning will dictate where growth occurs and is not expected to change dramatically from the current situation; build-out will occur in most of the city of Yakima UGA by 2040.
- Agricultural lands within the city's UGA will convert to urban uses. Non-irrigated agricultural lands in the county will be affected by urban expansion, while irrigated agricultural lands will generally remain in agricultural use.

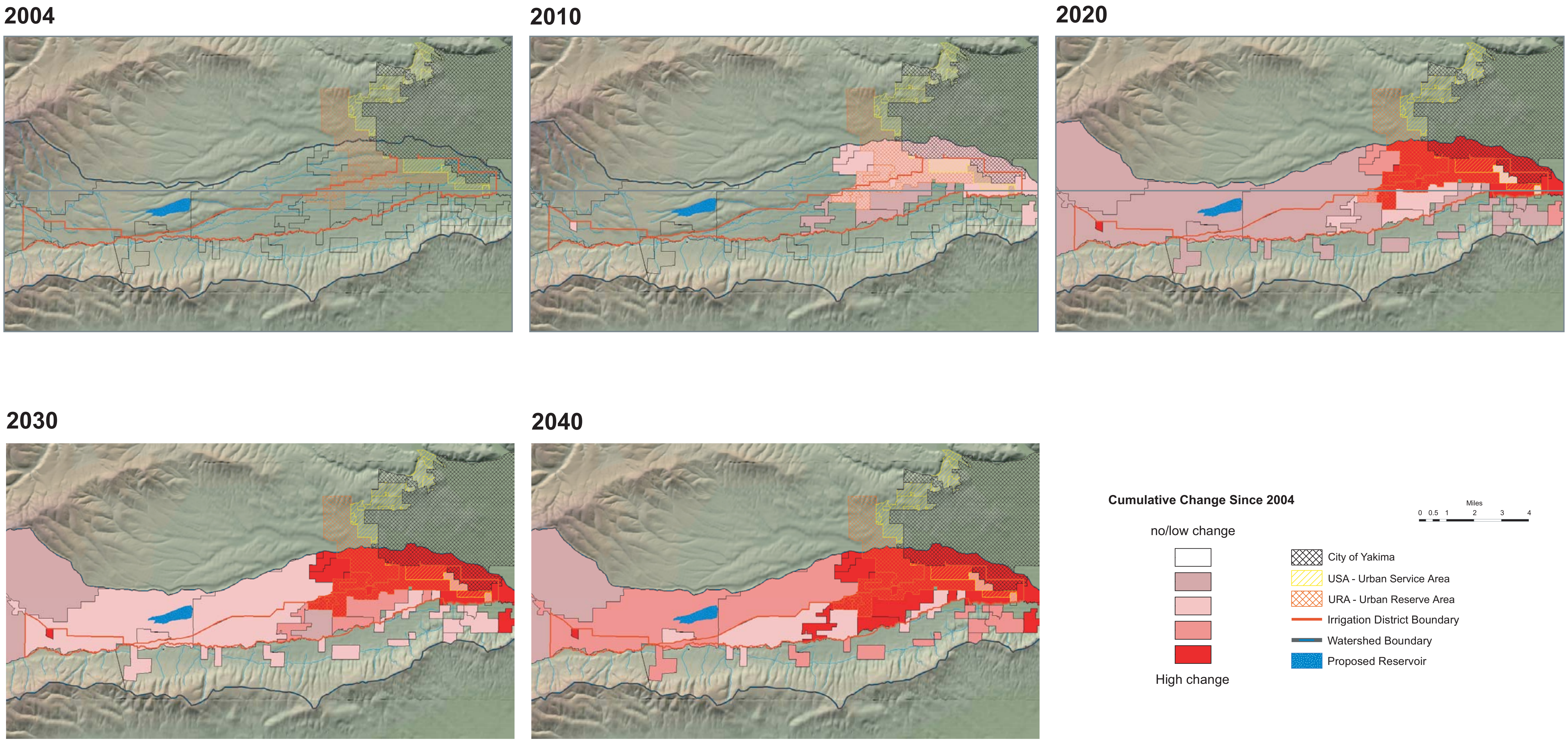
Model 1 assumes that the population growth is linear, and the city of Yakima maintains one-third of the total growth while the other two-thirds is in unincorporated Yakima County. Model 2 shows the growth rate in the UGA at twice that of the county, with two-thirds of all additional population growth occurring within the city and the county growing at a slower rate. For purposes of this evaluation, Model 2 was used for population projections, under the assumption that overall county population growth of 75,000 over the next 35 years would mostly be distributed within the UGA, consistent with the GMA. The implication for the Ahtanum Creek Watershed is that growth would generally proceed from the eastern third of the study area to the west, filling in first the residentially zoned areas, the majority of which are located in the eastern third of the study area. The areas of existing settlement, including Wiley City and Tampico, would also increase in density.

Table 6-7. Yakima County Population Projections

	2005	2010	2020	2030	2040
County Totals (including city)	**225,000**	**235,710**	**257,130**	**278,550**	**300,000**
Total change		10,710	21,420	21,420	21,450
Model 1					
City population	76,500	80,141	87,424	94,707	102,000
County population	148,500	155,569	169,706	183,843	198,000
Total	**22,5000**	**235,710**	**257,130**	**278,550**	**300,000**
Model 2					
Added from city		7,176	14,351	14,351	14,372
Added from county		3,534	7069	7,069	7,079
City total	76,500	83676	98,027	112,379	126,750
County total	148,500	152,034	159,103	166,172	173,250
Total	**225,000**	**235,710**	**257,130**	**278,550**	**300,000**

The Ahtanum Watershed would be impacted by significant expansion of residential development. Over the 35 years being considered in this analysis, the development would generally extend from east to west. Figure 6-1 shows a qualitative interpretation of projected urban growth in the Ahtanum Watershed for the years 2010, 2020, 2030, and 2040, cumulative from 2004. The interpretation was projected based on discussions with planners from the cities of Union Gap and Yakima and Yakima County (Rathbone, personal communication, 2004; Leung, personal communication, 2004; Hoge, personal communication, 2004). The first likely trend would be the "filling in" of appropriately zoned and of already platted acreage, particularly in the eastern end of the valley, and in the settlement areas of Tampico and Wiley City. These changes over the first 10 to 15 years would likely be followed by gradual changes in comprehensive plan designations and zoning that would first encompass the Rural Transitional areas and then gradually the Valley Rural zones, converting their zoning to Single-Family Residential. Some of these areas will be rezoned as Two-Family Residential and Multi-Family Residential.

All three county and city planners consulted noted that long-term conversion of agricultural uses to residential uses would, if other parameters such as roads, power, sewer and water access remained the same, occur first on non-irrigated acreage and subsequently on marginally irrigated acreage. The progression on Figure 6-1 shows that it is highly likely that the eastern half of the watershed would be almost fully residential by 2040. Those areas of lesser change in the center of the watershed are currently zoned as Agriculture.



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Map data are the property of the sources listed below.
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SOURCE: Central Washington University and Yakima County GIS, 2004

FIGURE 6-1

PROJECTED POPULATION CHANGES IN YAKIMA COUNTY AND LOWER AHTANUM CREEK WATERSHED

AHTANUM CREEK WATERSHED RESTORATION PROGRAM EIS

AHTANUM, WASHINGTON

Some agricultural landowners would likely seek permission to subdivide, particularly in the case of lands that are currently zoned as Agriculture but are either not being used for agriculture or are in low productivity uses, such as pasture and grazing. Specifically, non-irrigated areas and areas with unreliable water supplies would be the primary agricultural areas to be developed for residential use. Areas with more reliable water and accordingly higher valued crops would tend to remain in agricultural use and would retain the Agriculture zoning designation. Over the long term of the baseline analysis, land use change in the Ahtanum Valley would be a function of sewer and water capacity as well as the construction of major access roads into the area. The two most likely changes in vehicular access are the continued widening of Ahtanum Road and the long-term possibility of an arterial connection from Ahtanum Road north to State Route 12.

6.10.2.2 Economic Projections

Baseline projections at a county level to the years 2010, 2020, 2030, and 2040 were constructed from projections made by the Washington State Labor Market and Economic Analysis Branch (Washington State Auditor, 2004). The long-term projection rates were used to extrapolate geometrically into the four target dates. Table 6-8 presents the projections by broad economic sectors.

As shown in Table 6-8, the largest areas of projected increase would be in the professional services sector, which is expected to nearly quadruple in growth by 2040. This is followed by health care, construction, and retail sales, which are projected to approximately double by 2040. Government jobs are projected to double by 2040, comprising the largest projected job source in 2040. Agriculture, which currently represents the largest sector of employment, is projected to stay relatively flat in growth over the next 35 years, slipping to the third largest source of employment in 2040.

A second and expanding use of the affected land area is residential. As discussed in Section 6.9, Land and Shoreline Use, it is expected that lands within the cities of Union Gap and Yakima UGAs will continue to be developed for residential use over the 30-year projected period of this analysis. The effect of the conversion of agricultural uses to residential uses would be an increase in land value and consequently property tax revenue.

Economic growth in the agricultural sector would remain very similar to current levels in the future throughout the county, based on projections from the Washington State Employment Security, Labor Market and Economic Analysis Data (2004). Existing market trends in the Ahtanum Creek Watershed relating to agriculture would continue.

6.10.3 Alternative 2 – Watershed Restoration Program with Storage

Alternative 2 would result in the highest level of direct economic impact compared to the other alternatives, associated with creation of construction-related jobs and long-term operation of the watershed restoration and storage program. Construction of Pine Hollow Reservoir would result in the creation of between approximately 177 and 183 jobs, including all aspects of construction and services such as hotels and restaurants, to support the construction. Appendix E includes a more detailed description of the projected jobs to be created.

Table 6-8. Yakima County Projections to Years 2010, 2020, 2030, and 2040; Number of Jobs and Wages by Sector in 2004 Dollars

Industry	2004		2010		2020		2030		2040	
	Wages	Jobs	Wages	Jobs	Wages	Jobs	Wages	Jobs	Wages	Jobs
Total	$2,381,660,620	93,309	$2,624,262,039	102,553	$3,088,517,544	119,901	$3,666,865,922	141,529	$4,394,095,767	168,713
Agriculture	$314,359,780	18,979	$323,602,728	19,537	$325,875,096	19,674	$328,163,421	19,812	$330,467,814	19,951
Mining	$208,828	9	$208,828	9	$208,828	9	$208,828	9	$208,828	9
Utilities	$11,698,644	203	$11,698,644	203	$11,698,644	203	$11,698,644	203	$11,698,644	203
Construction	$77,102,741	2,730	$86,830,209	3,074	$105,845,541	3,748	$129,025,123	4,568	$157,280,906	5,569
Manufacturing	$306,977,333	9,594	$322,010,106	10,064	$348,718,367	10,899	$377,641,873	11,802	$408,964,362	12,781
Wholesale trade	$117,184,118	3,672	$128,134,184	4,015	$148,704,952	4,660	$172,578,168	5,408	$200,284,009	6,276
Retail trade	$206,898,218	9,240	$231,633,759	10,345	$279,604,202	12,487	$337,509,137	15,073	$407,405,957	18,195
Transportation	$58,506,863	2,111	$58,506,863	2,111	$58,506,863	2,111	$58,506,863	2,111	$58,506,863	2,111
Information	$47,193,677	1,267	$51,603,608	1,385	$59,888,094	1,608	$69,502,578	1,866	$80,660,579	2,165
Finance and insurance	$64,554,005	1,637	$70,586,142	1,790	$81,918,099	2,077	$95,069,299	2,411	$110,331,802	2,798
Real estate	$16,026,098	837	$17,523,629	915	$20,336,887	1,062	$23,601,787	1,233	$27,390,838	1,431
Professional services	$50,177,078	1,915	$65,343,608	2,494	$101,476,625	3,873	$157,590,096	6,014	$244,732,599	9,340
Management	$26,509,246	537	$34,521,934	699	$53,611,508	1,086	$83,257,032	1,687	$129,295,625	2,619
Administrative services	$39,641,585	2,227	$45,972,085	2,583	$58,848,156	3,306	$75,330,615	4,232	$96,429,555	5,417
Educational services	$21,011,041	880	$24,366,366	1,021	$31,191,008	1,306	$39,927,128	1,672	$51,110,099	2,141
Health care	$325,157,687	10,596	$366,180,367	11,933	$446,371,825	14,546	$544,124,763	17,732	$663,285,050	21,615
Arts, entertainment, and recreation	$13,177,624	1,062	$14,753,064	1,189	$17,808,365	1,435	$21,496,408	1,732	$25,948,230	2,091
Accommodation and food	$63,822,945	5,251	$72,724,746	5,983	$90,404,734	7,438	$112,382,873	9,246	$139,704,080	11,494
Other services	$57,568,588	4,320	$66,761,913	5,010	$85,460,892	6,413	$109,397,168	8,209	$140,037,623	10,509
Government	$563,884,521	16,250	$631,299,255	18,193	$762,038,857	21,960	$919,854,119	26,508	$1,110,352,302	31,998

Source: Calculated from Washington State Employment Security, Labor Market and Economic Analysis, 2004.

An estimated $15 to $16 million in annual direct expenditures during the construction period would occur under Alternative 2, which represents about $12 million spent in the construction industry. When compared to the projected $86 million construction industry in Yakima County in 2010 (Washington State Employment Security, Labor Market and Economic Analysis, 2004), this activity represents a 14 percent increase, a substantial beneficial impact. The mining industry would be the only other major sector that could potentially be beneficially affected. This would be due to mining as the source of building materials for the reservoir. The extent of this impact would depend on the amount of on-site materials used in the reservoir. However, impacts on the construction and mining sectors of the economy would be substantial under Alternative 2.

In addition to direct impacts, indirect impacts would accompany construction of the reservoir. Impacts to the local economy would vary depending on whether the contractor is local or out of the area, but modeling results indicate that indirect impacts could result in a multiplier as high as 1.75 times the direct impacts. In other words, if approximately $6.3 million were generated in direct impacts, as much as $4.7 million in indirect impacts could be generated as a result of Alternative 2, for a total economic impact ranging from $11.0 to $11.3 million from 2007 to 2015. As many as 130 additional jobs could be created in retail, wholesale, and other service sectors, for a total of between 301 and 311 total new jobs. Alternative 2 represents the highest potential for direct economic increases because jobs would be created during construction of the reservoir and habitat enhancement projects, as well as over the long term, due to operation and maintenance of the reservoir and enhancement projects.

If the operational economic impact of Alternative 2 is considered along with the impact of additional incomes that result from the significantly increased farm profits, area earnings would increase by as much as $5.3 million dollars per year in 2003 dollars[3]. When farm profits are added into this analysis, as many as 230 additional jobs could be created following completion of the reservoir.

Construction of the reservoir, and the accompanying improved reliability of irrigation supply, would alter the agricultural patterns and crops grown within the reservoir service area. Table 6-9 shows the changes in crops that could occur with implementation of the reservoir (Golder, 2004.) The major shifts portrayed are the conversion of acreage previously used as pasture into higher valued uses, particularly into hay, sweet corn, and wine grapes. These shifts in cropping patterns are the basis for the $13.1 million increase in revenues in the affected area that would result in a potential profit increase of $5.3 million. This profit increase assumes that the capital costs of the reservoir and related projects would be borne by institutions other than the farmers, such as the federal or state government. With the over 70 percent reduction of acreage dedicated to pasture, livestock production in the watershed would be reduced. This change would reduce livestock production from the primary to the third highest agricultural use in the watershed. The

[3] Prediction of farm profits is speculative. Because of the vagaries of responsibility for covering capital costs, farm profits should not be a component of the main body of the analysis. This is particularly the case because of their magnitudes. At $5.3 million per year, if this analysis were to include these speculative profits, they would dwarf those categories of economic flows that are far more probable.

conversion from livestock to higher value crops would increase property values. This would result in a continued trend away from the ranching culture in the watershed and surrounding area.

Table 6-9. Projected Cropping Patterns Before and After Pine Hollow Reservoir Construction

Crop	Before	After
	acres	
Apple	1,898	1,779
Sweet Cherry	260	485
Pear, Bartlett & winter	484	821
Hay, alfalfa & other	2,916	3,695
Pasture	5,460	1,589
Sweet corn	83	920
Wine grape	0	1,183
Blueberry	0	628
Total	**11,101**	**11,100**

Source: Golder, 2004.

The improved reliability of the water supply and the resultant conversion to more productive and profitable cropping patterns would likely result in more land remaining in agricultural uses in the watershed. There would be less pressure to convert agricultural lands to residential uses.

Implementation of the ACWRP could also result in changes in property values and accompanying changes to tax revenues. Property tax-based revenue flows can be conceptually linked to increases in property values due to the increased number of acres irrigated and the increased intensity/reliability of irrigation. The Golder (2004) study derived values that ranged from $500 to $2,100/acre for the increase in property value per acre due to irrigation. This range depended on whether the property was being brought into irrigation or whether the water was used to improve the reliability of irrigation; the range also was dependant on the location and size of the parcel. This EIS analysis assumes $1,500 per acre, the median of the range of values, as the average increase in the value of land that is attributable to the project.

Property tax assessments vary on a district basis depending upon local levies. In addition, there are uncertainties over the rate constraints imposed by State Initiative 747. After discussion with the Yakima County Assessor’s Office, a rate of $10 per thousand was chosen for this analysis (Cook, personal communication, 2004). Property tax revenue increases only apply to the operations period, after construction is completed. Property tax revenue increases from increased crop values associated with Alternative 2 would be approximately $165,000 per year; however, when evaluated against the loss of property taxes from lands used to construct the reservoir, the net effect would be an increase of approximately $140,000.

As noted in the Golder (2004) report, it is redundant when conducting a benefit/cost analysis to consider as benefits both the increase in the value of crops and the resulting increases in land value. However, in an EIS it is appropriate to use both measures to calculate impacts. Accordingly, the effect of potential increases of $5.3 million annually in farm profitability on regional income, employment, and tax revenues were considered, as well as the potential for higher land values. The increase in the value of $1,500 per acre for the impacted 11,000 acres was the basis for the property tax calculations above. It should be noted here that both of these impacts would be localized, accruing to owners of the irrigated acres.

Construction activities would cause the most significant economic impacts across the 35 years of the analysis. Impacts from the reservoir operations after construction is completed in 2010 would have significantly fewer financial impacts than construction impacts. The largest source of economic activity contributed by reservoir operation would relate to farm profits.

Construction associated with habitat and stream channel improvements would require a 10-year period to complete and extend beyond 2010, the projected completion date of the reservoir. The nature of work involved with this category combines some activities that are clearly construction oriented, such as relocating roads, with activities that are very labor intensive and so resemble operations and maintenance functions. These activities would create between 7 and 13 jobs over the course of the 35-year project period analyzed.

Economic impacts associated with increased recreation could occur. At the time of this analysis, there was not sufficient information on the planned reservoir recreation facilities, including stocking for sport fisheries, to be able to estimate recreational impacts with any degree of confidence. However, the economic benefits of any proposed recreation at the reservoir are expected to be small. The recreational impacts that could result from habitat improvements along the creek would likely be very small. Although the restoration measures would result in increases in fish populations, it is unlikely that sport fishery for listed species such as steelhead would be permitted within the timeframe of this analysis.

6.10.4 Alternative 3 – Watershed Restoration Program Without Storage

Direct economic impacts associated with Alternative 3 would be considerably less than those described for Alternative 2 because the major construction associated with the reservoir would not occur. Modeling results indicate that 8 to 14 additional jobs would be created as a result of implementation of habitat enhancement components, with $.68 to $1.2 million in direct expenditures. Indirect impacts would increase this number to as many as 22 additional jobs. Additional operational income would occur from approximately 2014 and beyond, ranging from a total of $215,000 to $358,000 and creating as many as 13 jobs. Agricultural jobs under Alternative 3 would not increase by nearly the level discussed for Alternative 2, under the assumptions used for the input-output model. Economic impacts associated with farm profits would be substantially lower than would occur with Alternatives 2 and 4 because while irrigation reliability would be improved through conservation, it would not improve to the extent associated with the reservoir. Total annual increased earnings, including farm profits, would range from approximately $455,000 to $807,000.

While some improvements to system reliability would occur in association with conservation and other programs, they would not be at the level described for Alternative 2. Therefore, the pressure to convert to residential development would likely continue, and income from agriculture and farm profits would be reduced. The conversion to residential uses would increase tax revenues.

Economic impacts associated with habitat enhancements are difficult to project, as described above. It can be assumed that some level of economic benefit could occur associated with improved recreational opportunities, improved water quality and aesthetics, and improved habitat value in the creek, but that benefit cannot be quantified.

6.10.5 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Direct economic impacts under Alternative 4 would be similar to those described for Alternative 2; however, they would be reduced slightly without the construction-related impacts associated with coordinated habitat restoration. Indirect impacts would be similar, although slightly less than those described for Alternative 2. In general, impacts in terms of increased earnings associated with Alternative 4 would be approximately 90 percent of the values discussed for Alternative 2.

6.10.6 Mitigation Measures

Compliance with adopted land use plans and policies will help to minimize unwanted economic impacts associated with any of the alternatives. The addition of new jobs would likely be seen as a positive economic impact, not warranting mitigation. Economic impacts associated with the acquisition of private property would be mitigated by compliance with all applicable property acquisition requirements as described in Section 5.7.

6.10.7 Cumulative Impacts

Implementation of the No Action Alternative would result in a continuation of current trends, with no influence from modifications to irrigation availability or improved habitat conditions. This alternative could contribute to an increasing trend away from agriculture and toward suburban residential development.

Alternatives 2 and 4 would improve reliability of irrigation and allow the potential for increased economic activity associated with construction and operation of the reservoir as well as reducing economic uncertainty for some agricultural activities.

Alternative 3 would be similar to Alternative 1 in terms of cumulative economic impacts.

6.10.8 Significant Unavoidable Adverse Impacts

There would be no significant unavoidable adverse economic impacts associated with any of the alternatives.

6.11 Cultural Resources

Assessment of impacts begins with the identification of cultural resources and historic properties within a project area, an evaluation of the significance of such properties, and then consideration of the scope of potential short-term and long-term impacts. Cultural resources may be protected by law and must be considered for special management or mitigation of adverse impacts if they are identified and evaluated as of particular significance, as defined by federal and state guidelines. Under SEPA, the Office of Archaeology and Historic Preservation (OAHP) is the sole state agency with technical expertise with regard to cultural resources. Under the National Historic Preservation Act, federal agencies must consider cultural resources in all licensing, permitting, and funding decisions. Agencies must consult with OAHP to ensure that cultural resources are identified. Federal agencies must obtain the formal opinion of OAHP as regards each site's significance and the potential impacts of agency actions on the site. Under SEPA, OAHP provides formal opinions to local governments and state agencies about a site's significance and the potential impacts of proposed projects.

Resources are typically defined as significant or potentially significant if they are identified as of special importance to an ethnic group or Indian tribe; or if the resource is considered to meet certain eligibility criteria for local, state, or national historic registers, such as the National Register of Historic Places (NRHP). The NRHP assessment criteria were developed by the National Park Service (NRHP, 1991). Resources may qualify for NRHP listing if they:

- Are associated with events that have made a significant contribution to the broad patterns of our history; or
- Are associated with the lives of persons significant in our past; or
- Embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Have yielded, or may be likely to yield, information important in prehistory or history.

According to the NRHP guidelines, the "essential physical features" of a property must be intact for it to convey its significance, and the resource must retain its integrity, or "the ability of a property to convey its significance." There are seven aspects of integrity, including location, design and setting.

There are also criteria used for assessment of potential eligibility for the Washington Heritage Register, similar to NRHP criteria. These include age of at least 50 years, integrity, and historical significance.

The exact nature of impacts to cultural resources from the alternatives cannot be determined without additional details on the proposed projects. The assessment of impacts to cultural resources would require the identification of cultural resources and historic properties within the project area, evaluation of the significance of such properties, and consideration of the scope and potential impacts. This assessment would take place at the project design stage and be included as part of any project level environmental assessment of the proposed ACWRP. However, it is possible to discuss the types of impacts that could result and provide a general assessment of potential impacts.

Impacts to cultural resources typically result from activities that occur in the vicinity of the resource. Adverse impacts to buried archaeological deposits could be the consequence of ground-disturbing, excavation, earth-moving, and construction activities. Adverse impacts to above-ground resources, such as historic structures, canals, and dams, can result from demolition, partial removal of structural elements, the addition of new features, and changes in the surrounding historical context of a resource. Traditional cultural properties should be identified in consultation with cultural specialists from the Yakama Nation, or other users, who could ascertain potential adverse impacts. Definition of adverse impacts to cultural resources should be conducted in consultation with OAHP.

The scope of adverse impacts is only properly defined in conjunction with adequate identification of cultural resources and historic properties. Identification efforts should typically include archival and historical research; review of project construction plans, drawings, and available geotechnical information; and subsequent on-site examination and field survey of project areas by an archaeologist and/or historian. Background research should include review of historical maps that date to 1907, which are archived by the AID; such maps provide information on historical ditch and channel locations and could suggest other features of historical relevance. Assessment of preferred alternative project designs would be necessary in order to identify potential impacts to existing irrigation systems (e.g., Johncox Ditch) that might be determined to be of historical significance.

Impacts to historic properties in the project vicinity that are presently listed on the NRHP would have to be determined. Two NRHP properties in the vicinity, Saint Joseph’s Mission (45YA362) and Kamiakin’s Gardens (45YA363H), appear to be located outside of the proposed reservoir construction area and would not likely be affected by construction activities. However, determination of long-term impacts to these properties, such as the security of water access to Saint Joseph’s Mission, would have to be assessed in consultation with OAHP.

Field examination could include pedestrian surveys and visual reconnaissance, small-scale test excavations or other subsurface investigations, and inventory and documentation of cultural and historic properties. Field surveys should be designed to account for possible minor changes in project design. Field surveys could incorporate identification strategies developed from predictive models, based on the occurrence of archaeological materials within environments and on landforms near to the project area (e.g., CH2M Hill, 1982). Identification efforts should include consultation and review by OAHP and Yakama Nation cultural resources specialists.

The Yakama Nation Cultural Resources Program has indicated that the tribe will become more involved as the project is further defined, especially if Alternatives 2 or 4 are selected (Meninick, personal communication, 2005).

6.11.1 Alternative 1 – No Action

Under Alternative 1, construction of conservation and habitat restoration projects conducted by separate agencies or entities could result in the types of impacts to cultural resources described in the previous section. The agencies or entities implementing the projects would be required to comply with any applicable requirements to assess impacts to cultural resources prior to construction.

6.11.2 Alternative 2 – Watershed Restoration Program with Storage

Impacts from the construction of Pine Hollow Reservoir and the conservation and restoration projects under Alternative 2 would include the general impacts described above. The limited cultural resource survey undertaken by the Yakama Nation in 1999 noted that available geotechnical core samples indicated "quite deep sediment" in the Pine Hollow area, which also has seasonally high water flows. These conditions make it possible that deeply buried archaeological deposits could be present, although no evidence of these was identified in the initial survey. In order to support adequate identification of potential resources, and subsequent definition of impacts, the Yakama Nation recommended that a complete archaeological and cultural survey be completed following final project design and prior to any construction (Yakama Nation Cultural Resources Program, 1999).

In addition, impacts to water rights and the security of water access to Saint Joseph's Mission after construction of the reservoir would have to be assessed in consultation with OAHP. In addition, tribal members could be adversely affected because access to lands in the inundated reservoir location would no longer be accessible for traditional activities.

6.11.3 Alternative 3 – Watershed Restoration Program without Storage

Under Alternative 3, impacts to cultural resources could occur as a result of construction associated with conservation and restoration projects and would be similar to those described for Alternative 1.

6.11.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts to cultural resources under Alternative 4 would be similar to those described for Alternative 2.

6.11.5 Mitigation Measures

Mitigation of adverse impacts as a result of the ACWRP would be determined in consultation with OAHP and appropriate stakeholders, such as the Yakama Nation, local governments, Saint Joseph's Mission, and other users. Mitigation of adverse impacts to buried archaeological sites could typically include project redesign to ensure avoidance of ground-disturbing actions in locations of archaeological deposits; monitoring of construction excavation in the vicinity of a site; and archaeological recording, sampling, or large-scale excavation at a site. Mitigation of adverse impacts to above-ground resources, including historic structures, could include impact avoidance through redesign; construction monitoring; and documentation of the resource consistent with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) standards.

Yakama Nation cultural specialists could request that ground-disturbing construction activities in the vicinity of known or suspected resources be monitored by a qualified archaeological monitor with the authority to stop work. Mitigation measures should specify protocols to be followed in the event of an inadvertent discovery in the project area, both during construction and following implementation of project operations. The Yakama Nation Cultural Resource Program should be apprised of the construction schedule as soon as it is developed.

6.11.5.1 Alternative 1 – No Action

No direct impacts to cultural resources would result from Alternative 1; therefore, no mitigation would be required of the ACWRP. Agencies and entities implementing separate conservation or restoration projects could be required to implement mitigation measures.

6.11.5.2 Alternative 2 – Watershed Restoration Program with Storage

Construction of Pine Hollow Reservoir could impact cultural resources in the area. Mitigation for any identified impacts would vary based upon the nature of the identified resource and the potential impact; however, mitigation could include the measures described in Section 6.11.5. Mitigation measures could be prioritized. Mitigation of impacts to water rights and the security of water access to Saint Joseph's Mission following construction of the project would have to be ensured; consultation regarding this mitigation should involve OAHP.

6.11.5.3 Alternative 3 – Watershed Restoration Program without Storage

Under Alternative 3, mitigation measures similar to those described for the No Action Alternative would be appropriate.

6.11.5.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Mitigation measures for Alternative 4 would be similar to those developed for Alternative 2.

6.11.6 Cumulative Impacts

Cumulative impacts associated with the ACWRP could include the potential for inadvertent discovery of sites and artifacts of cultural significance during any future excavation. Cumulative impacts could include impacts from erosion and changes in land use, such as activities of introduced animals and the erosive actions of wind, water, and temperature on newly exposed sediments or excavated channels that might contain archaeological deposits. Land development could support an increased population and demands on existing irrigation systems and water resources, which could stimulate an increase in vandalism or other human behaviors that could affect cultural and historical sites. These activities could include agriculture and land clearing, grazing, reclamation and flood control, and construction of roads and public utilities. Cumulative impacts could also reasonably include adverse impacts to historical water management systems, such as canals or dams downstream from the project area, which could require modification to support changes in operating capacity. In addition, development could adversely affect the historical characteristics of a locality, as well as future access to lands by groups engaged in traditional activities.

6.11.7 Significant Unavoidable Adverse Impacts

There is not enough information on cultural resources in the Ahtanum Creek Watershed to determine if there would be any significant unavoidable adverse impacts. This would be determined through detailed field studies and investigations that would be conducted as part of the project level environmental analysis for the ACWRP.

6.12 Public Services

This section discusses the impacts to public services and utilities that could occur as a result of implementation of the watershed restoration alternatives. The discussion also includes operation of the reservoir, flood control, and safety issues related to the operation of the reservoir and dam.

6.12.1 Alternative 1 – No Action

No direct impacts to public services or utilities are anticipated as a result of the No Action Alternative. This alternative assumes that individual agencies and entities would continue to implement water conservation and habitat restoration projects. These projects could result in improved reliability of irrigation water supply and improved stream habitat, but are not expected to be as effective as measures that would be undertaken as part of a coordinated ACWRP. Without implementation of a coordinated ACWRP, the problems associated with floods, the reliability of surface water supply, and the quantity of surface water flow may not be addressed on a watershed-wide level. Alternative 1 may result in a lack of coordinated conservation efforts and may not have as significant an impact on these problems as a coordinated ACWRP would have.

6.12.2 Alternative 2 – Watershed Restoration Program with Storage

6.12.2.1 Public Utilities

The proposed Pine Hollow Reservoir would not produce electric power or provide a public drinking water supply. Reservoir operations, including pumps, if required, would require electric power, which would be provided through existing connections with Pacific Power and Light. The amount of electricity required is not expected to significantly impact the power supply in the area.

Water conservation projects, such as improved sprinkler systems and timing devices, could require electricity to operate and slightly increase the demand for electrical power in the area. The increased electrical demand is not expected to significantly impact the power supply in the area. None of the habitat restoration programs are expected to impact public utilities.

6.12.2.2 Public Services

The proposed Pine Hollow Reservoir would provide storage for surface water to be used for irrigation and augmentation of instream flows. The reservoir would not provide a drinking water supply and would not generate hydroelectricity. The reservoir would not provide significant flood control to the project area, but could provide a small reduction of flood flows during non-peak events. The reservoir would be an off-stream reservoir and would not be designed to provide storage of flood waters. The diversion and enlarged Johncox Ditch would operate during winter and spring high flows, and could divert up to 160 cfs. That could reduce flood flows during non-peak events. Peak flows during major flood events have exceeded 1,000 cfs. The reservoir and smart diversion would have to be operated for flood control in order to provide any such benefits.

Reservoir maintenance and operation would require a joint operating agreement between the AID and the WIP. It is anticipated that through the joint operating agreement, either the AID would assume responsibility for operating and maintaining the reservoir, or a contract would be established with an outside entity to perform those responsibilities. The reservoir would be operated to fill as much as possible during the winter and spring when flows are high and would empty during the summer and fall when flows are low and the demand for irrigation is high.

Pine Hollow Reservoir could indirectly lead to an increased housing density in the watershed. Although the reservoir would not provide drinking water, reservoir water could be used for lawn and garden watering in residential areas. If a separate water supply was available for lawn and garden watering, the amount of water needed to supply a subdivision would be reduced and the density of the subdivision could be increased. The subdivisions could increase the demand for public services in rural portions of Yakima County. This is not expected to be a significant problem in the Ahtanum Creek Watershed. The reservoir would provide additional water for crop irrigation, and it is possible that some of that water could be used for lawn and garden watering. However, the additional water from the reservoir would more likely be applied to irrigate crop lands.

6.12.2.3 Public Safety

The proposed Pine Hollow Reservoir could pose a safety hazard to the area downstream of the reservoir in the unlikely event of dam failure. This would place increased demands on public services in the watershed. The Department of Ecology regulates dam safety for reservoirs that impound more than 10 acre-feet and would therefore regulate Pine Hollow Reservoir. Pine Hollow Reservoir would impound approximately 24,000 acre-feet of water. The dam would be approximately 180 feet high; therefore, it would be required to meet Ecology's highest standards for design and monitoring. Ecology's dam safety regulations include requirements for dam design and assessing the consequences of dam failure and developing an appropriate emergency action plan (see the following mitigation section for additional discussion). Dam failures are relatively rare in Washington. Ecology lists 14 “notable dam failures” since 1907 on its web site (Ecology, 2004). These failures resulted in nine deaths, the most recent in 1976. Ecology’s dam safety regulations are intended to minimize the potential for dam failure by providing design standards and review, inspection procedures, and periodic inspection by Ecology.

In addition to the potential for dam failure, the reservoir would pose a safety risk to the public and livestock who might inadvertently fall into the impoundment. Residents or visitors to the area could fall into the reservoir from the steep banks or fall from the dam if they manage to obtain access to the area.

6.12.3 Alternative 3 – Watershed Restoration Program without Storage

The water conservation programs associated with Alternative 3 could result in a slightly increased demand for electrical power similar to what is described for Alternative 2. None of the habitat restoration programs would impact public services or utilities. Fish screens would require additional electricity. No reservoir would be constructed under Alternative 3; therefore, no reservoir-related public utilities or services impacts would occur.

6.12.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Impacts to public services and utilities in the Ahtanum Creek Watershed under Alternative 4 would be similar to those identified for the conservation measures and reservoir operation for Alternative 2.

6.12.5 Mitigation Measures

Specific mitigation measures for impacts to public services and utilities in the Ahtanum Watershed would be developed during the project level EIS analysis when the exact nature of impacts is known. General mitigation measures that could be included are described below.

6.12.5.1 Alternative 1 – No Action

The No Action Alternative is not expected to result in direct impacts; therefore, no mitigation is required. Water conservation and habitat restoration projects undertaken by individual agencies and entities could help mitigate existing conditions of unreliable water supply and degraded stream habitat.

6.12.5.2 Alternative 2 – Watershed Restoration Program with Storage

Alternative 2 is not expected to create significant impacts on public utilities; therefore, no mitigation is proposed for utilities.

Establishment of an oversight group is envisioned, that would consist of representatives from the water users (AID and WIP) and fisheries agencies. The oversight group would provide consistent evaluation of reservoir operations and management to optimize the multiple uses of reservoir storage.

To ensure public safety, the design and construction of Pine Hollow Reservoir would be done in compliance with the state of Washington dam safety requirements (RCW 90.03.050). As part of the compliance, the design would include an assessment of the consequences of dam failure on downstream areas. If those consequences meet certain criteria, the development of an emergency action plan would be required. The emergency action plan would include procedures for responding to a dam failure, including detection and warnings. The emergency action plan would be developed in coordination with representatives from local emergency services. In addition, monitoring devices would be installed to monitor the stability of the dam and monitor groundwater levels in the dam and adjacent to the reservoir. Monitoring would be performed in perpetuity.

The reservoir proponents would develop a plan to address safety issues related to the reservoir. These could include limiting public access through limited access roads to the reservoir, gating access roads and the dam area, and fencing in certain high-risk areas.

6.12.5.3 Alternative 3 – Watershed Restoration Program without Storage

No significant impacts to public services or utilities are expected to result from the implementation of Alternative 3; therefore, no mitigation is proposed.

6.12.5.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Mitigation measures for Pine Hollow Reservoir impacts to public services, utilities, and safety would be the same as those proposed for Alternative 2.

6.12.6 Cumulative Impacts

Continued conversion of agricultural lands to residential uses would place increased demands on public services and utilities outside UGAs in the Ahtanum Creek Watershed.

6.12.7 Significant Unavoidable Adverse Impacts

No significant unavoidable impacts to public services and utilities were identified.

6.13 Existing Water Rights

Potential impacts to existing water rights in the Ahtanum Watershed include damages to existing water rights from creation of new rights or changes to existing water rights.

6.13.1 Alternative 1 – No Action

Under the No Action Alternative, no new water rights or changes to existing water rights would be required and no impact on existing water rights would be anticipated. To the extent that individual entities continue to implement state or federally funded conservation measures, additional trust water rights would be created.

6.13.2 Alternative 2 – Watershed Restoration Program with Storage

Under Alternative 2, a 24,000 acre-foot Pine Hollow Reservoir would be constructed to supply water to holders of water rights within the Ahtanum Watershed. A new water right would be required for storage. The new water right would be a reservoir permit, which would authorize a right to divert and store water year-round. The minimum quantity of water required under the reservoir permit would be the total amount needed to supply water to the WIP, Johncox Ditch, and AID water users.

Under existing water rights, those water users receiving water from AID or Johncox Ditch (the Northside water users) must cease diverting water from Ahtanum Creek after July 10 of each year. The Yakima Basin Adjudication Court has yet to issue its final decision on two issues that will determine whether certain Northside water users will have a right to divert after July 10 and, if so, what quantity of water they would be entitled to divert. If the court rules that the Northside water users have no right to divert after July 10, the water users would have to obtain a new water right for the second half of the season and for the additional quantity of water diverted and beneficially used during that time period. Ecology would likely issue a new water right as long as the reservoir did not impair other surface or groundwater rights.

The reservoir would provide all out-of-stream water use within the reservoir service area for the entire irrigation season, and there would be no individual diversions within the service area. This unified approach to water use in the Ahtanum Watershed could be a benefit to water right holders in that they would be more likely to receive their full water right on a more consistent basis than is currently the case where the water users are dependent on the natural flow in the creeks. Depending on the new delivery system, this alternative would require at least some water right holders to obtain a change in point of diversion. In addition, any water users who change from using groundwater to using surface water delivered from the reservoir would need to obtain a change in their point of withdrawal.

Ecology may only issue a new water right or approve a change to an existing water right if there would be no injury to existing water rights. In making its decision on a water right application, Ecology must consider all existing water rights, including surface water and groundwater rights. For surface water rights, Ecology will have the necessary information to evaluate impacts on existing water rights from a new water right for storage or changes in existing water rights once the Adjudication Court issues a Conditional Final Order in the Ahtanum Subbasin. For groundwater rights, Ecology may need to gather additional information in the Ahtanum Watershed before it can make its determination on a new water right or water right changes.

As discussed in Section 3.2.2 and Appendix B, the Yakama Nation has a right to irrigation water for its practicably irrigable acreage (PIA). The Report of the Court on the Yakima Adjudication indicates that the Yakama Nation would have a right to irrigate additional PIA lands if storage water became available. Construction of the Pine Hollow Reservoir could provide a source of water for additional PIA lands on the Yakama Reservation, and the tribe could claim a portion of the water stored in the reservoir. One of the purposes of the reservoir is to improve the reliability of the water supply to WIP. The WIP canal would be lined or piped.

Operation of the reservoir would require delivery of water to the water users consistent with their water rights, including the Yakama Nation's senior right to instream flow for fish. Alternatives 2 and 4 include provision of target flows for fish. Delivery of water would likely be carried out under contracts between the water right holders and the owner(s) and operator(s) of the reservoir similar to the contracts between the water right holders and Reclamation in the Yakima Project. If insufficient water were delivered or delivered on a schedule that did not comply with a water users water right, injury (as defined by Ecology) could occur.

The final decision of the Adjudication Court regarding a requirement to maintain 0.25 cfs in the stream for non-diversionary stock water may make maintenance of flows a requirement for Bachelor and Hatton Creeks. This would result in reduced flows in Ahtanum Creek (see Section 6.2.2).

The conservation measures that would be a part of Alternative 2 include lining the WIP canal, lining and piping conveyance systems, and on-farm improvements. To the extent the conservation projects are funded by state or federal money, the net water savings would be transferred to the Trust Water Rights Program. Installation of water meters would allow better tracking of water use, enforcement against unauthorized water use, and protection of senior rights from impairment.

6.13.3 Alternative 3 – Watershed Restoration Program without Storage

Because Alternative 3 does not include a storage reservoir, no new water right or changes in water rights would be required. The impacts from watershed restoration and conservation measures under this alternative would be the same as those under Alternative 2.

6.13.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Habitat restoration projects are not expected to impact water rights; therefore, the impacts to water rights from Alternative 4 would be expected to be the same as those for Alternative 2.

6.13.5 Mitigation Measures

6.13.5.1 Alternative 1 – No Action

Under the No Action Alternative, no new water rights or changes in water rights would be required, no impact on existing water rights would be anticipated, and no mitigation would be required.

6.13.5.2 Alternative 2 – Watershed Restoration Program with Storage

Under Alternative 2, a new water right would be required for storage, and depending on the final ruling by the Yakima Basin Adjudication Court, new water rights would be required for irrigation by the AID and Johncox Ditch users after July 10. Changes in points of diversion of existing water rights and changes from groundwater to surface water rights may be required. Ecology may issue a new water right or approve changes only if there would be no injury to existing water rights. Mitigation may be proposed to address any potential injury identified by Ecology. Until Ecology determines there may be a potential injury to existing water rights, specific mitigation options cannot be identified.

Construction of a storage reservoir could be considered a source of stored water to meet the Yakama Nation's PIA. The joint operating agreement that would be developed for the construction and operation of the reservoir would include provisions regarding the Yakama Nation's water rights. The project's provision of a more reliable water supply and improved delivery system would improve irrigation on the Yakama Reservation. Those improvements may permit the tribe to irrigate additional PIA acres without claiming additional water from the reservoir.

Operation of the reservoir would require delivery of water to the water users consistent with their water rights, including the Yakama Nation's senior right to instream flow for fish. The target flows included in the operation of the reservoir are intended to meet the Nation's right for instream flow for fish. If insufficient water were delivered or delivered on a schedule that did not comply with a water users water right, injury could occur and mitigation would be required.

6.13.5.3 Alternative 3 – Watershed Restoration Program without Storage

Because Alternative 3 would not include the storage reservoir, no new water right or changes to water rights would be required and no mitigation of impacts to water rights would be necessary.

6.13.5.4 Alternative 4 – Watershed Restoration Program without a Habitat Restoration Component

Possible mitigation under Alternative 4 would be the same as that discussed above for Alternative 2.

6.13.6 Cumulative Impacts

No cumulative impacts to water rights were identified as a result of the proposed ACWRP alternatives.

6.13.7 Significant Unavoidable Adverse Impacts

No significant adverse impacts to water rights were identified as a result of the proposed ACWRP alternatives.

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Yakima Valley Regional Library
Southeast Branch
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CHAPTER 9.0 COMMENTS AND RESPONSES TO COMMENTS

LIST OF COMMENTERS

Comment Letter No. 1 – Yakama Nation

Comment Letter No. 2 – David J. Kaumheimer

Comment Letter No. 3 – Fish And Wildlife, John Easterbrook, Regional Fish Program Manager

Comment Letter No. 4 – Office Of Archaeology And Historic Preservation, Stephenie Kramer, Assistant State Archaeologist

Comment Letter No. 5 – Yakima County Public Services, Dean Patterson, Environmental & Natural Resources Manager

Comment Letter No. 6 – Taylor Consulting Group, David Taylor, Sr. Consultant

Comment Letter No. 7 – Robert Mcinnis

Comment Letter No. 8 – Vernette Phillips

Comment Letter No. 9 – Bob West

Comment Letter No. 10 – Suzy West

Comment Letter No. 11 – Irene And George Glessner

Comment Letter No. 12 – Herke Ranch, Mark Herke

PUBLIC OPEN HOUSE COMMENTS

Commenter No. 1 – Jeff Peters, City of Yakima, Assistant Planner

Commenter No. 2 – David Lockhart

Commenter No. 3 – Vern Burke

Commenter No. 4 – Debora and Ken Boyle

Molly Adolfson

From:	Tom Ring
Sent:	Friday, April 08, 2005 5:01 PM
To:	Derek Sandison; Molly Adolfson
Subject:	Ahtanum DEIS comments

ACWRP DEIS Comments.doc

Derek and Molly,

Attached please find comments from Yakama Nation staff on the Draft ACWRP EIS. These comments are generated at the staff level and do not constitute a policy position of the Yakama Nation. Please call or email if you have any questions.

Tom

Comments
DRAFT PROGRAMMATIC EIS FOR THE AHTANUM WATERESHED RESTORATION PROGRAM.

Fact Sheet (p.2).

As the Nation has indicated before, the Nation wishes to make clear that the State
lacks jurisdiction on the Reservation for any purpose including any jurisdiction under
1-1 the State Environmental Policy Act. The Nation does not agree there is state
jurisdiction on the Reservation for any of the state "permits, licenses, and approvals"
listed here. Permits would be required through appropriate Tribal offices, including
the Yakama Nation Water Code Program and Zoning office.

1,1 Introduction.

1-2 The first paragraph should indicate that portions of the Ahtanum watershed lie in
Yakima County and portions on the Yakama Reservation.

1-3 2nd para: …mixed public, private, and tribal ownership…

As noted in the introduction, as to the Ahtanum Watershed the "… the southern portion of the watershed falls within the Yakama Nation Reservation…" Accordingly, as the Nation has indicated before, the Nation wishes to make clear that the State lacks jurisdiction on the Reservation for any purpose including any jurisdiction under the State Environmental Policy Act.

The Introduction references the boundaries as defined by the Ahtanum Creek "in the
1-4 middle and lower reaches." There is disagreement as to the correct boundary of the
Creek and Reservation. There are a number of maps within the Draft EIS which
generally locate the boundaries of the Ahtanum Creek watershed. (See, e.g. Figure 1-1). The Nation does not agree with the boundaries defined in the draft EIS to the
extent that it is intended to correctly define the boundaries of the Reservation.

The Nation also disputes that the area defined as Tract C is outside the Reservation and disputes that the State or any non-Indian party owns any land within Tract C.

The introduction claims that the "…state's first irrigation diversion … is located at
1-5 the St. Joseph Mission in the middle reach." While that may or may not be the first
non-Indian diversion in the state, the draft EIS itself notes that there were earlier
Indian diversions. See, p. 4-58 of DEIS.

1-6 p.2. 4th para: Most AID water is diverted from Ahtanum Creek into Bachelor and
Hatton Creeks and pumped from there.

The Introduction notes that "…AID currently assesses 8,285 acres for tax purposes
1-7 and serves approximately 5,470 acres with water." This figure is not correct. The
amount of land on the northside of the Creek which have a surface water right is

1-7 currently at issue in Ecology v. Acquavella. The evidence shows that AID serves substantially fewer acres. Ecology should delete these figures pending resolution of Acquavella..

1.2 Description of Proposal.

1-8 The proposal is described as a providing a vehicle to protect fish habitat and stream flow. The Nation does not agree with any proposal to the extent that it disputes that the Nation already has a senior Treaty water right for fish and other aquatic life in Ahtanum Creek.

1.3 Purpose and Need for the Proposal.

1-9 Contrary to the map in Figure 1-2, the Yakama Nation does not agree that the State has any authority to define shoreline designations on the Reservation. The document also does not necessarily define the correct boundaries of the Reservation.

1.4

1-10 "provide a net benefit" is a weak statement. Should read e.g. "substantially restore productivity of the aquatic ecosystem".

1.5

1-11 EIS change from "the basis" to "a basis".

1.6

1-12 **1st para:** Change "will use" to "may use".

1-13 **2nd para:** after "federal" add "or other federal actions were involved".

1.9.2.1 Alternative 1 – No Action.

1-14 The alternative states that "[t]here would continue to be insufficient instream flow for sustained fish habitat and an unreliable water supply for irrigation." (p. 1-11). The Nation disputes this to the extent that the no action alternative ignores or does not factor in that, under applicable orders of the federal courts and the Acquavella court, that the Nation is entitled to the flow in the Creek needed for its Treaty water right for fish and aquatic life.

1-15 Change "minor improvements" to "some improvements".

1.9.2.2. Alternative 2

1-16 This alternative fails to consider the rights of the Yakama Nation for both irrigation and fish water in the Ahtanum basin. See discussion under 1.9.2.1. The alternative is correct that the Nation can claim the water for its irrigation water rights. The alternative fails to mention that the Yakama Nation can also claim its Treaty water right for fish and other aquatic life from both storage and natural flow.

1-17 The alternative also fails to consider other possible storage sites other than the Pine Hollow Reservoir. Among other alternatives not addressed is the proposal which forms the basis of the Yakama Nation's and the United State's practicably irrigable acreage claim in Acquavella.

1-18 p. 1.12 last para: delete "prohibiting access of Tribal members", replace with eliminate traditional cultural practices due to inundation of the reservoir footprint. Change "would be expected" to "might".

1.9.3

1-19 para 1: After "Wahsington state" add "and federal".

1-20 Para 2: Delete "stakeholders such as".

1.10 Areas of Uncertainty and Controversy.

1-21 The document is correct that storage or any new state-based water rights cannot be developed without impairing the senior water and other Treaty rights of the Yakama Nation.

2.0 Alternative Development Process.

See discussion under Chapter 1.0.

2.2.2

1-22 after "cooperation with" add "the Yakama Nation and".

2.2.5

1-23 The repairs to Wapato Dam are not expected to influence flow conditions at the Mouth of Ahtanum creek.

2.3.2

1-24 p. 2.4: After "This alternative includes the following operational characteristics" add parenthetical "(These are conceptual characteristics for purposes of this EIS. Actual details have not been agreed upon)."

1-25 Add "or piped" after "the WIP canal would be lined".

General

1-26 It is not entirely clear how the reservoir would be operated under the current options. It might be advantageous to continue to utilize the current diversion points for irrigation as long as creek flows can support both irrigation diversions and fish flows. This would have several advantages; (1). Flows when available could still be diverted from the North Fork Ahtanum to maximize storage in the reservoir, (2). diversions would

maximize recharge of the shallow aquifer system early in the season. Use of reservoir storage for supplementing fish flows should be minimized . Fish flows should come primarily from natural flows in the creek. This would minimize temperature issues associated with reservoir storage water being used to supplement the creek and would increase stream flows in the reach between the John Cox diversion and
1-26 where ever fish supplementation water is returned to Ahtanum creek from the Pine Hollow reservoir.

The EIS can also be read to say that diversions will continue at the traditional locations and that instream flows would be supplemented from the reservoir. Supplementation with reservoir water opens up many new questions including the suitability of reservoir water quality for instream flow.

3.0 LEGAL AND REGULATORY FRAMEWORK.
3.2.1.1

As discussed above,the state laws on acquisition of water do not apply on the Yakama Reservation. Nor can state law in the off-reservation portion of the Ahtanum Basin be enacted or implemented to harm or impair the Yakama Nation's senior water
1-27 rights. The Nation does not necessarily agree with the description of the scope of the state's groundwater exemption but that exemption, whatever its scope, cannot act to withdraw water to which the Nation is otherwise entitled.

1-28 P 3-2 3rd line: add "domestic" before "groundwater exemption".

3.2.3. Tribal Water Rights.

The description fails to adequately and completely describe the Yakama Nation's
1-29 adjudicated water rights in the Yakima Basin including its off-reservation right to water for fish and other aquatic life.

3.2.4

The nature and extent of the Yakama Nation's and its members' duties to pay
1-30 assessments to WIP is in litigation so the Nation does not agree that it has the duty to pay assessments in all circumstances.

1-31 p. 3-6, para 2, line 3, change to read "The AID uses Ahtanum, Bachelor, and Hatton Creeks…"

3.3.3. Shoreline Management Act.

1-32 See discussion above. This act and other state laws do not apply within the Yakama Reservation.

4.1.1

1-33 The Columbia River Basalts range in age from about 17.6 to 6 million years.
Page 4-2: first line, change "define" to "cover".

4.2.3. Middle and Lower Reaches.

The scope and extent of the Yakama Nation's right to divert water through WIP is
1-34 currently in litigation. The Nation's water right is not limited by the amount diverted in
2002 nor in any other year.

4.3.1.1 Basalt Aquifer System

1-35 Strike "occasionally" from first sentence.

1-36 Strike "may tend to hydraulically isolate individual water-bearing zones" and replace with "form zones of lower vertical hydraulic conductivity".

Sedimeatary Aquifer System

1-37 p. 4-14, 1st full para, 1st lne: replace "recharge" with "leakage".

Alluvial Aquifer

1-38 p. 4-15, 2nd full para, 2nd line: After "irrigation water", add "and upward leakage from underlying aquifers".

4.3.2.1

1-39 p. 4.19, 4th para: Replace "vertical aquifer transmissivity" with "vertical hydraulic conductivity".

4.12 PUBLIC SERVICES AND UTILITIES.

The section appears to list public services outside of the Reservation. The Nation agrees
that the DEIS has no jurisdiction on the Yakama Reservation and that it is not appropriate
1-40 to plan for activities on the Reservation. To the extent it purports to list all public
services in the Ahtanum basin, it fails to list services provided on the Yakama
Reservation by the Yakama Nation and the United States government.

4.13.1 Previous Legal Proceedings in the Ahtanum Creek Watershed.

As the DEIS notes, the issues in the Ahtanum Creek are again being litigated in
Acquavella. The Yakama Nation is not in agreement with the Department of Ecology on
a number of issues in the adjudication. Accordingly, the Yakama Nation disputes
1-41 Ecology's summary of the adjudication to the extent inconsistent with the Yakama
Nation's position in that adjudication. The Nation incorporates its briefs and exceptions
in the consolidated Subbasin 23 proceeding in Acquavella herein by reference.

Without thereby limiting its objections, the Nation notes the following problems with the description here.

1-42 First, the summary is incorrect to the extent it implies that the Code Agreement was with all northside water users. The Code Agreement was with specific northside parties for the use of water on specific lands for specific purposes.

1-43 Second, the Nation disputes that there is any water available for so-called "junior" users as alleged on page 4-62. The Nation has specifically taken exception to the Court's rulings on the so-called "junior" rights.

1-44 Third, the summary correctly notes that the Court in Acquavella has held that the Yakama Nation has a senior Treaty water right for fish in the Ahtanum Creek basin. That Treaty water right for fish has a time immemorial priority date which is senior to the irrigation rights referenced on page 4-61. The Nation disputes that the State can, by building a reservoir or taking any other action, change the Treaty rights of the Yakama Nation.

p. 4-63, 2nd full para:

1-45 It is unclear what is intended by the statement that "if a storage reservoir is built"...the prevailing conditions in the creek would change from the natural flow regime. Of course, the Creek has not experienced the natural hydrograph for a century due to irrigation diversions and other influences in the watershed.. Building a reservoir might serve to move the hydrograph back in the direction of the natural hydrograph. The sentence should be clarified or stricken.

6.3.2.4

1-46 The assertion that increased vertical leakage resulting from decreasing well use would not be significant does not appear to be based on any analysis and is contradicted by earlier statements regarding the lack of knowledge of aquifer and aquitard properties. It should be struck.

6.3.2.5

1-47 The first two sentences are incorrect. Interactions among all the aquifers and the creek are currently being studied, not just the alluvial aquifer. Development is not being permitted in the sedimentary or basalt aquifers as well as the alluvium.

1-48 We do not understand the statement beginning with "A secondary impact . . ."). Please clarify.

6.5 Fish

1-49 **General**: There needs to be some accounting for the fisheries improvements that have taken place during the last 5 years along with the decrease in WIP irrigation supplies for the south side during that time period. Utilizing the current baseline condition tends to negate fisheries improvements related to future changes in the Ahtanum Basin . Proposed storage and conservation improvement options also are more beneficial when observed in the light of the decreased supply of irrigation water that is now experienced by the WIP.

1-50 The document should explain that the lack of reservoir benefits for fish are, in part, an artifact of the selection of a recent and short baseline period. If a reservoir were considered over a longer baseline that included long periods when the stream was being completely dewatered, the benefits analysis would look quite different.

6.5.1. Alternative 1 – No Action.

1-51 This fails to consider the effects of provision of flows in Ahtanum Creek under the Yakama Nation's Treaty water right for fish. It is not clear what flow regime forms the assumptions underlying the discussion.

6.13.2

1-52 The Nation disputes that the only alternative for storage is one where a "… reservoir would provide all out-of-stream water use within the reservoir service area for the entire irrigation season…" The Nation does not necessarily support this as an alternative and notes that the DEIS has failed to consider other alternatives for storage including the one that forms the basis of the Nation's practicably irrigable acreage claim in Acquavella .

1-53 The Nation has objected in Acquavella to a claim for 0.25 cfs in Ahtanum for non-diversionary stockwater by AID and renews its objection here to any such claim.

Reservoir Operation Information – APPENDIX A

1-54 The Yakama Nation disputes this to the extent it does not consider other reservoir options including other options for AID's proposed Pine Hollow Reservoir. Among other issues, the proposal fails to consider steps that may be needed to protect the water supply from unauthorized diversion between the point of diversion on Ahtanum Creek at the John Cox Ditch and the diversion to the Wapato Irrigation Project.

Appendix B – Supplement Information Water Rights and Total Water Supply Available.

1-55 The Nation incorporates its previous objections and comments by reference. The failure of the Nation to comment to any point in this Appendix does not mean agreement. The Nation reserves the right to comment later on the legal points herein as appropriate.

Comment Letter No. 1 – Yakama Nation

1-1. Comment acknowledged. There was no intent to imply in the Draft Environmental Impact Statement (EIS) that there is state jurisdiction over the Yakama Reservation. The EIS has been revised where appropriate to clarify this and appropriate tribal permits have been added to the Fact Sheet.

1-2. The paragraph has been amended to state that portions of the watershed are located on the Yakama Reservation.

1-3. The paragraph has been amended to include tribal ownership.

1-4. Comment acknowledged. The state has no jurisdiction over the Yakama Reservation. The Yakama Nation's dispute of reservation boundaries is acknowledged. Standard maps were used in the EIS. A footnote has been added to the reference to Figure 1-1 acknowledging that the Yakama Nation disagrees with the reservation boundary depicted.

1-5. A sentence has been added to section 1.1 of the EIS to acknowledge earlier tribal irrigation.

1-6. The paragraph has been amended to clarify the diversions to Bachelor and Hatton Creeks.

1-7. The text has been revised to clarify that the assessed acreage is based on Ahtanum Irrigation District (AID) records and that the allowable acreage will be resolved by the Adjudication Court. In addition, AID has provided more current information on the number of acres it assesses and the updated number has been included.

1-8. The EIS does not dispute that the Yakama Nation has a senior water right for fish and other aquatic life (see Sections 6.13.2, and 6.13.5.2). As stated in your comment, one of the purposes of the Ahtanum Creek Watershed Restoration Project (ACWRP) is to enhance stream flow. The enhanced stream flows would help meet the Nation's senior water right for fish and other aquatic life. Section 6.13.2 states that "operation of the reservoir would require delivery of water to water users consistent with their water rights, including the Yakama Nation's senior right to instream flows for fish."

1-9. Figure 1-2 and Section 3.3.3 have been amended to clarify that the state designation of shorelines does not apply to the Yakama Reservation. The comment regarding the dispute of reservation boundaries is acknowledged.

1-10. The comment is acknowledged. The language for the objectives of the ACWRP was agreed upon by the Ahtanum Core Group. The objectives were developed at a conceptual level and represent the opinion of the Core Group at the time the project started. As the ACWRP is developed, it is likely that the objectives will be refined.

1-11. The change has been made to the EIS.

1-12. Comment acknowledged. As stated in the EIS, the components of the restoration plan will be developed in cooperation with the Ahtanum Core Group, using the EIS as a basis for decisions. Ecology will not move forward on the ACWRP without the support from major stakeholders, including the Yakama Nation.

1-13. The text has been changed in the EIS.

1-14. The sentence has been reworded. See the response to Comment 8 regarding the Yakama Nation's senior water right for fish and other aquatic life.

1-15. The text has been changed in the EIS.

1-16. See the response to your Comment 8 regarding the tribal water right for fish and other aquatic life. Your comment regarding using the stored water to meet the Nation's treaty water right for fish and other aquatic life is acknowledged.

1-17. As required by the State Environmental Policy Act (SEPA), the Ahtanum Core Group identified and considered reasonable alternatives for the ACWRP that best meet the goals and objectives for the program. SEPA defines reasonable alternatives as "actions that could feasibly obtain or approximate a proposal's objectives, but at a lower environmental cost or decreased level of environmental degradation" (WAC 197-11-440(5)(b)). The storage alternative that forms the basis of the Yakama Nation's and the United States practically irrigable acreage claim in Acquavella is The Narrows Dam, an on-stream reservoir. An on-stream reservoir was not considered by the Core Group because the environmental impacts associated with an on-stream reservoir would not meet the SEPA reasonableness criteria.

1-18. The requested changes have been made.

1-19. The requested change has been made.

1-20. The text has been reworded, but "other stakeholders" has been left in because others, such as the St. Joseph Mission, could be impacted.

1-21. Comment acknowledged.

1-22. The requested change had been made.

1-23. Reference to the Wapato Dam repairs has been deleted from the EIS.

1-24. The requested change has been made.

1-25. The requested change has been made.

1-26. The details of operation of the reservoir would be refined in the future if a reservoir is included as a component of the restoration plan. A more detailed analysis of reservoir operation and delivery options would be considered at that time.

Alternatives 2 and 4 assume that direct diversions from the mainstem would be discontinued once the reservoir is in operation and that water for irrigation would be distributed to water users directly from the reservoir through piped conveyance and distribution systems. It is anticipated that these systems would use the pressure created by the reservoir to distribute the water. A more detailed analysis of reservoir operations may indicate that continuing diversions from the stream would be beneficial. However, providing both pressurized water from the reservoir and non-pressurized flow directly from the creek may require additional facilities and complicate operations.

The intent of Alternatives 2 and 4 is to operate the diversion of water from the North Fork to the reservoir so that the need to discharge from the reservoir to supplement instream flows in the mainstem is minimized. This would minimize the impact that reservoir water temperatures and quality may have on the water in the mainstem of Ahtanum Creek. Based on the results of the EIS analysis, the supplement from the reservoir would be small relative to the flows in the mainstem and so the impact on temperatures in the stream would not be considered a significant issue for fish habitat (see Section 6.5.2.2).

1-27. Comment acknowledged. The state laws regarding the acquisition of water rights do not apply to federally reserved water rights, including those on the Yakama Reservation. State law prohibiting impairment of senior water rights applies to all senior water rights, including the Yakama Nation’s off-reservation senior water rights.

1-28. This requested change was not made because the “groundwater exemption” applies to uses other than domestic as stated in the paragraph and in RCW 90.44.050.

1-29. A short description of the Yakama Nation’s water rights, including its right to water for fish and other aquatic life is provided in Appendix B (page B-11). A reference to this appendix has been added to Section 3.2.3 of the EIS.

1-30. The reference to Wapato Irrigation Project (WIP) assessments has been deleted from Section 3.2.4.

1-31. The requested change has been made.

1-32. A sentence has been added to Section 3.3.3 to clarify that the Shoreline Management Act does not apply to reservation lands.

1-33. Sentence has been clarified and the requested change has been to Section 4.1.1.

1-34. The section has been amended to clarify that the water right is not limited by the 2002 diversion.

1-35. The requested change has been made.

1-36. The text has been changed to clarify the potential effects of low permeability zones.

1-37. Requested change has been made.

1-38. Requested change has been made.

1-39. Requested change has been made.

1-40. Information regarding services on the Yakama Reservation portion of the watershed has been added to Section 4.12.1.

1-41. Comment acknowledged.

1-42. Comment acknowledged. This issue has not yet been resolved. See the discussion in Appendix B, Section 4 (page B-12).

1-43. Comment acknowledged. The discussion in Section 4.13.1 refers to what the Adjudication Court has decided to date. Objections have been taken. The Yakama Nation's objections are stated in Appendix B, Section 3 (Page B-12).

1-44. It is not the intent of the state or the ACWRP to change the Treaty rights of the Yakama Nation. See the response to Comment 1-8 in this letter regarding the Nation's senior water right for fish and other aquatic life. A sentence has been added at the end of the first paragraph of Section 4.13.1 stating that all water rights for out-of-stream uses are junior to the Nation's treaty right for fish.

1-45. The sentences have been revised to clarify that the prevailing conditions would change, thus creating different conditions for determining the Nation's water right for fish.

1-46. The text has been changed.

1-47. Text has been added to explain the conditions that would result from a change in groundwater withdrawal.

1-48. The text has been changed.

1-49. The selection of an appropriate baseline period for Ahtanum Creek is problematic. For a number of reasons post-1999 conditions were chosen to model the affect of watershed conditions on fish populations. If a long period ending in 1999 were chosen, it would reflect conditions, particularly for flow regime, that no longer exist. It is true that if the alternatives were being considered over a longer baseline that included sustained periods when the stream was being completely dewatered, the benefits analysis would look quite different. Similarly, as the Yakama Nation has pointed out, the post-1999 period does not accurately reflect the conditions fish have had to contend with over the last six decades. The current baseline may not be sustainable if, for example, there were reoccurring drought years.

It is clear that environmental conditions in the mainstem of Ahtanum Creek have improved significantly since 2000. Prior to 2000, Ahtanum Creek was completely dewatered from 7 to 8 miles below the upper WIP diversion from approximately July 10 through early November, when the fall rains came and refilled the shallow aquifer beneath the dewatered reach and restored stream flows. It is also likely that flows in all reaches below the dewatered area were lower during this July to October period, and therefore the total wetted area was less, maximum temperatures were greater, and predation risk was increased throughout the mainstem below the upper WIP diversion.

To put the different baseline conditions in context, the Environmental Diagnostics and Treatment (EDT) model was used to estimate the benefits of the Pine Hollow Reservoir relative to a pre-1999 baseline (a baseline ending in 1998 is the most appropriate period because initial efforts at preserving instream flow began in 1999). This estimated production is for a scenario in which flow and flow-related conditions reflect pre-1999 conditions. Before 1999, adverse environmental conditions, particularly the low stream flows had a greater impact on fish populations than the post 2000 conditions in the watershed used for the model. The pre-1999 conditions were compared with the impacts of the current baseline and “reservoir-only” alternatives. In terms of mean coho abundance, the current baseline is more productive with greater coho abundance than the pre-1999 baseline. A pre-1999 baseline would have substantially increased the benefits of the reservoir to the coho population, with 140 percent greater production than with the current baseline. Similarly, the mean abundances of steelhead and spring Chinook would be 144 percent and 177 percent larger, respectively if the population performance for these species when measured against a pre-1999 baseline. For these reasons, the post-1999 watershed conditions were chosen as the most appropriate baseline for evaluating the impact of the proposed reservoir and watershed restoration.

1-50. See the response to Comment 1-49 in this letter.

1-51. The EDT simulation of the No Action Alternative assumes the baseline, or "current", flow regime resulting from the flow routing analysis detailed in Appendix D. The flow routing analysis measures the impact of withdrawals, seepage, runoff, evaporation, and other variables on instream flows. Flows used as input for the routing analysis are historic flows measured on the North Fork and South Fork of Ahtanum Creek from 1946 to 1984. The baseline, or "current", simulation was completed to determine the impact of "current" irrigation practices on instream flows. Withdrawals for irrigation were estimated based on a survey of cropping and irrigation practices in 2002 completed for the Ahtanum Creek Watershed Assessment (Golder, 2004). The 2002 irrigation practices included reduced diversions by WIP after July 10 to maintain continuous instream flows. The No Action Alternative assumes that these practices will continue.

1-52. See the response to Comment 1-17 of this letter.

1-53. Comment acknowledged. The Nation's objection is noted in Appendix B (page B-13) of the EIS.

1-54. See the response to Comment 1-17 regarding other reservoir options. Any unauthorized diversions would be in violation of state water law. The reservoir alternatives assume that Ahtanum Creek, ditches and reservoir would be patrolled periodically in order to prevent unauthorized diversions. This assumption has been added to Section 6.2.5.2 as a proposed mitigation measure.

1-55. Comment acknowledged.

United States Department of the Interior

BUREAU OF RECLAMATION
Upper Columbia Area Office
1917 Marsh Road
Yakima, Washington 98901-2058

IN REPLY REFER TO:

UCA-1600
ENV-1.10

MAR 25 2005

Mr. Derek I. Sandison
Regional Director
Central Regional Office
Washington State Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, WA 98902

Subject: Comments on the Draft Programmatic Environmental Impact Statement for the "Ahtanum Creek Watershed Restoration Program"

Dear Mr. Sanderson:

2-1 We have reviewed the subject document and have the following brief comments.

The Washington Department of Ecology, working cooperatively with members of the Ahtanum Core Group, developed a thorough process defining several alternatives for a program to restore the health of the watershed. Four alternatives are evaluated in this EIS:

Alternative 1 – No Action
Alternative 2 – Watershed Restoration with Storage,
Alternative 3 – Watershed Restoration without Storage
Alternative 4 – Watershed Restoration without a Habitat Component.

An overview of these alternatives indicates that Alternative 2 may have unintended effects upon the Total Water Supply Available (TWSA) for the Yakima Project and upon flow and habitat improvements made under the Yakima River Basin Water Enhancement Project (YRBWEP). The level of detail contained in the EIS appears insufficient to allow a complete analysis of these concerns. A meeting may be needed with modelers to obtain a finer level of detail.

2-2 It appears that with either storage alternative 2 or 4, there would be created a greater demand on the TWSA or the fishery, or both. Waters not currently under a water right certificate are under claim or withdrawal by the United States in the ongoing adjudication. The Yakama Nation has time immemorial fishery rights which also could be affected. As you are already aware, the State has granted a withdrawal of all the remaining unappropriated water of the Yakima Basin, including the Ahtanum Creek sub-basin, to the United States. Consequently, as noted in the EIS, any new surface water appropriation in the Ahtanum Creek Sub-basin for storage or other beneficial uses will require a release of withdrawn water from the Reclamation. The Report on

2-2 Biologically-Based Flow Flows for the Yakima River Basin, developed as part of YRBWEP implementation, supports a normative or natural-like flow regime for fish propagation in the basin and any new long-term storage may reduce the ability of the river basin to move toward a more normative flow regime. In addition, reductions in flows within the system, during periods when water is being stored, could impact habitat enhancement efforts in the mainstem of the Yakima River.

2-3 Any watershed restoration without storage, such as Alternative 3, which includes water conservation measures and habitat restoration projects, would be unlikely to have any negative effects to YRBWEP activities. These comments should be considered to be preliminary only. Much more detailed modeling information is necessary to accurately determine any likely affects of the storage alternatives. We would be available to meet with your modelers to recommend necessary data assessment needs for determining any negative impacts from the storage alternatives.

We appreciate the opportunity to provide these comments.

Sincerely,

David J. Kaumheimer
Environmental Program Manager

Comment Letter No. 2 – U.S. Bureau of Reclamation, David J. Kaumheimer, Environmental Program Manager

2-1. Comment acknowledged. The Draft EIS is a programmatic evaluation of the potential impacts of conceptual alternatives proposed for the ACWRP. As stated in Sections 1.5 and 1.6 of the EIS, the purpose of the programmatic evaluation is to serve as a basis for decision on the ACWRP. As stated, additional environmental analysis will be conducted at a project level when the ACWRP is defined.

The EIS acknowledges potential impacts of the reservoir on the Total Water Supply Available (TWSA) in Sections 3.2.5 and 6.2.2 and Appendix B. If a reservoir is selected as part of the ACWRP, Ecology would coordinate with the Bureau of Reclamation to further analyze the effects of a reservoir on TWSA and the Yakima River Basin Watershed Enhancement Project flow and habitat improvements.

The Bureau of Reclamation has been invited to participate in the Ahtanum Core Group and to provide early input in the evaluation of alternatives for the ACWRP. The Core Group will continue to coordinate with the Bureau and to request its participation in the development of the components of the restoration program.

2-2. Your comments regarding the adjudication, TWSA, the Yakama Nation's treaty water rights, the Bureau's withdrawal of all remaining unappropriated water of the Yakima Basin are acknowledged and are noted throughout the EIS. The ACWRP will comply with the Final Decision of the Adjudication Court. See the response to Comment Letter Number 1, Comment 8 regarding the Yakama Nation fishery rights. Ecology will continue to consult with the Bureau regarding TWSA and the possibility of the release of the Bureau's withdrawal as the ACWRP is developed.

The TWSA analysis included in Appendix B, pages B-13 through B-14, indicates that minimal impact to TWSA will result from the alternatives outlined in the EIS. Overall, the analysis indicates that if either storage alternative were implemented (Alternative 2 or 4), the total volume of water flowing from Ahtanum Creek to the Yakima River would increase slightly, on average, from April to October. During an extremely dry year, such as 1977, the April to October flow would decrease slightly, but the impact on TWSA and flows in the Yakima River would be negligible and not measurable.

More discussion was added to the EIS in Sections 3.2.5, 6.2.2 and page B-14 on the potential effect on Yakima River flow during the remainder of the year when the reservoir would be filling. The analysis indicates the flow discharging from Ahtanum Creek into the Yakima River would decrease in average years by increase in dry years as a minimum flow in Ahtanum Creek would be maintained.

2-3. Comments acknowledged. The Bureau has been included in ACWRP discussions in the past and will continue to be consulted. See the response to Comment 2-1 above regarding additional modeling of impacts from storage.

Washington Department of FISH and WILDLIFE

Fish Program, Fish Management Division
Region 3 Headquarters, 1701 S. 24th Ave., Yakima, WA 98902
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March 24, 2005

Derek I. Sandison, Regional Director
Central Regional Office
Washington State Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, WA 98902

Subject: Review Comments on ACWRP Draft SEPA Programmatic EIS

Dear Mr. Sandison:

The Washington Department of Fish and Wildlife (WDFW) has reviewed the above-referenced document and provides the following comments for your consideration and use in finalizing the Programmatic EIS for the Ahtanum Creek Watershed Restoration Project (ACWRP).

General Comments

First and foremost, WDFW recommends that the Dept. of Ecology (DOE), as SEPA lead agency, select **Alternative 2 – "Watershed Restoration with Storage", as the preferred alternative**. It is clear to WDFW that a comprehensive, coordinated program incorporating: 1) basin-wide habitat restoration projects, 2) an aggressive water conservation program to maximize irrigation efficiency, and 3) water storage at the proposed Pine Hollow Reservoir, provides the highest net benefits for all water users, including in-stream and riparian fish and wildlife habitat and out-of-stream consumptive uses such as irrigation.

3-1 The "no action" alternative is unacceptable to WDFW because implementing independent water conservation and habitat restoration projects on a "piecemeal basis" will likely not result in significant enhancement (or even preserve the poor current status) from a fish and wildlife (F&W) population and habitat perspective. Continued human population growth and urbanization in the Ahtanum Valley will inevitably result in further deterioration of F&W habitat and populations. WDFW recognizes the value in maintaining a viable agricultural economy in the Ahtanum Basin that delays or minimizes the conversion to residential development. Fish and wildlife species and their habitats will benefit from maintaining a low density, rural environment associated with "environmentally-friendly" agriculture---that is, modern, progressive agricultural activity that utilizes water efficiently and protects floodplain function and instream and riparian habitats required by fish and wildlife to prosper.

3-1 Alternative 3 (Watershed Restoration Without Storage) and Alternative 4 (Storage and Water Conservation Without Habitat Restoration) also fail to fully meet the needs of all stakeholders in the Ahtanum Basin. Based on the EDT analysis conducted in support of the Draft EIS, excluding the habitat restoration components in Alternative 4 eliminates most of the purported fish and wildlife benefits from the program. If significant fish and wildlife benefits disappear, critical "non-reimbursable" public funding credited to fish and wildlife enhancement will not materialize. The agricultural community alone will be unable to fund Alternative 4 without F&W associated funding assistance---particularly because agricultural-oriented program costs (storage and water conservation) are usually "reimbursable" and must be repaid by private waterusers that benefit from public investment. WDFW believes that only a programmatic alternative that generally satisfies the watershed restoration needs of all instream and out-of-stream stakeholders has a reasonable chance of receiving broad support from the public, policy-makers and potential funding partners.

3-2 Lastly, there are two critical uncertainties associated with the issuance of new water storage rights for the proposed Pine Hollow Reservoir (PHR). Moving forward with a preferred alternative that includes water storage requires that the Dept. of Ecology and the Ahtanum Core Group (ACG) attempt to resolve, in an expeditious manner, whether the U.S Bureau of Reclamation is willing to release PHR water storage from the 1979 Yakima basin-wide 3-3 withdrawal of unappropriated water. A second uncertainty that could be viewed as a "fatal flaw" is the issue of the Yakama Nation claiming PHR water to help satisfy the unmet "practicably irrigable acreage" needs of the Yakama Reservation. WDFW believes that a binding agreement is needed, before proceeding with storage construction, that specifies that ACWRP stored water will be used on the Yakama Reservation only to improve water supply reliability for lands currently served by the Ahtanum Division of the Wapato Irrigation Project.

Specific Comments

Figure 4-8

3-4 The fish distribution maps are somewhat inaccurate and need to be revised prior to finalizing the EIS. The legend for each species distribution map needs to be revised to show which life history stage(s) is illustrated (e.g. adult spawning, juvenile rearing, etc.).

Table 4-2

3-5 Indicate that [carrying] capacity and mean abundance are expressed in "adults". As indicated in Fig. 4-8, spring chinook only utilize the lowermost reach of Ahtanum Creek---and only for juvenile rearing. Spring chinook currently cannot complete their life cycle in the Ahtanum watershed. No adult spawning currently occurs. Table 4-2 gives the reader the false impression that current mean abundance is 26 adults with a maximum carrying capacity of 118 adults. The table should reflect that spring chinook have been extirpated from the Ahtanum Basin except for "dip in" rearing of juveniles produced elsewhere in the basin. Likewise, the EDT model simulations predict an unrealistically high current abundance of steelhead (174 adults). These estimates need to be tempered with actual stock status data---far fewer steelhead have actually been observed to spawn in the creek. The only estimate that appears reasonable is

3-5 the coho abundance (59 spawning adults). This table and any supporting text should be revised to provide the reader with a true picture of the current status of the anadromous fish resources.

Page 4-34; Section 4.5.1.3

3-6 What happened to priority reaches for habitat preservation? The absence of a narrative section on preservation priorities leads the reader to believe that there is no high quality habitat worth acquiring and protecting from degradation. Please explain the relative value of protection vs. restoration priorities for each species and reference the EDT analysis in Appendix C.

Page 4-35, Spring Chinook Salmon

3-7 In the first sentence of this section, indicate that current utilization is limited to juvenile rearing in the lower reaches near Union Gap. In the second sentence, indicate that historical use included all life history stages, including spawning adults. The remainder of the paragraph should be deleted because this does not describe the current status of spring chinook or you should indicate that these life history stages and timing refer to potential chinook utilization if the habitat and flow regime of the Ahtanum Creek watershed are restored.

Page 4-36, Paragraph 2

3-8 In the last sentence, elaborate on the significance of having a high percentage of age-1 steelhead smolts. Faster growth rates that allow smoltification to occur at age-1 results in higher smolt production because a second year of freshwater mortality is avoided.

Page 4-36, Coho Salmon

3-9 Native coho were extirpated from the entire Yakima Basin in the mid-to-late 1970's, including the Ahtanum watershed. By that time, coho had already been reduced to very low abundance by a variety of in-basin habitat and flow-related factors and by out-of-basin sources of mortality such as over-harvest and mainstem Columbia R. dam impacts. Out-of-basin impacts were the final blow that extirpated native coho---particularly classic, "mixed stock" over-exploitation in the ocean and the lower Columbia R. sport and commercial fisheries, where upper Columbia Basin wild coho stocks co-mingled with abundant lower Columbia R. hatchery coho that could sustain high levels of harvest.

Currently, hatchery coho are not released as smolts in the Ahtanum basin. Coho smolts are only released from four acclimation pond sites---two on the Naches R. and two on the upper Yakima R. The Yakama Nation releases age-0 coho fry or fingerlings in the Ahtanum Cr. watershed.

Page 4-37, Bull Trout, Paragraph 2

3-10 WDFW has conducted annual bull trout spawning surveys on N.F. Ahtanum Cr. since 1993. Surveys began on the Middle Fork in 1996 and the Yakama Nation has been surveying the South Fork for bull trout spawning since 2000. WDFW will provide a table showing all spawning survey results through 2004 that should be included in the final EIS.

Page 6-8, Alternative 2, Mitigation Measures

3-11 WDFW will insist that operation and management of any water storage facilities be governed by multi-party oversight committee consisting of, but not necessarily limited to, the two irrigation districts (AID and WIP), effected federal and state natural resource agencies (DOE, WDFW, USFWS, NOAA-Fisheries), and the Yakama Nation.

Page 6-11, Section 6.3.2.2, Water Conservation

3-12 Aggressive implementation of the irrigation water conservation component of Alternative 2 is critical to WDFW support for development of water storage at Pine Hollow Reservoir. High priority water conservation projects should be implemented prior to or concurrent with storage development. Reducing the annual irrigation demand by 29 percent (13,300 acre-feet) or more, if feasible, increases the operational reliability of the reservoir, while minimizing the impact of water withdrawal on Ahtanum Creek fish and wildlife populations and their habitats.

3-13 The sentence in this section suggesting that lining or piping the WIP canal would reduce base flows in lower Ahtanum Creek gives the reader a misleading, negative impression regarding the value of water conservation. Groundwater inflow from leakage will be reduced, however, irrigation diversion reductions attributed to conservation measures means that more water stays in the creek in "real-time" at the point-of-diversion. Canal leakage water may return to the creek at a time and location that does not provide maximum benefit for fish and wildlife. In other words, a seasonal time lag that results in water returning after the critical summer/fall low flow period or that enters the creek well downstream of the point-of-diversion is not preferred to retaining more water in the creek during the normal period of maximum irrigation use.

Page 6-28, Section 6.5.2.2, Paragraph 2 and Table 6-3

3-14 Pine Hollow Reservoir storage diversion is expected to reduce mean monthly flow in Ahtanum Creek during the normal reservoir refill period (late Oct. – May). WDFW recognizes that this is an unavoidable impact to instream resources that must occur in order to meet the late spring-summer-early fall surface water needs of all stakeholders. However, diversion of water should not occur during the normal low flow period (mid-July through mid-October), which is an annual constraint on rearing habitat/fish production for coho, steelhead and bull trout. Out-of-stream users need to rely on water already stored in PHR by mid-July and supplemental groundwater sources during this annual low flow period. Diversions into PHR should wait until fall rains resume, significantly increasing stream flow---usually mid-to-late October.

3-15 Also, why does the reach between Hatton Cr. return and Lower WIP diversion show a 13% decline from current base flow when reaches above and below show significant increases?

Page D-3, Appendix D

3-16 "Flat-lining" instream flow targets year-round (e.g. 20 cfs for the North Fork; 25 cfs for mainstem Ahtanum Cr.) in order to increase PHR yield from 15 KAF to 16 KAF is unacceptable to WDFW. Instead of abandoning any attempt to provide "normative" flows on monthly basis, WDFW recommends that reservoir net yield be increased by reducing the conveyance losses associated with delivering water to PHR through the enlarged Johncox Ditch. Estimated reservoir leakage and evaporation losses represent only 20 percent (400 ac-ft) of the 2,000 acre-feet difference between the 17 KAF diverted from the North Fork and the 15 KAF average annual yield (see Page 6-11). By subtraction, Johncox Canal conveyance losses are estimated to

3-16 be 1,600 ac-ft (80%) of the total loss. The enlarged Johncox Canal (160 cfs capacity) should be completely lined with concrete to significantly reduce or piped to completely eliminate transit conveyance losses. This additional, one-time, capital construction cost would have the same or greater positive benefit on reservoir net yield as reducing instream flow targets and "flat-lining"-- an unacceptable environmental cost to instream fish and wildlife resources that would occur every year over the life of the project.

Thank you for the opportunity to provide comments on the Draft Programmatic EIS. WDFW

3-17 looks forward to continued active participation as a member of the Ahtanum Core Group to finalize this EIS and to work on developing the specific suite of elements to be included in the final preferred alternative for the ACWRP.

Sincerely,

John A. Easterbrooks

John A. Easterbrooks
Regional Fish Program Manager

Comment Letter No. 3 – Fish and Wildlife, John Easterbrook, Regional Fish Program Manager

3-1. Your comments regarding WDFW's preferred alternative are acknowledged.

3-2. Comment acknowledged. See the response to Comment Letter Number 2, Comment 2 regarding the Bureau's release of unappropriated water in the Yakima Basin.

3-3. Your comment regarding the need for an agreement with the Yakama Nation prior to development of the ACWRP is acknowledged and is noted in Section 1.10 of the EIS.

3-4. Figure 4-8 has been revised to indicate the life history illustrated for each species.

3-5. All EDT simulations are primarily indices of the *relative impact* of the alternatives, not as absolute (or observed) estimates of current or future fish production. Table 4-2 represents "habitat potential," not actual fish production. This distinction can be illustrated by considering a pristine river system upstream of an impassible dam. The habitat above the dam may well have the potential to support thousands of salmon and steelhead, even though its actual production is zero.

The text accompanying Table 4-2 has been changed to indicate that the habitat production *potential* refers to adults, even though at present no spring Chinook adults, and very few coho and steelhead adults, spawn in the watershed. Equilibrium abundance for populations with such low productivity is very sensitive to the density of juvenile fish in the system. For example, an error in productivity of only plus or minus 10 percent would result in an abundance estimate 30 percent larger or smaller. Productivity was emphasized because, even with abundant carrying capacity (rearing space), habitat with low productivity potential is very likely to cause the extirpation of salmon and steelhead populations.

3-6. Comment acknowledged. Information about areas most suitable for habitat preservation has been added to Section 4.5.1.3.

3-7. The text in section 4.5.1.4 under the spring Chinook heading has been revised to reflect that current spring Chinook use of the lower several miles is limited to juvenile rearing; and that historic use by spring Chinook included all the life history stages, including spawning. It is important to retain the discussion on life history characteristics since all of the life stages are being modeled, including for extirpated Chinook. The life history description for potential Chinook utilization has been clarified.

3-8. The last sentence in 4.5.1.4 under the steelhead heading has been modified to describe the significance of having a high percentage of age-1 steelhead smolts.

3-9. The text in 4.5.1.4 under the coho heading has been revised to reflect that native coho were extirpated from the entire Yakima subbasin in the mid-to-late 1970s and that currently, hatchery coho are not released as smolts in the Ahtanum Watershed; the Yakama Nation releases age-0 coho fry or fingerlings in the watershed.

3-10. A table (Table 4-3a) showing all bull trout spawning results has been incorporated into section 4.5.1.4 under the Bull Trout heading.

3-11. Comment acknowledged. As noted in Section 1.10 of the EIS, a Joint Operating Agreement would need to be developed and will include the key stakeholders. This would include appropriate fish and wildlife agencies.

3-12. Comment acknowledged. Irrigation water conservation is included in all of the EIS alternatives. The two alternatives that include a storage component (Alternatives 2 and 4) include conservation programs that would be developed in conjunction with the storage reservoir.

3-13. Comment acknowledged. A clarifying statement has been added to Section 6.3.2.2.

3-14. Alternatives 2 and 4 are intended to limit diversions from the North Fork of Ahtanum Creek during the normal low flow. Under these alternatives, diversions to the reservoir would only occur when instream flow requirements have been met. Diversions to the reservoir would occur during the low flow period if the flow in North Fork was high, as might occur during a rainy summer or fall period. The details of operation of the reservoir would be refined in the future if a reservoir is included as a component of the ACWRP. A more detailed analysis of reservoir operation and diversions would be completed at that time.

3-15. Table 6-3 has been corrected. The modeling results do indicate an increase in the mean September and October flows in Ahtanum Creek in all reaches downstream of the Upper WIP Diversion under the Pine Hollow Reservoir alternatives.

3-16. The analysis of constant year-round flow targets was done largely for comparison, to determine the relative impact that instream flow targets would have on reservoir yield. It is anticipated that instream flow targets will be determined through additional analysis and discussion with the Ahtanum Core Group and Ecology as the components are selected for the ACWRP.

The analysis completed for the *Ahtanum Creek Watershed Assessment* (Golder, 2004) assumed a 10 percent conveyance loss through the renovated Johncox Ditch. Analysis done for the EIS assumed the same loss. A 10 percent loss may be slightly conservative, assuming the ditch is lined. If the Johncox Ditch is lined with concrete, shotcrete, or another impermeable liner, losses would be minimized. However, some loss would still occur through evaporation, and seepage through joints and cracks in the lining. Lining and maintenance of the ditch to reduce losses would be given significant consideration. Piping of the ditch has been considered as well. However, the ditch intercepts and distributes runoff from Pine Mountain for irrigation. Piping the ditch would make collection and use of that runoff much more difficult. Piping the ditch would also likely require multiple large diameter pipes to provide the needed capacity, which could be very expensive.

3-17. Comment acknowledged. WDFW's continued participation with the Ahtanum Core Group is appreciated.

STATE OF WASHINGTON

Office of Archaeology and Historic Preservation

1063 S. Capitol Way, Suite 106 • Olympia, Washington 98501
(Mailing Address) PO Box 48343 • Olympia, Washington 98504-8343
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March 22, 2005

Mr. Derek Sandison, Regional Director
Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, WA 98902

In future correspondence please refer to:
Log: 032205-02-ECY
Property: Watershed Restoration Program for Ahtanum Creek SEPA EIS

Dear Mr. Sandison:

4-1 We have reviewed the materials forwarded to our office for the proposed project referenced above. The project area has significant potential for archaeological and historic resources. If Alternative 2, 3, or 4 is chosen, archaeological and historic properties surveys will be needed prior to project commencement. Any archaeological sites or historic properties will need to be inventoried and their eligibility and significance assessed. If impacts cannot be avoided, mitigation measures will have to be developed in consultation with this office and the Yakama Nation Cultural Resources Department.

4-2 If federal funds or permits are involved Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36CFR800, must be followed. This is a separate process from SEPA and also requires identification of historic properties and archaeological sites, as well as consultation with this office and the Yakama Nation.

4-3 These comments are based on the information available at the time of this review and on behalf of the State Historic Preservation Officer. Should additional information become available, our assessment may be revised. Thank you for the opportunity to comment on this project and we look forward to receiving the survey report. Please note that as of July 1, 2005, OAHP will be requiring the use of OAHP Archaeology Site Forms for all archaeological survey projects. You can obtain a copy of the Archaeology Site form from our website at www.oahp.wa.gov. Also note that as of January 1, 2005, OAHP requires that all historic property inventory forms provided to our office be submitted in an electronic version using the Historic Property Inventory Database. If you have not registered for a copy of the database, please log onto our website and go to the Survey/Inventory page for more information and a registration form.

Sincerely,

Stephenie Kramer

Stephenie Kramer
Assistant State Archaeologist
(360) 586-3083
StephenieK@cted.wa.gov

cc: Johnson Meninick
Shane Scott

Comment Letter No. 4 – Office of Archaeology and Historic Preservation, Stephenie Kramer, Assistant State Archaeologist

4-1. The need for additional archaeological studies and possible mitigation is acknowledged in Sections 5.11 and 6.11.

4-2. Compliance with Section 106 of the National Historic Preservation Act has been added to the list of potential federal permits in the Fact Sheet. The ACWRP would comply with this requirement if federal funding or permits are part of the selected restoration program.

4-3. Comment acknowledged.

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VERN M. REDIFER, P.E. - Director

March 29, 2005

Derek Sandison, Central Regional Director
Wa. Dept. of Ecology
15 W. Yakima Ave, Ste. 200
Yakima, WA 98902-3452

RE: SEPA comments for Ahtanum Watershed Restoration Program EIS

Dear Mr. Sandison,

5-1 Thank you for the opportunity to comment on this proposal. Our apologies for the late date of our comments. Below are a list of concerns relating to the Draft EIS for the Ahtanum Watershed Restoration Program. They mainly deal with the apparent incompleteness of the impact assessment. Specifically, basic information seems to be missing that is needed to assess the impacts, even from a phased environmental review perspective, and to determine which alternative to choose.

5-2 1. In the alternatives description, two of the main components proposed on the program are the dam and restoration activities. Yet there is no elements of either described in the plan. In order to assess the impacts of the dam, one needs to know at least the basic components that would be needed to make it happen. For the dam, this would include: diversion size and location, main distribution features such as to the WIP and main trunk lines to the Ahtanum Valley, alterations to the existing facilities, etc. 5-3 For the habitat restoration activities, what kind of projects would be needed, and where are they needed? Our Surface Water Management Division is in favor of engineered channels such as at S. 42nd Ave. and Emma Lane. They are also interested in working with the other agencies in implementation of habitat enhancement projects in the watershed such as large wood projects, side channel projects, etc. They will try to integrate them into the Ahtanum Creek CFHMP, and would like to see a more integrated restoration plan developed that actually looks reach by reach at what is possible to do.

5-4 2. There is no information about the operation of the dam to determine the impacts it would have on Ahtanum Creek. The primary piece of information needed would seem to be how much water would be taken from the river, and at what season. This would allow some assessment of the impact to the regular flows in the river. This should be depicted using the hydrographs on page 4-8 for displaying the current condition, and then adjusting them based on the flow diversion for the dam.

5-5 3. Page 4-49, para. 1, end: The jurisdiction description should be modified. Non-federal and non-tribal lands are subject to local land use regulations unless used for forest practices under the FPA.

5-6 4. Page 4-49, para. 2, middle: The 1982 land use zones have been superceded by new zoning districts in 2000. Clarifying language should be added.

5-7 5. Page 4-50, para. 5: The subdivision information seems wrong. You can contact our Planning Staff that conduct subdivision reviews can confirm this information for you.

5-8 6. Page 4-49, para. 1, top: The state designates both sides of Ahtanum Creek as shoreline. Whether the state law applies to Yakama Nation land is a separate matter.

5-9 7. Page 5-3, sect. 5.2.2: The impacts to the flow dependent functions of the river due to altering spring freshet flows need to be considered. The assessment of impacts from the dam seems to be limited to construction and turbidity. Yet the diversion of increased volumes during a different time of year from the current situation will have consequences. There may be both positive and negative impacts (i.e. increase in-stream flows, etc.). The information discussed in items 1 and 2 above are needed to determine the impacts for alternatives that use the dam.

5-10 8. Page 5-4, sect. 5.3: The assessment of groundwater impacts needs to be informed by changes in the irrigation canal system, and by the expansion of water use in the valley resulting from the dam.

5-11 9. Page 5-4, sect. 5.4: Similar to other comments, changes to flood flows will change the habitat forming processes of the river. Impacts to fish and wildlife habitat can't be determined until changes to flood flows are determined. It does not appear that this has been adequately studied.

5-12 10. Given the unknown flow alteration situation, our Surface Water Division would like to see some kind of formal or written agreement that ensures current flow regimes, especially below the Upper WIP and AID diversion, are maintained into the future. Unless those flows are maintained, much of the rationale for restoration is lost.

Thank you for the opportunity to comment on this project. If you have any questions, please contact me at the number above and I can forward your questions to the relevant staff person.

Sincerely,

Dean G. Patterson

DEAN G. PATTERSON
Environmental and Natural Resources Manager

G:\Development Services\Users\DEANP\MISC\REVIEWS\DOE Aht w-shedEIS scoping.DOC

Comment Letter No. 5 – Yakima County Public Services, Dean Patterson, Environmental & Natural Resources Manager

5-1. Comment acknowledged. As noted in Section 1.5, the purpose of a Programmatic EIS is "to evaluate nonproject governmental actions such as policies, plans, or programs and is used as the basis for future project decisions." The Programmatic ACWRP EIS is a programmatic level environmental evaluation of conceptual alternatives that could be selected for the ACWRP. As stated in Section 1.6, "Elements of the ACWRP would be selected from the alternatives evaluated in this EIS" and additional project level evaluation would be conducted as appropriate for the selected elements of the ACWRP.

5-2. As stated in Section 2.1 of the EIS, the alternatives presented in the Programmatic EIS are conceptual approaches to watershed restoration. Conceptual level details of the reservoir and dam were included in the EIS as described in Section 6.2.2 and Appendix A. Conceptual level restoration projects are presented in Section 6.5 and Appendix C. In addition, as described in Section 1.10 of the EIS, a separate study is being conducted on more specific restoration projects and potential funding for those projects. The results of that study will be available from Ecology in June. The County has been invited to participate in that project. As stated in Section 1.6 of the EIS, additional SEPA analysis will be conducted on the specific components of the ACWRP as appropriate, including a reservoir and restoration projects if those are chosen as part of the ACWRP.

5-3. The general types of restoration projects considered in the EIS are listed in Section 2.3.3.1. The purpose of the EDT model described in Sections 4.5.1.1 and 6.5 was to determine where habitat restoration efforts would provide the most benefits, on a reach basis. The priority reaches for habitat restoration are listed in Section 4.5.1.3 of the EIS. A separate project is being undertaken to identify specific restoration projects for the priority reaches and funding sources for those projects. The results of that study will be available from Ecology in June 2005. As the components of the ACWRP are developed, County projects will be integrated into the restoration plan.

5-4. As described in responses to your Comment 5-2 above, conceptual level details of the reservoir operations were included in Sections 6.2.2 and Appendix A. The hydrographs that you requested are included in Appendix D and summarized in Section 6.2.2.

5-5. The requested change has been made.

5-6. The language has been changed to clarify the date of the zoning districts.

5-7. The text in Section 4.7.3.2 has been clarified based on input from the Yakima County Planning Department.

5-8. As noted in the response to Comment Letter 1, Comment 9 and in Section 3.3.3 of the Final EIS, the Shoreline Management Act does not apply to the Yakama Reservation. WAC 173-18-430 specifically excludes the lands on the reservation from designation as Shorelines of the State.

5-9. The long-term impacts to surface water flows resulting from our analysis of the proposed reservoir are included in Section 6.2.2. A more thorough discussion of the flow routing analysis is included in Appendix D. The long-term impacts of diversions to the proposed reservoir on fish habitat are included in Section 6.5.2. A detailed description of the analysis done to determine impacts to the fish habitat are included in Appendix C. More detailed analyses will be conducted in future SEPA evaluation of program components.

5-10. The groundwater impacts discussed in Section 5.3 are short-term construction impacts. Operation or long-term impacts are discussed in Section 6.3 and include changes in the canal system and use of reservoir water.

5-11. Instream flows, including habitat forming flows, are evaluated in Section 6.2 of the EIS. As referenced in Section 6.2, the detailed discussion of the analysis of long-term impacts to surface water due to the proposed reservoir is included in Appendix D. That analysis included an allowance for “channel-forming” flows, meaning that flows greater than 350 cfs would be routed downstream as flood flows rather than being diverted to the reservoir. Additional evaluation of the impact of flows on habitat would be conducted in future SEPA documents following selection of the components of the ACWRP.

5-12. The maintenance of minimum instream flows is included in the alternatives analysis of the EIS (see Section 6.2 and Appendices A and D). As noted in Section 6.2.2, a detailed analysis of instream flow targets was not included in the programmatic EIS, but would be undertaken as part of a project-level EIS. The maintenance of minimum instream flows would be part of the Joint Operating Agreement that would be developed to implement the selected ACWRP as noted in Section 1.10 of the EIS.

TAYLOR CONSULTING GROUP L.L.C.
• Policy Development • Government Relations • Land Use

DEPT OF ECOLOGY
Received
MAR 24 2005
CENTRAL REGION OFFICE

March 22, 2005

Mr. Derek Sandison, Regional Director
Central Regional Office
Washington State Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, WA 98902

RE: Ahtanum Creek Watershed Restoration Program – Draft Programmatic EIS

Dear Mr. Sandison,

6-1 On behalf of the Ahtanum Irrigation District I would like to thank you for the opportunity to comment on the above mentioned document. This Draft Programmatic EIS represents thousands of hours and many years of work to arrive at where we are today. The Ahtanum Irrigation District would like to thank you for the dedication you have given to this project. We are confident the Final Programmatic EIS will show Alternative 2 as the "preferred alternative" based on the benefits it brings to the watershed as a whole.

6-2 As a whole, the Draft Programmatic EIS is well written and concise, which will provide decision makers with the information necessary to make long-term decisions. We have attached our comments on the Draft Programmatic EIS for inclusion as part of the public record. The issues raised in the attached comments are based on personal experiences, observations and on ground facts. The Board of the Ahtanum Irrigation District would like to offer you, your staff and the consultant an opportunity to discuss these issues should any questions arise.

Once again, on behalf of the Ahtanum Irrigation District we thank you for the opportunity to comment on the Draft Programmatic EIS for the Ahtanum Creek Watershed Restoration Program. Should you have any questions, please don't hesitate to contact us.

Sincerely,
Taylor Consulting Group

D. V. Tayl

David V. Taylor, Senior Consultant

Cc: Ahtanum Irrigation District

1661 Beane Road, Moxee, Washington 98936 • 1(509) 949-6445 • 1(509) 452-7705 fax • tcg@nwinfo.net

Ahtanum Irrigation District Comments
on the
Draft Programmatic EIS for the Ahtanum Creek Watershed Restoration Program

6-3 1. Page 3, Fact Sheet: The Fact Sheet indicates a project level EIS for the reservoir would be prepared in 2007. We believe this process could begin in 2005, concurrent with the development of the Ahtanum Creek Watershed Restoration Program.

6-4 2. Page 1-1, Section 1.1: In addition to Wiley City and Tampico, the unincorporated town of Ahtanum should be included.

6-5 3. Page 1-2, Section 1.1: The Draft Programmatic EIS describes the diversions in Ahtanum Creek as being inadequate to meet the water demand for crops growing in the watershed, and these inadequacies lead to relatively low crop value. This analysis demonstrates the need for irrigation delivery improvements and for water storage, both of which could be achieved through implementation of Alternative 2.

6-6 4. Page 1-2, Section 1.3: This section provides an excellent description as to the purpose and need for watershed restoration. In addition, three of the four bulleted items describe issues that could be addressed through construction of the Pine Hollow Reservoir.

6-7 5. Page 1-5, Section 1.5: The document describes the purpose of a Programmatic EIS as an evaluation of "nongovernmental actions such as policies, plans or programs and is used as the basis for future project decisions." Given the described purpose of a Programmatic EIS, we believe the Department of Ecology should consider designating the Ahtanum Creek Watershed Restoration Program a Planned Action under Title 43.21C RCW and Chapter 197-11 WAC in order to facilitate implementation projects. We believe such a designation meets the intent of the Planned Action statutes and rules and would allow implementation of some restoration projects much more quickly. For example, projects meeting RCW 90.58.147 which utilize best management practices could move forward with little or no review based on the contents of this programmatic EIS.

6-8 6. Page 1-5, Section 1.6: The document indicates a 30-year timeframe was chosen because it is the likely period in which the benefits of habitat restoration would be achieved. We would ask Ecology to consider the utilization of hybrid vegetation as a temporary means to achieve habitat improvements. A planned residential development in Walla Walla County has utilized such techniques in order to achieve habitat improvements in a very short period of time. Once native vegetation is established, the temporary hybrid vegetation is removed.

6-9 7. Page 1-12, Section 1.9.2.2: The Draft Programmatic EIS indicates construction of the Pine Hollow Reservoir would increase water supply for irrigation and instream flows; however, even with construction of the reservoir other supplemental irrigation sources would be needed to meet the irrigation demand of the basin. The factual basis for this statement needs to be explained in detail. Are the additional irrigation needs based on the Practicably Irrigable Acreage (PIA) for the Yakama Indian Reservation?

6-10 In addition, the DEIS indicates "cultural impacts under Alternative 2 could include prohibiting access of tribal members to the Pine Hollow area." We believe this potential impact is already occurring as the proposed reservoir site is private property and, as such, this section should be revised to reflect current circumstances.

6-11 8. Page 1-14, Section 1.9.3: We agree and concur that the Department of Ecology must evaluate new water right applications and water right change applications to determine if existing water rights would be impaired. We believe the document should specify that any approved water right change applications would retain their priority dates.

6-12 9. Page 3-3, Section 3.2.1.2: This section discusses water right change requests and indicates the Yakima County Water Conservancy Board would review any change application requests associated with the Ahtanum Creek Watershed Restoration Program. Although we are not necessarily opposed to the Yakima County Conservancy Board reviewing change requests, we believe the Board should only be involved in change requests not associated with the Pine Hollow Reservoir. Because a new storage right is required from the Department of Ecology, we believe the DOE should review all new water right and change applications specifically associated with the Pine Hollow Reservoir as a consolidated application.

6-13 10. Page 3-3/4. Section 3.2.1.4: In the discussion of trust water rights, the document cites RCW 90.38.030 and describes how some trust water rights are created. Does the DOE view the proposed Pine Hollow Reservoir as a mechanism to create trust water rights in the Ahtanum Creek basin?

6-14 11. Page 3-4, Section 3.2.1.5: This section discusses the ongoing Yakima River Adjudication and explains "lost or extinguished" water rights. It should be noted extinguished water rights are not trust water rights, as defined by the statute.

6-15 12. Page 3-5, Section 3.2.3: It is our understanding the Yakama Nation's water rights are not being specifically adjudicated through the Yakima River Basin adjudication. In addition, the McCarran Amendment only allows state courts to adjudicate federally reserved rights during a statewide adjudication. The information contained in the document should be clarified.

6-16 13. Page 3-7, Section 3.3.1: Discusses the Federal Endangered Species Act and specifically cites the Section 9 "take" prohibition and that "harm" has been defined to include significant habitat modification. The Section also indicates the U.S. Supreme Court has upheld this definition. Section 3.3.1 does not, however, include a discussion related to the "actual death or injury" standard upheld by the Courts.

In Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, the U.S. Supreme Court affirmed regulations defining "harm" to include significant habitat modifications and other acts that actually kill or injure wildlife. The Court concluded that any person may be liable for actions that indirectly take a listed species through habitat modification. However, the Court also stressed that liability for take is contingent on evidence that such

6-16 habitat modification is the immediate cause of actual death or injury to a listed species. The 9th Circuit case Defenders of Wildlife v. Bernal, illustrates the "actual" death or injury standard imposed by the Supreme Court. In Defenders of Wildlife v. Bernal a school district sought to build a new school in critical habitat for the endangered pygmy owl. The Court found that even though the school district's action might adversely affect the habitat of the endangered owl it was not a take because there was no proof construction of the school would cause an actual death or injury.

6-17 14. Page 3-7, Section 3.3: This section describes several federal and state habitat management programs. The Washington State Growth Management Act (Title 36.70A RCW) and Watershed Planning Act (Title 90.82 RCW) should also be discussed within this section.

6-18 15. Pages 4-7&8, Section 4.2.2: Based on the discussion contained in Section 4.2.2 and information contained in Figure 4-3 we believe the need for irrigation storage has been clearly demonstrated.

6-19 16. Page 4-10, Section 4.2.3: The DEIS indicates continuous flow in Ahtanum Creek has been maintained since 2000. Based on personal observations of several AID Board members, 2002 was the first year continuous flow was maintained in Ahtanum Creek.

6-20 In addition, previous studies in the Ahtanum Creek watershed show the WIP canal as having substantially lower efficiency in conveyance. We would ask the information from the previous studies be reviewed and included in this EIS.

6-21 17. Page 4-25, Section 4.5: This section describes the fish species present in the Ahtanum Creek watershed. Included in the list of fish species is summer steelhead, including its resident form (rainbow trout), and indicates it is listed as threatened under the ESA. This statement is inaccurate in that resident rainbow trout are not listed under the ESA. In addition, the legality of providing ESA protection to an unlisted species has not been settled in the courts.

6-22 18. Page 5-4, Section 5.3.2: Could construction of the Pine Hollow reservoir increase the groundwater level in the area? If so, what positive impacts could be experienced from an increase to groundwater levels?

6-23 19. Page 6-5, Section 6.2.2: The document cites construction of the reservoir would not provide an adequate irrigation supply for the entire WIP and AID. Based on the information contained in the Draft programmatic EIS and other studies previously prepared, it appears adequate irrigation supply for AID and WIP would occur if the PIA were not included in the figure. We ask that the reservoir be evaluated for providing water to the current irrigable acreage only.

6-24 20. Page 6-7, Section 6.2.2: The DEIS points to the temperature model which indicates water released from the reservoir would exceed the 16 degrees C threshold for salmon and trout spawning in August and September. Previous studies have indicated water

6-24 released from the reservoir would be too cold for salmon and trout spawning. This information needs to be clarified prior to issuance of the FEIS.

6-25 21. Page 6-13, Section 6.3.2.4: This section describes the transferring of groundwater rights in exchange for receiving reservoir water. It must be noted the groundwater rights described in this section are private property rights independent of the Ahtanum Irrigation District. Whether or not these private groundwater rights are transferred should not be included in this evaluation, as AID has no control over these rights.

6-26 22. Page 6-19, Section 6.4.2: This section describes potential impacts to plants and wildlife and indicates a mixture of native and non-native vegetation is likely to colonize the mud flats during the summer. It is important that an aggressive noxious weed elimination program be implemented in order to prevent their spread to agricultural lands.

6-27 In addition, this section cites the John Cox Ditch as being lined and piped. While we don't oppose lining the John Cox Ditch, we do have serious concerns with piping the conveyance ditch. The John Cox Ditch captures runoff from Pine Mountain and Cottonwood which are used by the AID for irrigation purposes.

6-28 23. Page 6-33, Section 6.6.2: It should be noted the dam would be located on the eastern end of the canyon. In addition, we believe most potential aesthetic impacts will be negated by burying conveyance piping.

6-29 24. Page 6-56 & 57, Section 6.12.2.1: We believe the overall amount of electricity used within the AID will be reduced because the majority of the system will be pressurized. In addition, although AID does not anticipate generating hydropower at this time, we do not want to foreclose that option for the future. We believe the reservoir may be used to create the electricity needed to pump to the limited areas where the system will not be pressurized.

6-30 25. Page A-1: The Reservoir Operation Information should be updated to include the following information:

A. A "smart" diversion will be included at the Cottonwood interceptor, based on the Dames and Moore study; and

6-31 B. When the reservoir is full some diversion would occur to equalize the reservoir level.

6-32 In addition, service to the customers **WEST** of the reservoir may require pumping.
6-33 Finally, we ask the various Fish and Wildlife Agencies decide whether they want the reservoir to augment instream flows.

6-34 26. We believe the water yield from the Pine Mountain water flow has not been considered and we believe a properly constructed interceptor could catch high flows and divert the flows to the Pine Hollow Reservoir, thereby increasing the total water supply available.

Comment Letter No. 6 – Taylor Consulting Group, David Taylor, Sr. Consultant

6-1. Comment acknowledged. The Final EIS will not include designation of a preferred alternative. The components of the restoration plan will be selected after completion of the Final EIS and will be selected jointly by Ecology, the Ahtanum Core Group, and other stakeholders. Selection of the components of the restoration plan will require agreement among the stakeholders, including the Yakama Nation.

6-2. Comment acknowledged.

6-3. Preparation of a project level EIS could not begin until the components of the restoration plan are selected and agreements have been reached among the stakeholders. This is likely to take until the end of 2005. In addition, preparation of a project level EIS would require the resolution of details associated with the ACWRP such as funding, which would determine whether a National Environmental Policy Act (NEPA) evaluation would be required. The project level EIS will be started as soon as reasonable.

6-4. Ahtanum has been added as an unincorporated town.

6-5. Comment acknowledged.

6-6. Comment acknowledged.

6-7. Ecology has consulted with Yakima County planning staff regarding the feasibility of incorporating the Pine Hollow Reservoir as a Planned Action. County staff have indicated that the County does not typically do Planned Actions and staff are not certain that a Planned Action would be appropriate for the reservoir. County staff indicate that permitting the project through the normal zoning process and doing a separate construction EIS for the reservoir would be the appropriate course of action. If an ACWRP is developed that includes a reservoir, Ecology will continue to consult with the County on the appropriateness of the Planned Action process.

6-8. Hybrid vegetation, such as hybrid poplars, exhibits very fast growth response. While this does accelerate the achievement of some of the desired restoration functions (for example shade), it does not contribute as much as native vegetation does to other desired attributes such as wildlife habitat or contributions of large wood to streams. Hybrid trees, for example, do not produce wood that persists as long in the stream. Accepted riparian restoration practices emphasize, where possible, the use of vegetation that is native to the watershed. The concept of using hybrid vegetation will, however, be considered as the Core Group moves forward with developing enhancement alternatives.

6-9. The Pine Hollow Reservoir would increase the reliability of surface water supplies. However, the reservoir would not yield enough water to reliably meet 100 percent of irrigation demands throughout the season. The irrigation demands used as a baseline in this study were estimated based on the survey of water users completed for the *Ahtanum Creek Watershed Assessment* (Golder, 2004). The information collected in the survey represents the acreage and types of crops irrigated in 2002. The baseline demand scenario is an estimate of the total irrigation demand generated by those acreages and types of crops. The estimated baseline demand is greater than the average estimated yield of the reservoir and so additional water sources would be needed to meet the irrigation demand generated by those acreages and types of crops. The irrigation demands used for the analysis are discussed in detail in Appendix D of the EIS.

The baseline demand scenario and reservoir analysis do not necessarily include irrigation demand for all acreages included in the Practicably Irrigable Acreage (PIA), or for any other acreages that were not being irrigated at the time of the crop survey. The details of operation of the reservoir with respect to water rights and irrigation needs would be refined in the future if a reservoir is included in the components selected for the ACWRP.

6-10. The statement regarding tribal access to the reservoir area has been revised per Comment Letter 1, Comment 18.

6-11. A statement regarding changes and transfers retaining their original priority date has been added to Section 3.2.1.2.

6-12. We agree that it would make sense for all applications for new water rights and changes associated with construction of a reservoir to be considered together. Ecology will consider combining the water rights applications. A sentence has been added to Section 3.2.1.2 clarifying that applications for change can be filed with either the County Conservancy Board or Ecology.

6-13. The Pine Hollow Reservoir would not be a mechanism to create Trust Water Rights, however; some of the conservation measures undertaken as part of the ACWRP could create Trust Water Rights, depending on the funding source. See Section 6.13.2.

6-14. The limitations of trust water rights are clearly described in Section 3.2.1.4.

6-15. The Yakama Nation's water rights are being adjudicated as part of the Yakima Basin Adjudication. The McCarran Amendment allows adjudication of federally reserved water rights in a "general stream adjudication." A federal court in Oregon has held that an adjudication that involves only surface water rights and not groundwater rights is a "general adjudication" for the purposes of the McCarran Amendment.

6-16. Comment acknowledged.

6-17. Brief discussions of the Growth Management Act and the Watershed Planning Act have been added to Section 3.3 of the Final EIS.

6-18. Comment acknowledged.

6-19. Section 4.2.3 has been revised to reflect your comment regarding the year in which year-round stream flows were maintained in Ahtanum Creek.

6-20. Section 4.2.3 has been revised to reflect your comment regarding the relative efficiencies of AID and WIP conveyance facilities.

6-21. Section 4.5 has been revised to clarify that rainbow trout is not a listed species.

6-22. Section 5.3.2 is a discussion of short-term impacts to groundwater. Long term impacts, including positive impacts to groundwater levels, are addressed in Section 6.3.2.1.

6-23. See the response to your Comment 6-9 above.

6-24. The temperature data provided in the EIS is based on thermal modeling of the reservoir under the conditions assumed for Alternatives 2 and 4. We are not aware of previous studies that used thermal modeling to determine the impact of water temperatures on fish. According to the thermal modeling done for the EIS, the temperatures from the reservoir would only exceed the 16 °C threshold for salmon and trout spawning during the late summer when the reservoir level is low. Based on the results of the EIS analysis, the supplemental flow from the reservoir would be small relative to the flows in the main stem and so the impact on temperatures in the stream and would not be considered a significant issue for fish habitat (see Section 6.5.2.2).

6-25. Section 6.3.2.5 is a general discussion of the impacts to groundwater levels if groundwater rights were exchanged for more reliable surface water rights. This transfer could occur as a result of construction of the reservoir and needs to be discussed as a potential impact. It is not intended to imply that Ahtanum Irrigation District has any control over the transfer of those rights. A sentence has been added to Section 6.3.2.4 to clarify that the groundwater rights are privately held.

6-26. Section 6.4.5 states that a noxious weed control program would be developed as part of the implementation of the ACWRP.

6-27. The analysis completed for the EIS assumed 10 percent conveyance loss through the renovated Johncox Ditch. Our analysis estimated that 17,000 acre-feet would be diverted to the proposed reservoir during an average year. The resulting 1,700 acre-foot loss is significant. Piping the ditch is mentioned, but may not be feasible for the reasons you mentioned. Piping the ditch would also likely require multiple large diameter pipes to provide the needed capacity, which could be very expensive.

6-28. The text has been changed to reflect this comment. Your comment about aesthetic impacts is acknowledged.

6-29. Your comment regarding the potential for an overall reduction in the amount of electricity used in the Ahtanum Irrigation District is acknowledged. Hydropower generation was not considered as part of the conceptual alternatives for the ACWRP, but could be considered in the future.

6-30. Our understanding is that the “smart” diversion would be located on the North Fork of Ahtanum Creek at the top of the Johncox Ditch. Updated or corrected information would be incorporated into a detailed operation plan if the reservoir is included in the restoration plan.

6-31. The reservoir operation information (Appendix A) has been revised to indicate that the diversion would operate to fill the reservoir and keep it as full as possible.

6-32. The reservoir operation information (Appendix A) has been revised to indicate that service to customers west of the reservoir would require pumping.

6-33. Comment acknowledged. A decision on the use of reservoir water to augment streamflows would be part of the decision process when the components of the ACWRP are selected.

6-34. The Pine Mountain drainage was included in the flow routing analysis as an inflow into the reservoir. The details of operation of the reservoir will be refined in the future if the reservoir is included in the ACWRP. A more detailed analysis of the interception of runoff should be considered at that time.

Ann Root

From: Derek Sandison
Sent: Thursday, March 03, 2005 11:57 AM
To: Ann Root; Molly Adolfson
Subject: FW: EIS-

fyi

-----Original Message-----
From: Wellner, Joanne
Sent: Thursday, March 03, 2005 11:51 AM
To: Sandison, Derek
Subject: EIS-

7-1 Today a gentleman named Robert McInnis came in with a NOA for the EIS. He said he had been looking at a neighbors and noticed an error on figure 4-2. It shows on the figure that his well is 300 ft south of Bachelor Creek and it is 300ft south of Hatton Creek.

Joanne R. Wellner
Dept. of Ecology-CRO SEA & Admin. Assist.
509/575-2680
jwel461@ecy.wa.gov

Comment Letter No. 7 – Robert McInnis

7-1. Comment acknowledged. As noted on Figure 4-2, the source of the map is the Ahtanum Creek Watershed Assessment prepared by Golder Associates. No additional research on well locations was conducted as part of the environmental analysis for the EIS. A note has been added to Figure 4-2 to indicate the correct location of the McInnis well.

Vernette Phillips
5597 S. Gledhill avenue
apt. L.
Marysville, California
95901-7037

March 17, 2005

Derek Sandison
Department of Ecology
15 West Yakima avenue Suite 200
Yakima, Washington

Re: Ahtanum Creek Watershed

Dear Mr. Sandison:

8-1 I myself am attending school here in California.
Please send me a copy of your Final Draft of the
Ahtanum Creek Watershed Containing 200 pages.

8-2 Comment: As of Today I am still not clear as to the final Orders of Court Decisions Pertaining to the Area. I am a land holder and as of today have not received any permits or Legal Documents to Enter nor Conduct any improvements. No starting Dates of Contracts, Ect.
there is much Digging and land lease issues within Our tribal Government that I have not been informed of.

8-3 Gathering Data is time consumming and involves a lot of Currency to process your findings. I'm All for education. But when it comes to bidding for a project through our Legislation Funding (GRANT)

Page II

Comment Continued:

I do hope that as a constituent, I also will be
8-3 able to be heard. For my name is on your mailing
List of "Persons of Interest"

I do not agree with any Economic Development in
that area. Yes the Population Growth and our
families are growing and buying properties in
the area and at this time we have needs.
8-4 Yakima Schools needed to co-ordinate the "Return
of their Fingerlings", which they planted in our
Ahtanum Creek. Yakima River is our Natural Fish
Hatchery. The Elder's know how we the Native American
Indians of the Yakama Nation. Survive from this
God given area.

Yakama Nation Headquarters are writting asking me
for their consent to Study the area.
There's Non-Indians Leasing/Renting our tribal allotments
8-5 And No Currency is Received but they have their
Private Property Signs; up; Denying us the Land owner's
to enter or use our right-of-way to gather our
Seasonal Traditional Foods.

Please send me a copy of your Draft to the
8-6 address above. And please except my comment
and main points of interest

Thank You, I'll be waiting for your Reply.

Vernette Phillips 3/17/05
#3775 Yakama Enrolled
Tribal Land Holder

Comment Letter No. 8 – Vernette Phillips

8-1. A copy of the Draft EIS was sent to you.

8-2. Comments acknowledged. The actions you note are not part of the ACWRP.

8-3. Comment acknowledged. Your name is on the mailing list and you will continue to receive information about the ACWRP.

8-4. Your opposition to economic development in the area is acknowledged.

8-5. Comment acknowledged. The actions you note are not part of the ACWRP.

8-6. As noted in response to your Comment 8-1, a copy of the Draft EIS was sent to you and your comments are included in the Final EIS.

March 20, 2005

Mr. Derek Sandison
Central Regional Director
Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, WA 98902-3452

Dear Mr. Sandison:

Re: Ahtanum Creek Watershed Draft Programmatic EIS

My comments on the draft programmatic EIS are as follows:

9-1 1) You need an Option 5, Conservation Only. From what I can see this option seems to be the lowest cost with the largest water benefit.

9-2 2) You need to re-do the economic tables or provide a cost analysis, which would show the cost of each option without adding in things like farm profits and net downstream flows.

9-3 3) How can you justify further wasting tax dollars (*Herald-Republic 3/20/05 story)* when the draft EIS states the reservoir water could be claimed by the Yakama's to irrigate its PIA?

9-4 4) It seems that almost everyone involved in this project stands to gain if the project is constructed. There are representatives from irrigation districts, DOE, Fisheries, Wildlife, and paid consultants. Who represents the taxpayer who will end up paying for this project or the landowners who will lose their property?

9-5 5) The study lists what conservation would save in Option 2, but it does not list how much water is saved by Option 3, conservation and habitat restoration without a reservoir.

9-6 6) How many landowners are involved with the 11,000 irrigated acres in question?

9-7 I would also like to know how much has been spent to date on these studies for the Pine Hollow reservoir and who has paid the bill.

Sincerely,

Bob West

Bob West
PO Box 521
Yakima, WA 98907-0521
509-972-2550
wwwest@nwinfo.net

Comment Letter No. 9 – Bob West

9-1. Alternative 3, Watershed Restoration without Storage is a "conservation only" alternative from the perspective of improvements to agricultural water supply. Since that is only one of the purposes of the ACWRP, Alternative 3 includes a habitat restoration component to meet the purpose of providing a net benefit to the watershed aquatic ecosystem (Section 1.4). Your proposed "conservation only" alternative would not meet the objectives of the proposal.

9-2. As stated in Section 6.10, an economic analysis is not a required analysis under SEPA. The analysis in the EIS was included to provide a general understanding of the potential economic impacts of the proposed alternatives at a programmatic level. The analysis was not intended as a cost-benefit analysis and therefore, does not include all of the economic elements requested in your comment. As stated in Section 1.6, additional economic analysis could be required for some elements that could be chosen for the ACWRP.

For the purposes of the EIS, it is appropriate to include farm profits and net downstream flows because the EIS is analyzing the potential impacts and benefits of a watershed restoration program, not just Pine Hollow Reservoir.

9-3. As stated in the EIS (Section 6.13.2), if a reservoir were constructed as part of the ACWRP, the Yakama Nation could claim stored water to provide a source of water for additional Practically Irrigable Acreage (PIA) on its lands. The issue of water for PIA would be resolved as part of the negotiations for a Joint Operating Agreement developed for implementation of the ACWRP and operation of the reservoir (Sections 1.10 and 6.13.5.2). It is unlikely that a reservoir would be constructed as part of the ACWRP if the Yakama Nation would claim the stored water for PIA, because the objectives of the ACWRP would not be met under that circumstance.

9-4. One of the purposes of the SEPA is to disclose the potential impacts of a proposal to the public and to solicit public input on a proposal. That public input becomes part of the public record and is included as part of the decision-making. For the ACWRP, there will be additional opportunities for public input on the project when project level environmental analyses are conducted and before the state Legislature should the state undertake funding for the reservoir.

9-5. Information on potential water savings through conservation measures is described in Section 6.2.2 for Alternative 2. Section 6.2.3 states that the impacts of conservation for Alternative 3 would be the same as those for Alternative 2.

9-6. The 11,000 irrigated acres figure is based on the Golder Associates *Ahtanum Creek Watershed Assessment* (2004). The Golder acreage calculation was based on surveys of landowners in the watershed and limited on-farm visits. The *Watershed Assessment* did not attempt to determine how many landowners were involved with the 11,000 acres irrigated. The number of landowners who would benefit from the reservoir can be approximated by the number of landowners assessed by the Ahtanum Irrigation District. In 2005, the District is assessing approximately 1,600 landowners. Additional landowners associated with the Johncox Ditch and other irrigation systems would also benefit from the reservoir.

9-7. The only study to date that has been conducted exclusively on Pine Hollow Reservoir was the Dames and Moore Constructability Review that was completed in 1999. The Dames and Moore study was funded by State Referendum 38 funds. The cost of the project was $300,000. The other studies have examined restoration of the watershed, with Pine Hollow Reservoir included as only a component of an overall restoration of the watershed. The 2004 Golder Associates Ahtanum Creek Watershed Assessment was funded by a grant from the U.S. Department of Agriculture (USDA) to AID. The USDA grant was passed through the Washington State Department of Agriculture to AID which in turn, provided funds to Ecology to conduct the study. The cost of the Watershed Assessment was $369,000. This Ahtanum Creek Watershed Restoration Program EIS was funded through the State Drought Preparedness Account and the State Building Construction Account. The cost of the ACWRP EIS was $325,000.

Comment Letter No. 10

March 20, 2005

Mr. Derek Sandison
Central Regional Director
Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, WA 98902-3452

Dear Mr. Sandison:

Re: Ahtanum Creek Watershed Draft Programmatic EIS

My comments and questions about the draft EIS for the Ahtanum Creek Watershed Restoration Program are:

10-1

1. Mud Flats. In all sections where the mud flats are mentioned, there should be recognition that, in addition to weeds growing, there will be an increase in water insects, particularly mosquitoes. Receding water will leave small pools and puddles ideal for mosquito breeding—in the season in which they will be breeding most prolifically. This should mention the serious diseases mosquitoes carry and mitigation necessary.

10-2

2. Economics. It is interesting that, as far as I can tell, in Appendix E the economic models seem to assume only added value comes from the projects. The text of the document states that any farm profit at all assumes federal and/or state taxpayers are paying the capital costs. Yet farm profits come in at $22 million in the first ten years, with almost $50 million each ten years thereafter.

   I believe the document should clearly state the anticipated COST of each option. Not doing so allows proponents to say the reservoir costs $82 million *(Yakima Herald article 3/20/2005)*, when both reservoir options (Options 2 and 4) list the construction cost at $134 million. Stream channel improvements and habitat restoration are not included in that figure. In addition to construction being a potential one-time boon to the local economy, there needs to be some analysis that will help determine whether there is enough potential improved farming on 11,000 acres to justify the cost of the project. The report should also mention whether or not the capital costs are inclusive or exclusive of interest on any loans.

On page 6-48 the report says farm profit assumes taxpayers pay the capital costs, rather than the farmers, but the added property value of $1,500 per acre (page 6-49) accrues to the landowner. Why should taxpayers pay to increase the wealth of the land owners? That's $16.5 million in increased value going to just a few
10-2 ($1,500 x 11,000 acres benefiting from the project). Are irrigators going to invest a like amount in the project to accrue this benefit?

How much will the farmers have to pay for the water? How can the irrigation district members make any decisions until they have an estimate of how much the water will cost?

3. Water Rights. We read in the newspaper that the Washington State legislature has a bill with $200,000 in it for more studies for Pine Hollow. And Representative Clements states the proponents need $550,000. Why is this before the legislature when water rights issues are still unresolved? Without a written agreement from
10-3 the Yakama Indian Nation, this will be a waste of money that is very hard to come by in our state and could be better spent on something substantive. Or will the Washington taxpayers foot the bill and then the Yakama Nation gets to come in at the end without spending a dime? Why go forward to any next step until you have a signed agreement with the Yakama Nation? Shouldn't all who benefit be sharing in the cost of these studies?

I hope these issues can be addressed in the final Programmatic EIS.

Suzy West

Suzy West
PO Box 521
Yakima, WA 98907-0521
509-972-2550
wwwest@nwinfo.net

Comment Letter No. 10 – Suzy West

10-1. Information has been added to Section 6.4.2 regarding the potential for mosquitoes to breed in the receding water. The need for mitigation for increased mosquitoes has been added to Section 6.4.5.

10-2. See the response to Comment Letter 9, Comment 2 regarding economic analysis in the EIS.

10-3. The next step would involve development of a watershed restoration program based in part on the analysis from the EIS. This would include development of an agreement among the stakeholders in the ACWRP, including the Yakama Nation. The money included in the legislative package is to fund the process of selecting the components of the ACWRP, which could include any combination of elements evaluated in the alternatives for the EIS. Selecting the restoration plan components requires an agreement among all of the stakeholders, including the Yakama Nation.

Ann Root

From: Derek Sandison

Sent: Tuesday, March 22, 2005 9:58 PM

To: Ann Root

Subject: FW: comments

-----Original Message-----
From: George Glessner [mailto:budg@nwinfo.net]
Sent: Tuesday, March 22, 2005 6:30 PM
To: Sandison, Derek
Subject: comments

Derek Sandison
Regional Director
Central Regional Office
Washington Dept. of Ecology

Dear Mr.Sandison:

11-1 Please know that my husband and I are very much in favor of the Pine Hollow Reservoir. It will provide a source of water when there is need to fight forrest fires in our area, it will help to preserve ground water for our wells, it will make possible the uninterupted flow of water in Ahtanum Creek ,which will allow the trees to grow along the creek, and prevent the fish from being killed from lack of water in the creek every July 10th. -----

11-2 Our understanding is that you will be fair in your buy out of landowners who will be displaced . ------ We do have a concern for those of us who will not be displaced and chose to remain on our property. ----- My husband is retired and we are pretty much on a fixed income. -----Our big concern and fear is that we will be taxed out of our property!! ---- We would like to know if this concern is being addressed and if so how?

Sincerely, Irene and George Glessner
381 W Ponderosa Dr.
Yakima,WA 98902
966-2375

Comment Letter No. 11 – Irene and George Glessner

11-1. Comment acknowledged.

11-2. Implementation of the ACWRP would not involve an increase in general tax rates.

Herke Ranch

19201 Ahtanum Rd.
Yakima, Washington 98903

March 24, 2005

Re: Comments on Pine Hollow Reservoir EIS

Dear Mr. Sandison,

I am writing this response in representation of the Johncox Ditch (as it's president) and as a life long resident of the Ahtanum valley and an AID water user. In fact, our family also utilizes surface water on the Yakima Reservation. Our family has farmed and ranched here continuously since 1871.

I think some real historical perspective is important.

Shortly after this valley was settled, it was discovered that a certain kind of hops grew here like nowhere else that was very much in demand. To put it mildly when it came to this particular hop, the Ahtanum valley and particularly Tampico was King.

I don't offer this to suggest that this hop "supremacy" can be rebuilt with the building of Pine Hollow. The situation that caused the valley's loss of it's hop growing advantage is rooted in the fact that tastes for beer changed dramatically after women
12-1 began drinking beer. No sexism, just fact.

It is well known that hops require a lot of water.

Yet, today there are persistent water shortages. Why?

If then at the turn of the century hops were grown, and I assure you they were and rather well, how is it that today there is no water?

Three large-scale shifts have occurred with respect to the Ahtanum valley, which I believe are largely responsible.

The first was the loss of intensive farming in the Ahtanum valley when hops were lost as a major crop. It's just a fact of life.. This area has a short growing season. No other crop was found to fill the economic niche that hops provided. Granted, there were many crops grown in the valley with hops being just one, but hops "payed the bills".

When hop prices were good, all the hop growers bought a new Buick. In the big picture, the migration of people to the cities was also evident and many smaller ranches and farms consolidated to fewer and larger. Regrettably, much land has already been converted to houses.

The second major shift was the large scale logging that has been conducted in the Ahtanum watershed. Snow melts much more early and more quickly than used to be the case. I can't condemn logging. People need wood products and our family enjoys selling our timber from time to time (though most of that timber is not in this water shed). It is just a fact of life that the surface water is leaving the valley earlier than in the past. Perhaps reforestation of some of the most over-logged lands should be included in the comprehensive plan.

Finally, the "last straw" was the Ninth Circuit ruling that the south-side users get all irrigation water after July 10 each season "that can be beneficially used".

Short of revisiting that court ruling, it's moot. Also, the Ninth Circuit did not destroy any water; it in fact only reallocated it to deny the north side users post July 10th.

Logging is a forgone conclusion. Again, logging did not destroy any water; it just caused run offs to occur more early.

12-1

With regards to the farming that occurred in the past, all of the early irrigation was flood and rill. By today's standards it is considered *wasteful*! I submit to you that this practice in this case was in fact **most prudent.** For in fact, this rill and flood irrigation cause huge amounts of water to fall into the substrate only to re-surface down the valley and be intercepted later in the irrigation season by other irrigators. The run-off during slightly sub-normal to above normal snow pack years in the Ahtanum is hardly timid. Normally, these run-offs (usually May is the biggest month) resemble a flood. The month of May is also a big irrigation requirement month as well. Getting *modern or progressive*, i.e. Converting to sprinklers or houses has cost this valley the use of a treasured water storage facility that did not cost tax money and only cost the farmer for the bigger labor layout as rill & flood are more labor intensive. This underground structure, one that resides under everyone's land, is in fact the first Ahtanum Reservoir.

Once regulation occurred each season, water still became scarce, but the fact that each successful grower "gave it hell" with respect to irrigation early when the water was abundant, the rest of the summer was not as bad as if each grower had just "puttered along" and then dried up like a fool. For in the process of applying "too much" water early when it was available, each grower banked water in the soil profile that the crop used when water was again short later in the irrigation season. A good percentage of the water that entered the substrate was **later** intercepted by other water users down the valley and used to maintain their crops. Success is hard to argue with. The crop did make it to market.

12-1 The operative phrase here is "give it hell when you've got it" really applies to the Ahtanum valley. It constitutes over-irrigation (early) and under or deficit irrigation (late season).

12-2 This whole over/deficit irrigation concept is presently lost on Ecology and the Tribe in the current adjudication. Water duty in all other sub-basins is at .02 CFS. All other sub-basins have the "expectation" that water will be **season long**. What magical powers do the farmers of the Ahtanum possess that allows Ecology et al to believe that half as much water for half the season is constructive?????? Could Ecology clue us into our inner powers that we are unaware of such that we could tap them???? Help in this matter would be greatly appreciated. I guarantee you that the Ahtanum Valley will be one large housing sprawl shortly without it's farmers being allowed to "give it hell" with the early "flood flows" from the Ahtanum Creek. It is inescapable. Once the current adjudication is complete and the likely North-side water duty is "rigidly" fixed at .01 CFS, the matter of conversion of the remaining farms to housing projects is only a matter of when – and a short when at that.

12-3 One needs to look no farther than Ecologies own EIS to confirm that much water is lost from Ahtanum Creek in a number of locations only to resurface later and farther down the valley. Imagine the recharge that occurred with rill and flood irrigation. For with that practice, whole ranches and farms did large-scale recharge merely by irrigating, not just the streambed zone. The beauty of it was that it was done when the Ahtanum's waters were in flood stage if not on the verge of it. Who did this hurt?? I maintain NO ONE! Who will suffer if the whole Ahtanum valley "grows" only houses in the future?

12-4 In Ecologies EIS, it is mentioned that building and operating the Pine Hollow Reservoir will not affect flooding. I suggest instead of designing for "failure", build Pine Hollow for success. Design the conveyance (Johncox Ditch) large enough to handle real flows. This will allow the storage facility to fill with greater confidence. When the Ahtanum "rumbles" it does so for sometimes relatively short times therefore, build the conveyance for SUCCESS.

12-5 I have never heard that it does not take water to sustain fish. If water is actually "out of vogue" with fish people ………… then lets now do away with the minimum flow in the Ahtanum main stem at least for this season. I am referring to "expert opinion" in the draft EIS that implies that the reservoir will not greatly improve fish life.

I have heard that WFDW does not want any Pine Hollow reservoir water for fish. They have said that it will not help the fish in this case. Then why is so much water from other reservoirs being "wasted" on fish? Large amounts are dumped every year from area reservoirs in the name of fish enhancement. Are we to consider this other dumping of water to be malfeasance?? I have heard first that the Pine Hollow water would be too

12-6 warm. I doubt that. Early run-off from the Ahtanum is very cold. A deep pool like Pine Hollow would form would in my estimation not warm up as much as these experts suggest. I have also heard that the water would be too cold. That is laughable on its face. I have worked with enough fish people to know that contention is a joke. It is not even worthy of further comment. And finally, water is being bought from willing farmers to be left in streams to "enhance the fishery". Is this yet another example of malfeasance? I think not. I notice that this draft EIS concludes that temperature change will be small. The premise though is that not much reservoir water will go for fish. Now, that's really hyperbole.

12-6 Experts? Common sense is more reliable. I suggest that this proposed project would greatly help with fish life. I have heard a great deal of hyperbole about fish welfare vs. this proposed project. I am surprised that the reservoir would not be used to enhance fish flow. I also doubt that that condition would persist if Pine Hollow were to be built. Rather, I would predict that not only would the fish interests jockey for significant flows from Pine Hollow, but also that the Yakima Tribe would attempt to seize the remaining water. Thus the North-side irrigators would end up once again empty handed. Worse still, large O&M charges against irrigators and the water going elsewhere.

12-7 As an upper-Ahtanum resident/farmer, I have two over-arching concerns in particular with this project. How will upper end of the valley water rights be handled if the reservoir is built? Will the Johncox have water in the late season as we have been promised? Will it be pumped back up to us from the reservoir or diverted from the creek?? The same question applies to our families ranch. It has been couched both ways.

12-8 What are the O&M charges and any other costs associated with this project that are to be charged to the landowner going to be?

12-9 In conclusion, I support the proposed project to build the Pine Hollow Reservoir. Water is the essence of life. The Ahtanum valley is an area that chronically has either too much water or too little. Storage of excess flows to be metered out during times of shortage is the best solution. Pine Hollow would do this. But how it is controlled and by whom is of paramount importance. The outcome of the adjudication and this proposed project will determine this valleys fate.

Respectfully submitted,

Mark Herke

Comment Letter No. 12 – Herke Ranch, Mark Herke

12-1. Comment acknowledged.

12-2. The establishment of a water duty is outside the scope of the EIS for the ACWRP. One of the purposes of the ACWRP is to improve the irrigation water supply, including increasing the length of the irrigation season.

12-3. The EIS addresses current groundwater conditions, which are controlled by current climate patterns, land use, and irrigation practices. The EIS describes potential changes to groundwater conditions due to redistribution of surface water under various alternatives. The EIS does not address anecdotal descriptions of historical and undocumented irrigation practices, nor does it speculate on the consequences of dramatic shifts in land use.

It is true that some of the excess water applied during rill and flood irrigation percolates to groundwater and can surface in streams to provide streamflow at some time in the future. However, it is uncertain when and where that water will surface in the stream. In addition, considerable amounts of water are wasted from a rill and flood irrigation system evaporation off fields and runoff from the end of fields.

12-4. Flood control has not been included as a primary feature of the proposed diversion and reservoir. As noted in the EIS, the ability of the proposed reservoir to reduce flooding would be limited by the size of the diversion from Ahtanum Creek and maintenance of channel-forming flows. The proposed diversion would have a capacity of 160 cfs. For comparison, the flood flows on the North Fork of Ahtanum Creek are approximately 600 cfs (10-year flood), and 860 cfs (100-year flood). Providing capacity to divert a significant portion of these flood flows to the reservoir would require a much larger diversion and ditch.

The discussion of our analysis included in Appendix D assumes an allowance for "channel-forming" flows, meaning that flows greater than 350 cfs were passed downstream as flood flows rather than being diverted to the reservoir. These flows were identified as the flows that transport material and form the channel, as needed for continued health of the fish habitat. The details of operation of the reservoir and diversion would be refined in the future if a reservoir is included in the ACWRP.

12-5. Water is necessary to sustain fish. The stream flow patterns in Ahtanum Creek watershed have improved over time, and that is assisting the fish populations. The reservoir would be operated to improve the reliability of instream flows, which would benefit fish. However, as pointed out in the analysis of the alternatives, improving flow alone is not sufficient to recover the fish populations. Instream and riparian habitat improvements are necessary to provide for all of the fish life history needs (migration, spawning, and juvenile rearing) and to support population abundance, productivity and diversity.

The Washington Department of Fish and Wildlife does support the Pine Hollow Reservoir concept as stated in their comment letter on the Draft EIS. See Comment Letter Number 3, Comment 1.

12-6. The temperature data provided in this report are based on thermal modeling of the reservoir under the conditions assumed for Alternatives 2 and 4. According to the analysis, the temperatures from the reservoir would only exceed the 16°C during the late summer when the reservoir level is low. See additional information on reservoir water temperature in the response to Comment Letter Number 6, Comment 4.

The intent of Alternatives 2 and 4 is to operate the diversion of water from the North Fork to the reservoir so that the need to discharge from the reservoir to supplement instream flows in the main stem is minimized. Based on the results our analysis, the supplement from the reservoir would be small relative to the flows in the main stem and so the impact on temperatures in the stream and would not be considered a significant issue for fish habitat (See Section 6.5.2.2).

See the response to your Comment 5 regarding instream flows and fish habitat improvements.

12-7. The details of how water would be supplied to irrigators at the upper end of the valley have not been defined. However, the EIS states that the reservoir would require delivery of water to water users consistent with their water rights (Section 6.13.2). That would include delivery to the Johncox Ditch users. The intent of the storage alternative is to provide water for the full irrigation season.

12-8. The costs of the project to the landowner, including operation and maintenance costs are not known at this time. The costs would depend on the components selected for the ACWRP and the funding source for the project, among other issues.

12-9. Comment acknowledged.

STATEMENT OF JEFF PETERS

My name is Jeff Peters and I'm the Assistant Planner for the City of Yakima.

The City of Yakima would just like to go and state their support for alternative No. 2, Watershed Restoration With Storage, and just add that this is a somewhat lesser solution than Blackrock Reservoir, and we're in full support of it.

As one of the many stewards of water resources in the Yakima Valley, the City of Yakima is in full support of the Ahtanum Creek Watershed Restoration Program. Because of the City's long-time involvement in watershed planning and the development of the Yakima Habitat

1-1 Improvement Plan, we are well aware of the extensive efforts by Ahtanum Irrigation District, the Yakama Nation, Yakima County and others to develop the Pine Hollow Reservoir. All of the currently available information supports the position that this project, when completed, will be beneficial to agriculture and to the habitat associated with the Ahtanum Creek corridor. The agriculture benefits will primarily accrue due to a lengthened irrigation season, and habitat will be enhanced as a result of the increased instream flows for fish.

The concept of additional storage throughout the

1-1 Yakima River Basin is an essential tool for the preservation and enhancement of our economy and environment. The Bureau of Reclamation is currently studying additional storage options for consideration in the Yakima River Watershed Plan.

We understand that there is a great deal of work to be accomplished to bring this project to fruition and to realize the potential benefits. However, the City supports the efforts of Ahtanum Irrigation District and Yakama Nation to be good stewards of the natural resources associated with their efforts in the Ahtanum Creek corridor, and the potential enhancements that could result by the development of Pine Hollow Reservoir.

(OPEN HOUSE CONCLUDED AT 7:00 P.M.)

STATEMENT OF DAVID LOCKHART

I am David Lockhart; my name is spelled D-a-v-i-d L-o-c-k-h-a-r-t.

2-1 From what I understand about the proposal for the reservoir, I think it would be a good thing. The benefits for the economy, the farmers, the people in the area, I think, would be a positive. I haven't had an opportunity to read the entire Environmental Impact Statement as of yet; but overall, I think it's a good idea to put the reservoir in.

2-2 There's a lot of unanswered questions: property taxes issues, what that process is going to entail; or when will the property owners who will be impacted by the reservoir, when will they be contacted; and give us specifics about what's going to happen. A lot of unanswered questions still that there's a lot of people concerned about.

STATEMENT OF VERN BURKE

I am Vern Burke, B-u-r-k-e.

3-1

I was just wondering if they had put any funding into this project for long-term insect management, being that the west end of the reservoir, after probably 30, 40 days of water withdrawal, will be a swamp, basically; and so with the bug problem that's going to happen and the West Nile virus thing that's going around, what -- what are they going to do to try to control that?

I'd like that addressed.

STATEMENTS OF DEBORA AND KEN BOYLE

I'm Debora Boyle. I am Ken Boyle. It's B-o-y-l-e.

4-1

DEBORA: It's just that we'd like to see it happen, if it's going to happen, as soon as possible; because we'd like to get on with our lives.

KEN: The farmers need water. We've got to do something, and we're ready to move on. But let's do it.

You know, we've found another place; but we can't go until they do something.

PUBLIC OPEN HOUSE COMMENTS

Commenter No. 1 – Jeff Peters

1-1. The City of Yakima's support of Alternative 2, Watershed Restoration with Storage, is acknowledged.

Commenter No. 2 – David Lockhart

2-1. Comment acknowledged.

2-2 Your comments regarding the uncertainty of details related to implementation of the ACWRP are acknowledged. As stated in the EIS, this environmental analysis was conducted at a conceptual or programmatic level. The details of the ACWRP and its specific impacts on property owners will not be known until the elements of the ACWRP have been selected and additional analysis has been conducted. It is currently estimated that selection of the components of the ACWRP will begin later this year and that additional environmental analysis will be conducted starting in 2006 or 2007.

Commenter No. 3 – Vern Burke

3-1. See the response to Comment Letter Number 10, Comment 1 and Section 6.4.5 of the Final EIS regarding insect control.

Commenter No. 4 – Debora and Ken Boyle

4-1. Comments acknowledged. Timing of construction is dependent on selection of the components of the ACWRP as noted in response to Commenter No. 2, Comment 2.

APPENDIX A – RESERVOIR OPERATION INFORMATION

Reservoir Operation Information

The facilities that would be required to enable diversion and storage in the proposed reservoir include the following:

- A "smart" diversion constructed at the location of the head of the current Johncox Ditch to divert water from the North Fork of Ahtanum Creek to an expanded Johncox Ditch for conveyance to the new Pine Hollow Reservoir. The flow controls would limit the diversion based on maintenance of instream flow targets and channel-forming flows. When flows in the North Fork are less than instream flow targets, as listed in Table D-1 in Appendix D**,** no water would be diverted from the stream. When flows are equal to or greater than channel-forming flows (350 cfs) for a period of consecutive days, no water would be diverted from the stream. ~~When the reservoir is full, no flow would be diverted from the stream~~When instream flow targets and channel-forming flow criteria are met, water would be diverted as needed to fill the reservoir and keep it as full as possible.
- A fish screen, installed at the diversion with a capacity equal to the capacity of the expanded Johncox Ditch (160 cfs).
- Expansion of Johncox Ditch from its current capacity of approximately 15 cfs to a capacity of 160 cfs. This expansion was identified in the *Ahtanum Creek Watershed Assessment* (Golder, 2004) and the *Pine Hollow Reservoir Project Overview* (Dames and Moore, 1999b) as the capacity needed to convey flow to refill the proposed reservoir.
- The proposed 24,000 acre-foot Pine Hollow Reservoir impounded at the lower end by an earth-fill dam. The dam would include an emergency overflow spillway and a piped outlet near the base of the dam.

The controls on the reservoir outlet would first divert flow to the mainstem of Ahtanum Creek to supplement instream flow as needed. Then available flow would be conveyed through a system of pipes to the AID and WIP users as defined by the joint operating agreement developed for reservoir operations. The layout of a conveyance and distribution system to deliver water from the reservoir has not been evaluated as part of this EIS. However, it is anticipated that Alternative 2 would include the following conveyance and distribution facilities:

- An outlet pipe from the reservoir to the mainstem of Ahtanum Creek, extending across the creek to the upper WIP canal.
- Conveyance piping that would extend along the north side of Ahtanum Creek to customers east and west of the reservoir. The *Ahtanum Irrigation District Water Conservation Plan* envisioned a pipe that would extend to Goodman Road on the east. The required length of pipe may be shorter if urban land uses develop to the west of Union Gap that would not require surface water for irrigation. The *Ahtanum Creek Watershed Assessment* (Golder, 2004) determined that a pipe would also be required along the south side of the creek for delivery to WIP customers.
- Service to customers ~~east~~ west of the reservoir would require pumping, as outlined in the *Ahtanum Creek Watershed Assessment* (Golder, 2004).
- Lining or piping of the upper and lower WIP canals.
- Distribution laterals that would deliver water from the main conveyance pipe to the farms where the water will be used.

APPENDIX B – SUPPLEMENTAL INFORMATION ON WATER RIGHTS AND TOTAL WATER SUPPLY AVAILABLE

Supplemental Information on Water Rights and Total Water Supply Available

Water Rights

The following sections provide additional information on water rights in the Ahtanum Creek Watershed and related Yakima River Basin. Information is included on state water rights, federal tribal rights and Bureau Reclamation laws and policies.

State-Based Water Rights

Acquisition of Water Right

Prior to enactment of the surface water code in 1917 and the groundwater code in 1945, appropriative water rights were obtained by following the common law or statutory notice requirements and putting the water to beneficial use. Owners of pre-code water rights have been required to file a water right claim in order to preserve their water rights (RCW 90.14.071). Riparian water rights were obtained through ownership of land abutting the water source, and if such rights were not perfected by 1932 they were lost. Failure to file a claim results in a waiver or relinquishment of the right (RCW 90.14.071).

Since enactment of the surface water and groundwater codes, with one exception discussed below, the only way to obtain authorization to appropriate surface or groundwater is to apply for a permit from the Department of Ecology, develop the water diversion works or construct a well, and apply the water to beneficial use. Once this has been accomplished, the water right has been "perfected" and Ecology will issue a certificate for the quantity of water put to actual beneficial use.

The exception to the requirement to obtain a permit to appropriate water is the legislatively created exemption for the withdrawal of groundwater. Under the exemption, a well can be constructed and water withdrawn from an aquifer without a permit if the water will be used for (1) stock watering purposes, (2) the watering of a lawn or non-commercial garden not exceeding one-half acre in area, (3) single or group domestic uses in an amount not exceeding five thousand gallons a day, and (4) an industrial purpose in an amount not exceeding five thousand gallons a day (RCW 90.44.050). This section of the code is commonly referred to as the "groundwater exemption" and wells developed pursuant to the statute are known as "exempt wells."

Under the state's prior appropriation doctrine, water rights are regulated based upon priority date. In times of water shortage, a senior water right holder with an earlier priority date is entitled to use their full water right before the next junior right with a later priority date can be exercised. The priority date for a pre-code water right is the date the water was first put to beneficial use; for a riparian right it is the date the riparian land was patented from the federal government; and for a right authorized under the water code, once the water right is perfected the priority date relates back to the date of application.

New State-Based Water Rights

In order for Ecology to issue a permit for a new water right the Department must make four findings regarding the application: (1) the proposed use of water must be for a beneficial purpose; (2) there must be water available for appropriation; (3) the proposed use must not impair existing water rights; and (4) the proposed use must be in the public interest (RCW 90.03.290).

There is no single comprehensive definition of the types of beneficial uses, however the Water Resources Act provides the most relevant list of beneficial uses of water for purposes of the permit application process: "domestic, stock watering, industrial, commercial, agricultural, irrigation, hydroelectric power production, mining, fish and wildlife maintenance and enhancement, recreational, thermal power production purposes, preservation of environmental and aesthetic values, and all other uses compatible with the enjoyment of the public waters of the state" (RCW 90.54.020(1)).

There must be water available for appropriation from both a legal as well as a technical perspective. Technically, there must be water physically available from the source to meet the requested quantity of water. Water is legally available only if it can be appropriated without impairing existing water rights either by reducing the quantity available to satisfy those rights or by reducing the quality of the water available. For purposes of the impairment analysis, existing water rights include rights to withdraw or divert water, applications for new water rights (subject to exceptions authorized by rule), and instream flows set by administrative rule. A proposed direct diversion out of a surface water source will clearly affect that source. It is also recognized that withdrawal of groundwater from a source in hydraulic continuity with a surface water body may also reduce flow in the surface water and thus impair the instream flow right.

Finally, Ecology cannot issue a permit if the use of water will be detrimental to the public welfare, but can only issue a permit if the use of water would be in the public interest. The policies in the 1971 Water Resources Act "require allocation of water in a manner that preserves instream resources, protects the quality of the water, provides adequate and safe supplies of water and promotes regional water supply systems that serve the public generally" (Gregoire, et al., 2000). These factors inform Ecology's decision on whether granting an application for a new water right would be in the public interest.

In 1999, Ecology, the U.S. Bureau of Reclamation and the Yakama Nation agreed to study the groundwater resources in the Yakima Basin to develop a hydraulic model for water planning and management. Ecology agreed to withhold decisions on groundwater applications until the study results are in. Potential exceptions to the hold were identified as transfers and changes, public health and safety emergencies and domestic use from exempt wells (Ecology, 1999).

The general rule is that applications for new water rights are processed in the order they are received by Ecology. However, an application that "resolves or alleviates a public health or safety emergency caused by a failing public water supply system currently providing potable water to existing users" may be processed prior to competing applications from the same source of water[1] (WAC 173-152-050). Similarly, an application may be processed prior to competing applications if there is a public health or safety emergency or the proposed use is non-consumptive and would “substantially enhance or protect the quality of the natural environment” (WAC 173-152-050(2)).

Construction and operation of new storage facilities would require obtaining a reservoir permit from Ecology (RCW 90.03.370). Applications for reservoir permits are subject to the permitting requirements in RCW 90.03.250 through 90.03.320. Generally, parties that propose to put the stored water to a beneficial use must also file an application for a secondary permit. However, a secondary permit is not required where a water right permit or certificate for the source of the stored water authorizes the beneficial use (RCW 90.03.370(1)c). A secondary permit would not be required for water users in the Ahtanum Watershed who have water rights to Ahtanum Creek for the entire irrigation season that are confirmed in the Yakima Adjudication. However, for those parties who are confirmed a right to divert only until July 10th each season, a secondary permit would be required. An application for a secondary permit must refer to the reservoir as its source of supply and provide documentary evidence that “an agreement has been entered into with the owners of the reservoir for a permanent and sufficient interest in said reservoir to impound enough water for the purposes set forth in said application” (RCW 90.03.370(1)(a). When beneficial use of the water has been completed and perfected under the secondary permit, a final certificate of appropriation is issued that refers to the delivery works in the secondary permit and the reservoir in the primary permit.

The legislature has directed Ecology to expedite processing applications for certain types of storage proposals: (1) storage facilities that will not require a new water right for diversion or withdrawal of the water to be stored; (2) adding or changing one or more purposes of use of the stored water: (3) adding to the storage capacity of an existing storage facility; and (4) applications for secondary permits to use water from existing storage facilities (RCW 90.03.370(1)(b)). An application for a reservoir permit for a new Pine Hollow Reservoir would not be entitled to expedited processing under the statute.

Relinquishment

Once a water right is perfected, it must continue to be used or it is subject to being lost through abandonment or relinquishment. Common law abandonment requires nonuse for an extended period of time and an intent to abandon the right. Statutory relinquishment occurs when all or a portion of a water right is not used for five successive years, unless there is a sufficient cause for the nonuse (RCW 90.14.160-180). A water right can be relinquished even if it was not the intent of the water right holder to lose the right.

The legislature has defined “sufficient cause” to include, but not be limited to, the following circumstances: drought or other unavailability of water; operation of legal proceedings that

[1] The “same water source” or “source of water” means “any aquifer or surface water body, including a stream, stream system, lake, or reservoir and any spring water or underground water that is part of or tributary to the surface water body or aquifer, that the department determines to be an independent water body for the purposes of water right administration” (WAC 173-152-020(5)).

prevent the use of water; and federal or state leases/options to buy land or water rights that preclude or reduce the use of the right by the owner of the water right (RCW 90.14.140(1)). Several sufficient causes specifically apply to irrigation rights: temporary reductions due to varying weather conditions that warrant a reduction in water use; reliance on transitory presence of return flow in lieu of diversion or withdrawal of water from the primary source when the return flows are measured or reliably estimated; and reductions in water use due to crop rotation (RCW 90.14.140(1)). Specifically in the Yakima Basin, conservation measures implemented under the Yakima River Basin Enhancement Project will not result in relinquishment of the saved water as long as it is reallocated according to the law establishing the Enhancement Project (RCW 90.14.140(1)(i)).

In addition to the sufficient causes for not using water, the following water rights are exempt from relinquishment: a water right claimed for power development; a right used for standby or reserve water supply; water claimed for a future development where there is a fixed and determined development plan within the first 5 years after nonuse and action is taken to develop within 15 years of the last use; municipal water supply purposes water rights; a right leased to another who makes beneficial use of the water and the change is approved by Ecology; a right or portion of a right satisfied by the use of reclaimed agricultural industrial water; and a trust water right (RCW 90.14.140(2)).

In order for a right to be relinquished, Ecology must issue an order notifying the water right holder of Ecology's finding of relinquishment, (RCW 90.14.130), or a court in the course of an adjudication must enter an order confirming that a right has been relinquished (RCW 90.03.110.245). Ecology may also make such a finding when it makes a decision on a change application.

Changes and Transfers

In general, changes in place of use, purpose of use, and/or points of diversion or withdrawal of a water right, or transfers of water rights to others require approval by Ecology under RCW 90.03.380 or 90.44.100. As discussed in the Irrigation District Laws section below, Ecology does not regulate changes or transfers within an irrigation district or joint board of control. In the Yakima Basin, Ecology does not approve water rights transferred to instream flow (RCW 90.38.040(6)). Because water rights in the Yakima Basin are in the process of being adjudicated (see the following section), temporary changes of water rights subject to the adjudication must be approved by the Adjudication Court through an *Order Pendente Lite* (an interim order issued by the court that remains in effect for the duration of the adjudication or a shorter time as specified in the order). Decisions on permanent changes are made by Ecology. In making a decision on a change application, Ecology must make a tentative determination of the validity and extent of the water right, whether all or part of the right has been lost due to nonuse, and whether the change would impair any other water right. When acting on a change application for a surface water right, Ecology may not deny the application based on public interest considerations. Ecology may, however, deny a request to change a groundwater right based on such considerations.

In determining the extent and validity of the existing right, Ecology focuses primarily on how much water has been beneficially used. There are exceptions to the general requirement that a water right be perfected before it can be changed. An unperfected surface water right for municipal water supply purposes may be changed or transferred subject to the conditions identified in RCW 90.03.570 regarding water system plans, instream flow and watershed planning. The point of withdrawal or the place of use of a groundwater right that is still in the permit stage may also be changed. However, the purpose of use may not[2]. Once Ecology has determined the validity of the right, it must assess whether all or part of the right has been relinquished for nonuse.

Finally, in making its decision on a change application, Ecology must determine whether the change would impair existing water rights – either senior or junior in priority to the right sought to be changed. In contrast to an application for a new water right, Ecology is not required to consider potential impairment of pending applications for water rights when Ecology makes a decision on a change application. Existing rights are impaired if there would be a detrimental impact on the quantity or quality of the right or direct interference with the ability to exercise the right. To make this determination Ecology must quantify the consumptive use of the right. If the requested change would increase the amount of water used, the right would be unlawfully enlarged. "A change in the place of use, point of diversion, and/or purpose of use of a water right to enable irrigation of additional acreage or the addition of new uses may be permitted if such change results in no increase in the annual consumptive quantity of water used under the water right." For purposes of this section, "'annual consumptive quantity' means the estimated or actual annual amount of water diverted pursuant to the water right, reduced by the estimated annual amount of return flows, averaged over the two years of greatest use within the most recent five-year period of continuous beneficial use of the water right" (RCW 90.03.380(1)).

There have been recent legislative and administrative changes that allow Ecology to process change applications more promptly than was previously possible. Change applications may now be processed independently of applications for new water rights from the same source. Change applications may also be processed ahead of other previously filed change applications if there is not sufficient information for a decision on the previous application(s) and notice is given to the applicant(s) (RCW 90.03.380(5)). Applications for change may be processed prior to competing applications under the same circumstances as applications for new water rights: for public health or safety reasons. In addition, they may be processed ahead of competing applications if the change would substantially enhance the quality of the natural environment; would provide public water supplies to meet the general needs of the public for regional areas; or if the applicant is a party to an adjudication (WAC 173-152-050(3)).

The legislature has also attempted to speed up the decisions on change requests by authorizing the creation of county Water Conservancy Boards to make initial decisions on such applications (Chapter 90.80 RCW). A Water Conservancy Board applies the same standards as Ecology, and sends its record of decision to Ecology. Ecology may affirm, reverse, or modify the action of a board within 45 days (which may be extended by 30 days) of receipt of the record of decision. If Ecology does not act within the prescribed time period, the decision of the board becomes Ecology's decision.

[2] The issue whether the purpose of use of an unperfected groundwater right may be changed is currently being appealed to Division III of the Washington Court of Appeals in *City of West Richland and Benton County Conservancy Board v. Dept. of Ecology and Pollution Control Hearings Board,* Ct. of Appeals No. 226484-III.

Statutory Adjudication of Water Rights

An adjudication is a quiet title action of existing water rights to determine the rights and priorities for the use of water from a specific water source (RCW 90.03.110-90.03.240). An adjudication cannot grant new uses or new rights, rather the court analyzes claims for existing rights to determine their current validity. The rights are limited to the extent the water is being beneficially used. The surface water rights in the entire Yakima Basin are being adjudicated in Yakima County Superior Court. The decisions made in the adjudication will determine the extent and validity and relative priority of all surface water rights in the Yakima Basin.

An adjudication may be initiated by Ecology or upon a petition by one or more persons claiming a right to divert water (RCW 90.03.110). Ecology files with the superior court a report of the names of all those claiming a right to use water, a description of the claim and a brief statement of the facts relating to the water use. Those claiming the right to divert water are defendants in the case and bear the burden of proving their claimed right. At the end of the adjudication the court issues a decree confirming water rights and describing the nature of those rights. Ecology issues a water right certificate that incorporates the court's findings (RCW 90.03.240). Water rights subject to an adjudication that are not confirmed by the court are lost or extinguished.

To confirm a right that is based upon a certificate the court must find that the water user has complied with the permit conditions for beneficial use and exercised due diligence in putting the water to beneficial use. Claims for rights that were acquired prior to the permit system (1917 for surface water rights and 1945 for groundwater rights) must have been legally created under the common law or statutory notice requirements and perfected by being put to beneficial use. A right is quantified not on the basis of the amount stated in a claim or certificate, but upon the amount actually applied to beneficial use. Once the court has determined the quantity of water in a perfected right, it must determine whether all or a portion of the right has been lost due to common law abandonment or statutory relinquishment. The court also determines the land to which the water right is appurtenant.

Tribal Rights

Federal tribal reserved water rights are primarily based upon the *Winters* Doctrine, which was established in *Winters v. United States,* 207 U.S. 564 (1908). The two main principles of the doctrine are that (1) when the United States creates reservations, it implicitly included a reservation of water in an amount necessary to fulfill the purposes of the reservation, and (2) the priority date of the water right is the date the reservation was created. Courts have generally held that tribal reservations created in the 19th Century were primarily to give the tribes an agricultural base (see, *e.g., Arizona v. California,* 373 U.S. 546, 1963). Creation of a reservation may also imply the use of water for long-established aboriginal uses such as fishing and hunting. The priority date for water for such aboriginal uses is time immemorial (*United States v. Adair,* 723 F.2d 1394 (9th Cir. 1984)). Federal reserved water rights law does not distinguish between surface and groundwater, particularly where the two sources are in hydraulic continuity (*In re the water Rights of Gila River System and Source,* 989 P.2d 739 (Ariz. 1999)).

Federal tribal reserved water rights are not subject to the "use it or lose it" rule that is applicable to state-based water rights; therefore, the rights are not subject to relinquishment or abandonment for nonuse. The reserved rights are for potential future use as well as historic use. The future right for water for agriculture is defined by the practicably irrigable acres (PIA) standard. Those areas susceptible to sustained irrigation at a reasonable cost. The number of acres included within PIA is the number currently under irrigation plus those susceptible to irrigation but not yet developed.

Some reservation lands passed from ownership in trust for the benefit of the tribe to private ownership under the General Allotment Act of 1887 (Dawes Act, 24 Stat. 388). Under the Act a tribal member could be allotted 80 acres of irrigable land for agriculture or 160 acres of grazing land (25 U.S.C. sect. 331). The federal government would hold the allotted lands in trust for an individual tribal member for 25 years, after which the government could convey the land in fee to the allottee. The tribal allottee has a federally reserved water right that is not subject to relinquishment. The tribal allottee may convey his or her property and appurtenant water right to a non-tribal successor. If the tribal allottee has not beneficially used the water prior to selling the property, the non-tribal successor must put the water to beneficial use within a reasonable time after the property passes out of tribal allottee ownership. The right now held by the non-tribal allottee becomes subject to relinquishment.

Federal reserved water rights may be adjudicated in state court under the McCarran Amendment, (43 U.S.C. sect. 666(a)). Under the Amendment, Congress waived federal immunity and allowed the United States to be named in a state water rights general adjudication in its own capacity and as trustee for the tribes. There was some dispute whether a general adjudication required that both surface and groundwater be adjudicated. The Ninth Circuit has determined that groundwater need not be included for an adjudication to be a general adjudication (*United States v. Oregon*, 44 F.3d 758 (9th Cir. 1994)).

Irrigation District Laws

Irrigation districts are public entities formed pursuant to state statute. The primary purpose of an irrigation district is to divert and convey water to water users for irrigation of the lands within the district. An irrigation district may be formed for any of the purposes listed in the statute including the construction or purchase of new irrigation works, or repair or improvement and operation and maintenance of existing works for irrigation of lands within the district, construction or repair of diverting conduits from a natural water supply source to the point of distribution to individuals for irrigation, contracting with the federal or state government for irrigation purposes, and/or performance of all things necessary for the district to exercise the powers in the statute (RCW 87.03.010). In addition, irrigation districts have authority regarding purchase, sale and generation of electric power; provision of water to owners of irrigated lands within the district for domestic purposes; drains and sanitary sewers and sewage disposal and treatment plants; delivery of water to cities within the district; water for fire fighting purposes; and entry into contracts with other irrigation districts, boards of control, municipal or quasi-municipal corporations to jointly acquire and maintain works for irrigation and domestic water, drainage and sewerage (RCW 87.03.015).

Under Washington law, individual water users within the district are the owners of the water rights. An irrigation district is a trustee for the water users within the district and is obligated to deliver water to the water users subject to the bylaws and regulations of the district. Special provisions apply to transfers of water rights within and between irrigation districts. If the transfer is from one district to another, Ecology must receive the concurrence of each district that the transfer will not adversely affect the ability of the district to deliver water to other landowners or impair the financial integrity of the district (RCW 90.03.380(2)). A change in place of use by one or more water users within an irrigation district does not require Ecology's approval if the water use continues within the irrigation district; the only approval required is from the board of directors. If the water is provided by an irrigation entity that is a member of a joint board of control, the joint board must approve the change and it must not cause detriment or injury to existing rights (RCW 90.03.380(3)).

A joint board of control may be formed between

> . . . two or more irrigation entities which are the owners of, have an ownership interest in, or are trustees for owners of water rights having the same source or which use common works for the diversion and either transportation, or drainage, or both, of all or any part of their respective irrigation water supplies (RCW 87.80.010).

An "irrigation entity" means an irrigation district or any other entity that provides irrigation water as a primary purpose" (RCW 87.80.005(2)). An "ownership interest"' "means the irrigation entity holds water rights in its name for the benefit of itself, its water users or, in federal reclamation projects, the irrigation entity has a contractual responsibility for delivery of water to its individual water users" (RCW 87.80.005(4)).

Special provisions also apply to transfers of water in the case of a joint board of control. Ecology must approve any change of a water right that would change the point of diversion, purpose of use, or place of use outside the board's area of jurisdiction. Such approval is given pursuant to RCW 90.03.380. If the board's jurisdiction is within a federal reclamation project, the Bureau of Reclamation must also approve the change (RCW 87.80.130(2)(c)). If a transfer is between individual entities within the joint board of control, the board is required only to notify Ecology and any tribe requesting notification (RCW 87.8092)(d)). If the board of joint control wishes to undertake a water conservation or system efficiency improvement project that will result in distribution of saved water within the board's area of jurisdiction, it must first consult with Ecology and if within a federal project, obtain approval from Reclamation to assure the proposal will not impair rights of other water holders or Reclamation contract water users (RCW 87.80(2)(b)). The saved water may be redistributed within the area of the board's jurisdiction if it will not injure existing rights outside the board's area of jurisdiction, including instream flows established under state or federal law (RCW 87.80(2)(a)).

The only irrigation district in the Ahtanum Watershed is the Ahtanum Irrigation District (AID). It is an unusual district in that it does not own any canals, diversion or distribution works. The AID uses Ahtanum Creek as the conveyance works to deliver water to the individual users who divert directly from the creek. The Wapato Irrigation Project (WIP) is located on the south side of Ahtanum Creek within the boundaries of the Yakama Reservation. The WIP is operated by the Bureau of Indian Affairs in consultation with the Yakama Nation. The WIP diverts water from Ahtanum Creek and delivers it to reservation landowners in the Ahtanum Unit via the Ahtanum Main Canal and Lower Canal. Water users pay assessments to the WIP and the WIP delivers water prorata to tribal and non-tribal fee owners and properties held in trust for the benefit of the Yakama Nation. The WIP also diverts water from the Yakima River at the Wapato Diversion Dam at Union Gap for delivery to the Wapato-Satus Unit. AID, the Johncox Ditch Association, and the WIP each would be considered an "irrigation entity" for purposes of possible formation of a joint board of control.

Bureau of Reclamation Laws and Policies

The U.S. Bureau of Reclamation (Reclamation) operates the Yakima Irrigation Project (Yakima Project) for irrigation water supply, instream flows for fish, and flood control. The project~~, which~~ supplies water to most of the water users who divert surface water from the Yakima, Naches, and Tieton Rivers. The Yakima Project provides water to about 361,000 irrigated acres of the Yakima Project and represents about 70 percent of the total surface water diversions for major irrigation entities in the Yakima River Basin. The Yakima Project includes five major reservoirs with a total capacity of 1,065,400 acre-feet. A sixth reservoir, Clear Lake, has a capacity of 5,300 acre-feet and is used primarily for recreational purposes. The water supply for the Yakima Project is derived from natural runoff, storage, and return flow from irrigated areas.

The Yakima Project is composed of six irrigation divisions: Kittitas, Roza, Tieton, Wapato, Sunnyside and Kennewick. The Kittitas, Roza and Tieton Divisions divert upstream of the confluence of Ahtanum Creek and the Yakima River. The Wapato, Sunnyside and Kennewick Divisions divert from the Yakima River downstream of the confluence of Ahtanum Creek and the Yakima River.

Reclamation prepares forecasts of the expected Total Water Supply Available (TWSA) for the Yakima Project. TWSA represents the combined quantity of unregulated flow, return flow, and stored water available for use. TWSA is computed at Sunnyside Dam. The forecast is used to determine the adequacy of water supply to meet entitlements. Since 1995 the forecast of TWSA has also been used to determine the magnitude of instream flow needs (target flows) over Sunnyside and Prosser Diversion Dams pursuant to the Yakima River Basin Water Enhancement Project (YRBWEP) (Title XII, Public Law 103-434). Target flows are met from TWSA prior to determining if proration is necessary. Proration is the process the Reclamation employs in water-short years to allocate the TWSA.

There are two classes of water entitlements, proratable and nonproratable. Nonproratable water users have water rights with priority dates filed prior to 1905. Proratable water users have water rights with a later priority date, and therefore have a lower priority and may have their water allotments reduced during a low flow year. Nonproratable entitlements have not been cut back in any year to date. Any shortages that may occur after the nonproratable water rights are met are shared equally by all of the proratable water users. The total volume of entitlements supplied by Reclamation above the Sunnyside Dam is approximately 2.5 million acre-feet (MAF) for the April through October time period. Of those entitlements, 51 percent, or 1.28 MAF are proratable. The water users with the largest proratable supplies are the Roza Irrigation District, Kittitas Reclamation District, the WIP, and the Sunnyside Division. Table B-1 lists the entitlements for those water users with the largest proratable water supplies.

Table B-1. Summary of Entitlements for Largest Proratable Water Users

Water User	Proratable Entitlement (ac-ft)	Non-Proratable Entitlement (ac-ft)	Total (ac-ft)
Kittitas Irrigation District	336,000	0	336,000
Roza Irrigation District	375,000	0	375,000
Wapato Irrigation Project	350,000	305,613	655,613
Sunnyside Division	142,684	315,836	458,520

Downstream of Sunnyside Dam, the Kennewick Division diverts water from the Yakima River. The Yakima Project is not operated specifically to provide a water supply for the Kennewick Division users since in Reclamation's experience, those users obtain sufficient water from tributaries downstream of Sunnyside Dam and from return flow from irrigated areas between Sunnyside Dam and the diversions for the Kennewick Division.

The volume of TWSA can vary substantially depending on snowfall conditions in the Cascade Mountains. The average TWSA, covering a period since 1940, is over 3 MAF. During drought periods such as in 1977, 1993 and 1994, TWSA was just over 2 MAF.

It is the experience of Reclamation that unregulated flow (flow in excess of that needed for filling reservoirs or derived from tributaries without storage reservoirs) can meet irrigation demands in most years up to early July. At that time, the Yakima Project goes on "storage control" and most irrigation demands are then met from reservoir releases. During drought periods that date is earlier, usually during May.

Reclamation filed for withdrawal from appropriation of all unappropriated surface water in the Yakima River Basin under Chapter 90.40 RCW in 1979. The filing was made when Congress authorized YRBWEP. Ecology needs to extend the withdrawal every five years or less. The Reclamation withdrawal has received extensions and is still current. Therefore, any new surface water use in the Yakima River Basin would need to be agreed to by Reclamation. The new surface water user would need to demonstrate to Reclamation and Yakima Project water users that it would not adversely impact their water rights.

Ahtanum Subbasin Adjudication Supplemental Information

The following discussion is a supplement to the information on the Yakima River Basin Adjudication in Section 4.13. This discussion is a summary of the current status of remaining issues in the Ahtanum Subbasin proceeding before the Adjudication Court. The Court's ruling on these issues will determine the extent of the existing water rights in the Ahtanum Watershed. Any new water right for storage and any delivery of water to water right holders must be in compliance with and not impair existing rights.

1. Yakama Nation's Water Right

In the Report of the Court, the Court described the water rights of the Yakama Nation as follows. The Yakama Nation's irrigation right has a priority date of 1855, the date of the establishment of the Reservation. The number of acres historically irrigated is 3,306.5 acres (2,728.7 active and 577.8 idle). The annual quantity of water under the water right for the actively irrigated acres based on a water duty of 4.4 acre-feet/acre/year is 12,121 acre-feet. The instantaneous quantity (Qi) is described per Ahtanum II: (1) from April 1 through July 10 of each year, the Yakama Nation is entitled to 25 percent of the natural flow in Ahtanum Creek, and (2) after July 10, the Yakama Nation is entitled to 100 percent of the flow provided that (a) there is sufficient flow left in Ahtanum Creek for fish life, and (b) in later winter/early spring, there is enough flow for the AID to recharge its irrigation facilities. The irrigation right also has a PIA component for irrigation of future lands should stored water become available. The Court determined the total number of PIA at 5146.85 acres based on the capacity of the WIP as designed in 1915. The Qi for irrigation of future lands (idle plus irrigable) would be 0.0125 cfs and the QA would be 4.4 acre-feet/acre, an additional 10,639.86 acre-feet/year. The irrigation right is confirmed to the United States in trust for Yakama Nation in a proratable amount with tribal allottee and non-tribal successors on the Reservation.

The Yakama Nation's water right in the Yakima Basin for fish and other aquatic life was previously confirmed by the Adjudication Court. The right is unquantified but is described as the "minimum instream flow necessary to maintain fish life in Ahtanum Creek in light of prevailing conditions."

The parties have raised no objections to the Yakama Nation's water right for fish in their post-hearing briefs. They have, however, raised an objection to the number of acres that are considered to be PIA. The AID and Johncox Ditch object to the number used by the Court and argue it should be the number previously used by the Court—4,968 acres. These parties also claim that the use of water on south side lands in 2004 constituted waste. They claim that under the water duty established by the Court, there was enough water diverted to irrigate 3,680 acres and only 2,000 acres were actually irrigated. The Yakama Nation answers that the issue is not before the Court and the Court is basing its decisions on water use from 1957 through 2001, and should not consider water use in 2004.

2. Excess Water

The Court defines "excess water" as water that exists prior to July 10 when the flow in Ahtanum Creek is less than 62.59 cfs and (1) the on-Reservation water users are not using that excess water, and (2) the excess water is not being used to maintain fish life. The issues regarding "excess water" are (1) whether it actually exists and (2) if so, how it is to be calculated. The Yakama Nation and the United States argue there is no excess water because irrigable acres is the proper basis to quantify the Yakama Nation's water right and the courts have previously acknowledged there is not sufficient water to irrigate the acres identified within the capacity of the WIP as designed in 1915. Other parties respond that there is excess water to the extent it is not being beneficially used by the Yakama Nation. They contend that irrigable acres are relevant to the Yakama Nation's paper water right, but irrigated acres are relevant to whether there is any excess water available at any given time.

The parties make similar arguments regarding the calculation of excess water. The Yakama Nation and the United States contend that it should be determined by PIA, not by actual beneficial use. Further, they maintain that if the Court allows the northside water users to make a claim for water in excess of project capacity, the United States must be allowed to make a claim under PIA in excess of the same. Other parties respond that excess water should be calculated annually and daily by applying the water duty to the number of acres actually being irrigated.

3. Junior Water Rights

The issue of "junior water rights" is directly tied to that of excess water. Under the Court's analysis, junior water rights would be awarded to the parties who would be entitled to receive excess water. According to the Court they include north side water users who did not file an answer in the Ahtanum II case, and AID patrons who have been using more water than that confirmed in Ahtanum II. Claimants who failed to file an answer in Ahtanum II must prove that they were not properly joined to the case, that they are successors to a signatory to the Code Agreement, and that their water right was confirmed in the *Achepohl* Decree. The water rights to the excess water would be junior to the Southside water users and to the north side water users whose water rights were confirmed in Ahtanum II.

The objections to the Court's ruling on junior water rights are far ranging. The Yakama Nation and the Untied States object to any finding of junior water rights because they contend there is no excess water. They maintain that a federal tribal reserved water right is based on irrigable acres and includes the right to storage capacity of any future reservoir. Others maintain junior water rights exist, but only to water before July 10 each year. Others believe the junior rights should also extend after July 10.

There is also disagreement whether the TWSA should be a consideration when deciding whether there is any excess water and any junior water rights. The United States and the Yakama Nation maintain that TWSA must be considered because water that flows from Ahtanum Creek into the Yakima River contributes to flows at the gauge at Parker. Since the readings from the gauge are used to determine in part whether proration is necessary at any given time, a reduction in flows from Ahtanum Creek could mean that proration would occur more often and the reduction could be increased. Other parties maintain that any rights confirmed in Ahtanum are senior to the 1905 rights in the Yakima Project and therefore have the right to take the water from Ahtanum Creek.

4. North Side Water Rights

There is also an issue regarding where junior water rights may be used. The answer depends in large part upon whether or not the court in Ahtanum II awarded an aggregate right for the north side or individual parcel-by-parcel water rights. The Adjudication Court found that the 75 percent award is shared by the north side and parceled out according to the priorities established by the *Achepohl* Decree. The AID and Johncox Ditch argue that Ahtanum II awarded an aggregate right and placed no restriction on where excess water may be used on the north side and that the use of water there is governed by state law under *Achepohl*. Ecology and others argue that the north side rights were confirmed as individual rights and any change in place of use must be approved by Ecology.

5. Non-diversionary Stockwater Right

The Adjudication Court has ruled that there is a non-diversionary stockwater right, which requires 0.25 cfs to be retained in the streams when naturally available. The Yakama Nation and the United States argue strongly that no such right has been proved and there is no justification for a right senior to the Yakama Nation's 1855 priority date. Further, they assert that to keep 0.25 cfs in Bachelor and Hatton Creeks would require a diversion of 5 cfs from Ahtanum Creek and would shorten Yakama Nation's irrigation season by 2-4 weeks. Others parties maintain the non-diversionary stockwater right is appropriate and necessary.

Supplemental Information on the Effect of the ACWRP on TWSA

An analysis of the potential effect on TWSA was made. The current flow from Ahtanum Creek to the Yakima River for average flow conditions and for a representative dry year (1977) is shown in Table B-2. The flow from Ahtanum Creek between April and October is estimated to be 32,600 acre-feet on average. For a dry year such as 1977, the flow is much less—5,500 acre-feet in the April to October time period. Most of the flow occurs during the April to June period as snowmelt. For average flow conditions, over 80 percent of the flow from Ahtanum Creek occurs between April and June. That time period corresponds to when unregulated flows meet the demands of Yakima Project water users, including those downstream of Ahtanum Creek.

Table B-2. Average and Dry Year Flows in Ahtanum Creek

	Oct (cfs)	Nov (cfs)	Dec (cfs)	Jan (cfs)	Feb (cfs)	Mar (cfs)	Apr (cfs)	May (cfs)	Jun (cfs)	Jul (cfs)	Aug (cfs)	Sept (cfs)	April-Oct total (acre-feet)
Average	20	28	49	75	120	132	137	169	146	31	16	19	32,633
Dry Year (1977)	25	25	39	33	28	27	16	23	13	9	7	12	5,484

It should be noted that a reduction in diversions from Ahtanum Creek system after July 10 of each year recently occurred to improve instream flow. That action increased the flow discharged to the Yakima River.

The potential change in flow from Ahtanum Creek resulting from the alternatives was analyzed using the GoldSim model. The difference between average monthly flows for current flow conditions, which would generally continue under Alternatives 1 and 3 versus Alternatives 2 and 4 is summarized in Table B-3. For Alternatives 2 and 4, Pine Hollow Reservoir would divert surface water during the winter and spring time reducing flow. However, water from the reservoir would also augment streamflow to meet instream flow targets.

Table B-3. Difference in Average Monthly Flows at Union Gap with Implementation of ACWRP Alternatives

	Oct (cfs)	Nov (cfs)	Dec (cfs)	Jan (cfs)	Feb (cfs)	Mar (cfs)	Apr (cfs)	May (cfs)	Jun (cfs)	Jul (cfs)	Aug (cfs)	Sept (cfs)	April-Oct total (ac-ft)
Average Year													
Current Conditions and Alternatives 1,3	0	0	0	0	0	0	0	0	0	0	0	0	0
Alternatives 2,4	3	-2	-10	-5	-15	-9	-4	3	4	33	1	4	2,676
Dry Year (1977)													
Current Conditions and Alternatives 1,3	0	0	0	0	0	0	0	0	0	0	0	0	0
Alternatives 2,4	4	5	6	13	16	18	3	-19	-13	9	3	3	-562

The difference in the April to October flow volume at Union Gap between Alternative 1 and 3 (without Pine Hollow Reservoir) and Alternatives 2 and 4 (with Pine Hollow Reservoir) is approximately 2,700 acre-feet for average flow conditions and -600 acre-feet for dry years such as 1977. The flow volume for the April to October time period is used in TWSA calculations. A slight increase in flow during that time period is predicted for average conditions, while a very slight decrease is predicted for drought conditions. The potential effect on TWSA would be very small (much less than 0.1 percent) and would not be measurable by Reclamation. In addition, most of the flow reduction would occur during the time that the Yakima Project is not on storage control.

Effect on Other Reclamation Operations

Reclamation operates the Yakima Project on a year-round basis to provide irrigation water supply while reducing impacts on fisheries resources. Operations take into account requirements for spawning, incubation, rearing, passage, flushing/spike flows, ramping rates, power subordination, and carryover storage in the Yakima Basin on an annual to daily basis (U.S. Bureau of Reclamation, 2002). A discussion follows of the operational seasons and the potential effect of the ACWRP on Reclamation operations. The description of operations is mostly copied from the Interim Comprehensive Basin Operating Program (U.S. Bureau of Reclamation, 2002).

Fall Operations (August, September, October):

In August, river operators begin the transition to fall operations (August, September, October), which establishes the demands, constraints, and operational criteria for the next season. The fall operations period overlaps summer/fall operations, as the irrigation season is brought to a close. During August, September, and October, when the reservoirs are being drawn down to meet irrigation needs, releases are coordinated to maintain system storage flexibility so that flows can be ensured and provided for spawning, incubation, and rearing of spring Chinook eggs and fry operations during the next season of operations. Fishery flow needs are coordinated with System Operations Advisory Committee. During the late August through September 10th period, the mini flip-flop and flip-flop operations are performed. During the flip-flop operations, Reclamation lowers the releases from the Upper Yakima River Reservoirs and increases releases from Rimrock Reservoir. The Rimrock Reservoir releases are used to meet irrigation demands in the lower Yakima River system so that river levels can be kept low in the upper Yakima River system to benefit salmon. The flip-flop operation allows Reclamation to protect salmon redds in the upper river during the incubation and emergence/rearing periods, while minimizing the release demands and maximizing storage. Requests for power subordination are also possible on the lower river system during this period to maintain instream flows for migration, passage, and rearing.

Potential Effects of the ACWRP

The modeling performed for the ACWRP (Table B-3) indicates an increase in flow for each of the three fall months for both average and wet years for Alternative 2 or 4. No change in flow would occur for Alternative 1 or 3. No effect on fall operations would result from any of the alternatives as flow into the Yakima River would remain the same or increase.

Winter Operations (November, December, January, February):

During this period, stream flows into Yakima Project reservoirs in excess of downstream requirements are stored. Flows are bypassed or released to provide instream flow for the incubation of spring Chinook eggs and fry and to meet other fish demands. Release schedules also consider flood control requirements. Flood control operations that may occur are guided by flood control space guidelines for the reservoirs and by forecasts of future runoff. Flood control operations must consider real time stream flows downstream of the dams prior to releasing water. For example, stream flows in the Yakima River at Easton, Cle Elum, Ellensburg, Parker, and Kiona; in the Naches River at Cliffdell; and in the Naches River are evaluated prior to any reservoir release. The main objective during flood control operations is to provide maximum protection against flood damage in the Yakima River Basin as a whole, without jeopardizing the irrigation water supply for the following year. Other issues or constraints at this time include migration flow and possible power subordination in the lower river system.

Potential Effects of the ACWRP

The modeling performed for the ACWRP (Table B-3) indicates a decrease in flow for each of the four winter months for average years and an increase in flow for dry years for Alternative 2 or 4. No change in flows would occur for Alternative 1 or 3. The maximum decrease in flow during average years is 15 cfs during February. Filling the proposed Pine Hollow Reservoir would cause the decrease in flow. As a comparison, the mean flow in the Yakima River at Parker (downstream of Ahtanum Creek) is approximately 3,000 cfs in February. The change in flow resulting from filling the reservoir would be small and not measurable in the Yakima River during the winter operation period in average water years. In dry water years, flow is controlled more closely in the Yakima River. The mean flow in the Yakima River at Parker during the winter months in a dry water year is approximately 1,000 cfs, or one-third that of an average water year. However the modeling performed for the ACWRP indicates an increase in flow during a dry year in this time period. The increase is caused by the imposition of instream flow targets on the North Fork and Main Stem Ahtanum Creek.

Alternative 2 or 4 would cause a slight and not measurable reduction of flow in the Yakima River during average water years. During dry water years when Yakima River flows are much less, the alternatives would slightly increase flow. No effect on operations would result from Alternative 1 or 3.

Spring/Summer Operations (March, April, May, June):

Stream flows into the reservoirs in excess of downstream requirements are stored during this period. Irrigation diversion demand is largely met from natural flow accruing below the reservoirs from unregulated tributaries such as Ahtanum Creek. Some supplemental releases are made for instream flow maintenance for incubation and rearing where unregulated inflow downstream of the dams is inadequate. Occasionally releases are made for enhanced passage flows, spikes, or other flow enhancement needed to encourage smolt out-migration. Other issues or constraints at this time include migration flows and possible power subordination in the lower river system. Releases to maintain appropriate flood control space are provided as necessary. Spring/summer flood control operations at the five project reservoirs occur each water year, even during most dry years. The volume of runoff potential is estimated by the runoff forecast in balance with the TWSA process. The runoff forecast and the flood space guide curves are taken into account in the refill process and in the timing of attaining a full storage system. Reservoirs are generally brought to their highest level during the late May through June time period. Some of the reservoir inflow is stored and some is passed through the reservoir to supplement unregulated flows and return flows to meet downstream diversion demand. Unregulated flow and return flow are generally adequate to meet irrigation diversions through June. However, storage releases have begun as early as May in dry years and as late as August in wet years. The average date of storage control (period of record, 1926 to 1999) in the Yakima River basin is June 24th.

Potential Effects of the ACWRP

The effect on TWSA from Alternative 2 or 4 was described in the previous section of this Appendix B, with a slight increase in flow available for TWSA in average years and a slight decrease in dry years. Water from unregulated tributaries not captured by Reclamation is used as a water supply prior to the time when contract obligations are met out of TWSA (April). That water, called flood water, is used to prime canals and provide frost water and some early season water to irrigators. The irrigation districts with flood water claims located downstream of Ahtanum Creek are the Sunnyside Division and the Wapato Irrigation Project. The modeling performed for the ACWRP indicates a decrease in flow of 9 cfs for an average water year in March. During a dry water year, an increase of 18 cfs is predicted. In comparison, the mean flow in the Yakima River at Parker is 3,150 cfs during March and during a dry year is much less, approximately 1,200 cfs.

Alternative 2 or 4 would cause a slight and not measurable reduction of flow in the Yakima River during average water years during the March time period. During dry water years when Yakima River flows are much less, either alternative would slightly increase flow. No effect on operations would result from Alternative 1 or 3.

APPENDIX C – SUPPLEMENTAL INFORMATION ON EDT MODELING

Supplemental Information on EDT Modeling

Table C-1.

Aquatic and Riparian Habitat Factors Impacting Ahtanum Creek Watershed Spring Chinook Populations

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Ahtanum, Bachelor return - 42nd Avenue	o	◯	•				●	•	●	●			•		●	⬤		●
Ahtanum, L. WIP Div - American Fuit Rd	o	◯	•				●	•	●	•			•		●	⬤		●
Ahtanum, Marks Rd - Bach-Hat Div	o	◯	•				●	•	●	•			•	•	●	⬤		●
Ahtanum, U. WIP Div - forks	◯	◯	•				•	•	●						●	●		●
NF Ahtanum, Mouth - RM 2.0	O	O	•				•	•	●						⬤	●		●
SF Ahtanum, Mouth - RM 2.0		O	•				•	•	●	•					⬤	●		●
Ahtanum, Mouth - Goodman Rd	o	O	•				●	•	●	●					⬤	⬤		●
Ahtanum, 42nd Avenue - Hatton return		O	•				●	•	●	●			•		●	⬤		●
Ahtanum, Bach/Hat Div - U. WIP Div	o	O	•				•	•	●	•				•	●	⬤		●
Ahtanum, Goodman Road - Bachelor return		o	•				●	•	●	●			•		⬤	⬤		●
Ahtanum, Hatton return - L. WIP Div	o	o	•				●	•	•	•					●	⬤		●
Ahtanum, American Fruit Rd - Marks Rd		o	•				●	•	●	•				•	●	⬤		●
Ahtanum, L. WIP Diversion Dam																		
Ahtanum, Bach/Hat Diversion Dam																		
Ahtanum, Upper WIP Diversion Dam																		
Yakima Benton to Powerplant														•	•	•		•
Yakima Chandler Bypass Reach									•					•	•	•		•
Yakima delta														•	•	•		•
Yakima delta to Horn Dam									•					•	•	•		●
Yakima Horn Dam to Benton											•			•	•	•		•
Yakima Prosser Dam to Satus									•		●		•	•	●	•		•
Yakima Satus to Toppenish	o												•	●	●	•		⬤
Yakima SSide Dam to Ahtanum Cr			•				•	•	●		⬤			•	•	•		●
Yakima Toppenish to Sunnyside Dam	o				•								•	•	•	•		⬤

Key to strategic priority (corresponding Benefit Category letter also shown)

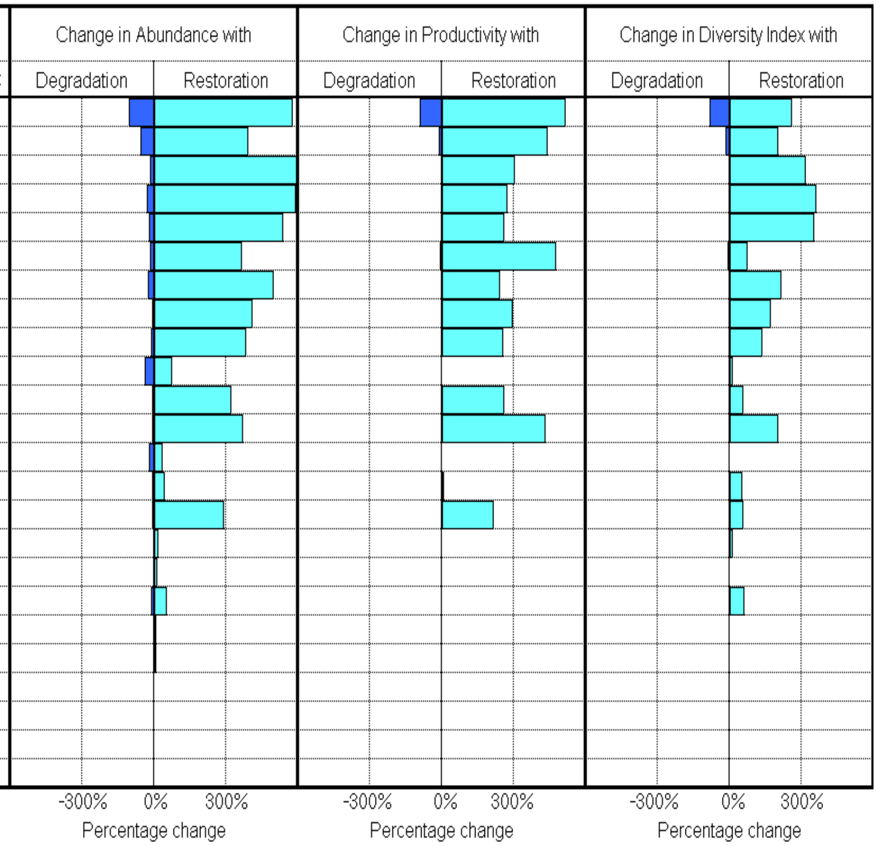
A ◯ High; B O Medium; C o Low; D & E Indirect or General

The factors are derived from the EDT model simulation.

Table C-1 displays the relative habitat restoration or protection benefits, and the degree of impact (high, medium, or low) on key habitat indicators for the Ahtanum Creek spring Chinook population based on the Ecosystem Diagnosis and Treatment (EDT) model analysis. Restoration/protection benefits and habitat impacts are evaluated based on the degree of habitat degradation from the historic base line and the relative importance of the specific reach for the population's life stages (migration, spawning, rearing, etc.).

Table C-2.
Relative Habitat Protection and Restoration Benefits for the Ahtanum Creek Watershed Spring Chinook Population for each of the EDT Model Reaches

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Ahtanum, U. WIP Div - forks	A	1	A	1
NF Ahtanum, Mouth - RM 2.0	B	2	B	5
Ahtanum, Marks Rd - Bach-Hat Div	C	5	A	2
Ahtanum, Bachelor return - 42nd Avenue	C	5	A	3
Ahtanum, L. WIP Div - American Fuit Rd	C	4	A	4
Ahtanum, Bach/Hat Div - U. WIP Div	C	3	B	7
Ahtanum, Mouth - Goodman Rd	C	7	B	7
Ahtanum, 42nd Avenue - Hatton return	D	8	B	6
Ahtanum, Hatton return - L. WIP Div	C	6	C	8
Yakima Toppenish to Sunnyside Dam	C	3	D	12
Ahtanum, American Fruit Rd - Marks Rd	D	8	C	9
SF Ahtanum, Mouth - RM 2.0	E	12	B	6
Yakima Satus to Toppenish	C	5	D	14
Yakima Prosser Dam to Satus	D	9	D	11
Ahtanum, Goodman Road - Bachelor return	E	11	C	10
Yakima Horn Dam to Benton	D	10	D	12
Yakima delta to Horn Dam	D	8	E	15
Yakima SSide Dam to Ahtanum Cr	D	10	D	13
Yakima Chandler Bypass Reach	E	11	E	16
Yakima Benton to Powerplant	E	12	E	17
Yakima delta	E	13	E	18
Ahtanum, L. WIP Diversion Dam	E	14	E	19
Ahtanum, Bach/Hat Diversion Dam	E	14	E	19
Ahtanum, Upper WIP Diversion Dam	E	14	E	19



Habitat restoration and protection values are based on the impact of current habitat conditions on population abundance, productivity, and capacity relative to historic habitat conditions.

Table C-2 displays the relative changes in key population performance indicators under habitat restoration or degradation for the Ahtanum Creek spring Chinook population. Abundance denotes the expected average number of returning adults; Productivity is an estimate of the maximum number of returning adults per spawning fish; and Diversity describes the proportion of life history patterns that are self-sustaining (that result in at least one returning adult per spawner). The restoration rank is based on the increase in the performance indicators the population would experience if the reach were restored to historical conditions. The preservation rank is estimated based on the change in the population's performance that would result if the reaches were thoroughly degraded.

Table C-3.

Aquatic and Riparian Habitat Factors Impacting Ahtanum Creek Watershed Summer Steelhead Populations

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
NF Ahtanum, Mouth - RM 2.0		A	B				C						C		A	B		B
NF Ahtanum, RM 2.0 - Nasty Cr	C	A	B				C		C				C		A	B		B
NF Ahtanum, Nasty Cr - Foundation Cr	C	A	B				C		C						A	B		B
NF Ahtanum, Foundation Cr - MF Ahtanum	B	A	B				C		C						A			B
NF Ahtanum, MF Ahtanum - McLain Canyon	A	A	C				C		C						A			B
NF Ahtanum, McLain Canyon - access limit	C	A	C				C		C				C		A	B		B
SF Ahtanum, Mouth - RM 2.0	A	A	C				C		C						A			B
SF Ahtanum, RM 2.0 - access limit	A	A	C				C		C				C		B	B		B
Ahtanum, Mouth - Goodman Rd		A	B				B	C	B				C		B	B		A
Ahtanum, Goodman Road - Bachelor return		B	B				C		C						A	B		B
Ahtanum, Bachelor return - 42nd Avenue	C	B	C				B		C	C			C	C	B	A		B
Ahtanum, 42nd Avenue - Hatton return	B	B	B				C		C	C			C	C	B	A		B
Ahtanum, Hatton return - L. WIP Div		B	C				C		C				C	C	B	A		B
Ahtanum, L. WIP Diversion Dam	B	B	C				C								A			B
Ahtanum, L. WIP Div - American Fuit Rd		C	B				C		B	B			C	C	A	A		B
Ahtanum, American Fruit Rd - Marks Rd		C	B				B		C	B			C	C	B	A		B
Ahtanum, Marks Rd - Bach-Hat Div		C	B				B		C	B			C	C	B	A		B
Ahtanum, Bach/Hat Diversion Dam		C	C				B		C	C			C	C	B	A		B
Ahtanum, Bach/Hat Div - U. WIP Div		C	B				C		C						A	B		B
Ahtanum, Upper WIP Diversion Dam		C	B				B		C						A	B		B
Yakima Prosser Dam to Satus	C	C			C				B		A			B	B	C		C
Yakima SSide Dam to Ahtanum Cr		C			C		C	C	B		A		C	B	C	C		C
Bachelor, Current adult rack - Spring Cr			B				C		B	B			C	C	A	A		B
Bachelor, potential rack just above Spring Cr																		
Bachelor, Spring Cr - Bach/Hat Div			B				C		C	C			C	C	B	A		B
Foundation, Mouth - access limit																		
Hatton Cr: Adult barrier at mouth																		
Hatton, mouth - Bach/Hat Div											A							
MF Ahtanum, Mouth - access limit			C				B		C	C			C	C	B	A		B
Nasty, Mouth - start of perennial flow																		
Nasty, start of perennial flow - access limit			B				B		B	C			C	C	B	A		B
Spring Cr, Mouth - access limit											A							
Yakima delta to Horn Dam			B				B		B	C			C	C	B	A		B
Yakima Chandler Bypass Reach									B	C				C	C	C		B
Yakima Benton to Powerplant									C					B	C	C		C
Yakima Chandler Bypass Reach					C				C				C	B	C	B		C
Yakima delta														B	C	C		C
Yakima delta to Horn Dam									C					B	C			B
Yakima Horn Dam to Benton											B			B	C	C		C
Yakima Satus to Toppenish					C				B					B	B	C		A
Yakima Toppenish to Sunnyside Dam					C				C					B	C	C		A

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

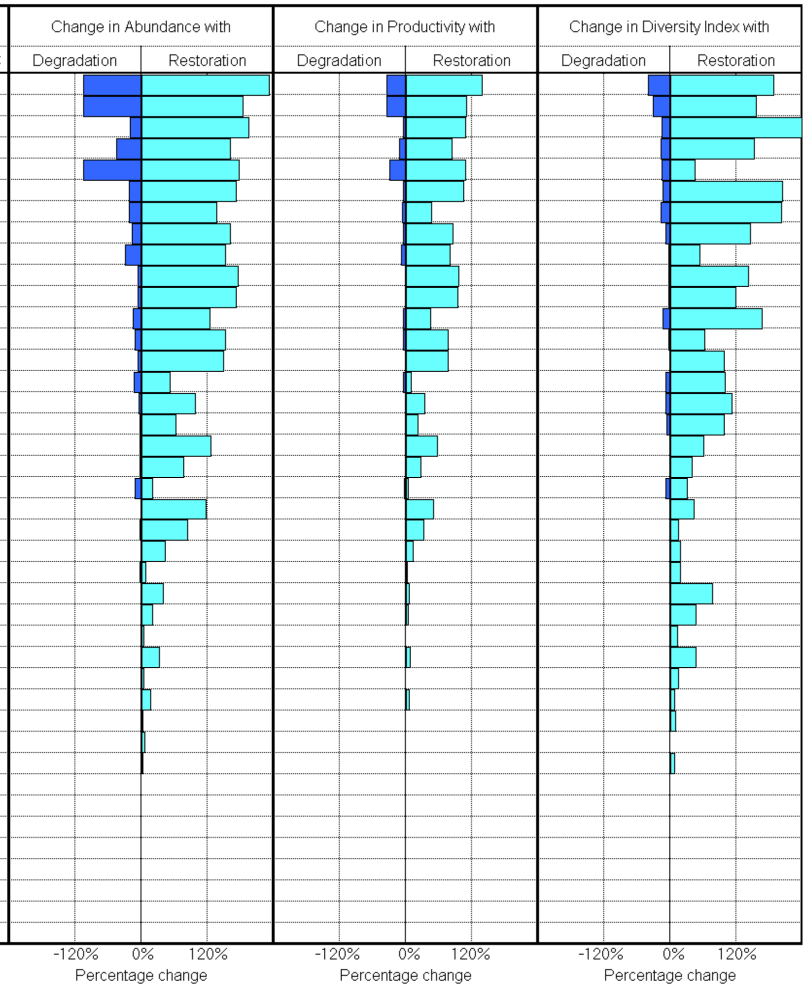
The factors are derived from the EDT model simulation.

Table C-3 displays the relative habitat restoration or protection benefits, and the degree of impact (high, medium, or low) on key habitat indicators for the Ahtanum Creek summer steelhead population based on the Ecosystem Diagnosis and Treatment (EDT) model analysis. Restoration/protection benefits and habitat impacts are evaluated based on the degree of habitat degradation from the historic base line and the relative importance of the specific reach for the population's life stages (migration, spawning, rearing, etc.).

Table C-4.

Relative Habitat Protection and Restoration Benefits for the Ahtanum Creek Watershed Summer Steelhead Population for each of the EDT Model Reaches

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Ahtanum, U. WIP Div - forks	A	1	A	1
SF Ahtanum, RM 2.0 - access limit	A	1	A	2
NF Ahtanum, Nasty Cr - Foundation Cr	C	6	A	1
NF Ahtanum, MF Ahtanum - McLain Canyon	B	3	A	5
NF Ahtanum, McLain Canyon - access limit	A	2	A	7
NF Ahtanum, RM 2.0 - Nasty Cr	C	7	A	3
Ahtanum, Marks Rd - Bach-Hat Div	B	4	B	8
SF Ahtanum, Mouth - RM 2.0	C	8	A	6
MF Ahtanum, Mouth - access limit	B	5	B	10
Nasty, Mouth - start of perennial flow	D	12	A	4
NF Ahtanum, Mouth - RM 2.0	D	13	A	5
Ahtanum, L. WIP Div - American Fuit Rd	C	9	B	9
Ahtanum, Bach/Hat Div - U. WIP Div	D	11	B	10
NF Ahtanum, Foundation Cr - MF Ahtanum	D	13	B	10
Yakima Prosser Dam to Satus	C	10	C	15
Ahtanum, Bachelor return - 42nd Avenue	D	14	C	12
Ahtanum, Mouth - Goodman Rd	D	14	C	14
Foundation, Mouth - access limit	E	17	C	11
Ahtanum, Hatton return - L. WIP Div	E	15	C	16
Yakima Toppenish to Sunnyside Dam	D	11	D	22
Ahtanum, 42nd Avenue - Hatton return	E	24	C	13
Nasty, start of perennial flow - access limit	E	20	C	17
Ahtanum, American Fruit Rd - Marks Rd	E	19	D	20
Yakima Satus to Toppenish	E	16	E	23
Yakima SSide Dam to Ahtanum Cr	E	22	C	18
Yakima Horn Dam to Benton	E	21	D	21
Yakima Chandler Bypass Reach	E	18	E	25
Bachelor Cr: Adult barrier at mouth	E	25	D	19
Yakima delta to Horn Dam	E	20	E	24
Ahtanum, Goodman Road - Bachelor return	E	25	E	23
Yakima Benton to Powerplant	E	23	E	26
Hatton Cr: Adult barrier at mouth	E	25	E	27
Yakima delta	E	24	E	28
Ahtanum, L. WIP Diversion Dam	E	25	E	29
Ahtanum, Bach/Hat Diversion Dam	E	25	E	29
Ahtanum, Upper WIP Diversion Dam	E	25	E	29
Bachelor, Current adult rack - Spring Cr	E	25	E	29
Bachelor Cr.-2A(new adult rack)	E	25	E	29
Bachelor, Spring Cr - Bach/Hat Div	E	25	E	29
Hatton, mouth - Bach/Hat Div	E	25	E	29
Spring Cr, Mouth - access limit	E	25	E	29



Habitat restoration and protection values are based on the impact of current habitat conditions on population abundance, productivity, and capacity relative to historic habitat conditions.

Table C-4 displays the relative changes in key population performance indicators under habitat restoration or degradation for the Ahtanum Creek steelhead population. Abundance denotes the expected average number of returning adults; Productivity is an estimate of the maximum number of returning adults per spawning fish; and Diversity describes the proportion of life history patterns that are self-sustaining (that result in at least one returning adult per spawner). The restoration rank is based on the increase in the performance indicators the population would experience if the reach were restored to historical conditions. The preservation rank is estimated based on the change in the population's performance that would result if the reaches were thoroughly degraded.

Table C-5.

Aquatic and Riparian Habitat Factors Impacting Ahtanum Creek Watershed Coho Populations

Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Ahtanum, Bachelor return - 42nd Avenue	L	H	L				L	L	L	M					M	L		M
Ahtanum, U. WIP Div - forks	H	H	L				L	L	M						M	L		M
Ahtanum, Mouth - Goodman Rd	L	M	L				L	L	M	M					H	L		M
Ahtanum, Hatton return - L. WIP Div	L	M	L				L	L	L	L					M	L		M
Ahtanum, L. WIP Div - American Fuit Rd	L	M	L				L	L	M	L					M	L		M
Ahtanum, Marks Rd - Bach-Hat Div	M	M	L				L	L	M	L					M	L		M
NF Ahtanum, Mouth - RM 2.0	L	L					L	L	M						M	L		M
NF Ahtanum, RM 2.0 - Nasty Cr		L	L				L	L	H						M	L		M
NF Ahtanum, Nasty Cr - Foundation Cr		L	L				L	L	H						M	L		M
NF Ahtanum, Foundation Cr - MF Ahtanum		L	L				L	L	M						M			M
SF Ahtanum, Mouth - RM 2.0		L	L				L	L	H						M	L		M
SF Ahtanum, RM 2.0 - access limit		L					L		H						M			M
Ahtanum, Goodman Road - Bachelor return		L	L				L	L	L	M					H	L		M
Ahtanum, 42nd Avenue - Hatton return		L	L				L	L	L	M					M	L		M
Ahtanum, American Fruit Rd - Marks Rd		L	L				L	L	M	L					L	L		M
Ahtanum, Bach/Hat Div - U. WIP Div	L	L	L				L	L	M	L					M	L		M
Nasty, Mouth - start of perennial flow		L	L				M	L	H						M	M		H
Yakima SSide Dam to Ahtanum Cr		L	L		L		L	L	H	L	H			L	L	L		M
NF Ahtanum, MF Ahtanum - McLain Canyon							L	L	H						M			M
Ahtanum, L. WIP Diversion Dam																		
Ahtanum, Bach/Hat Diversion Dam																		
Ahtanum, Upper WIP Diversion Dam																		
Bachelor Cr: Adult barrier at mouth											H							
Bachelor, Current adult rack - Spring Cr			L				L		L	L					M	L		M
Bachelor, potential rack just above Spring Cr																		
Bachelor, Spring Cr - Bach/Hat Div			L				M	L	M	L					M	M		H
Foundation, Mouth - access limit			L				L	L	H						M			M
Hatton Cr: Adult barrier at mouth											H							
Hatton, mouth - Bach/Hat Div			L				M	L	M	L					M	M		H
MF Ahtanum, Mouth - access limit							L	L	H						M			M
Nasty, start of perennial flow - access limit			L				L	L	H						M			M
Spring Cr, Mouth - access limit			L					L	L	L					L			M
Yakima Benton to Powerplant														M	L			L
Yakima Chandler Bypass Reach									H					M				L
Yakima delta														M	L			L
Yakima delta to Horn Dam									L					M	L			M
Yakima Horn Dam to Benton											M			M	L			L
Yakima Prosser Dam to Satus					L				H		M			L	L	L		M
Yakima Satus to Toppenish					L									L	M	L		H
Yakima Toppenish to Sunnyside Dam	L				L				L					L	L	L		H

The factors are derived from the EDT model simulation.

Key to strategic priority (corresponding Benefit Category letter also shown)

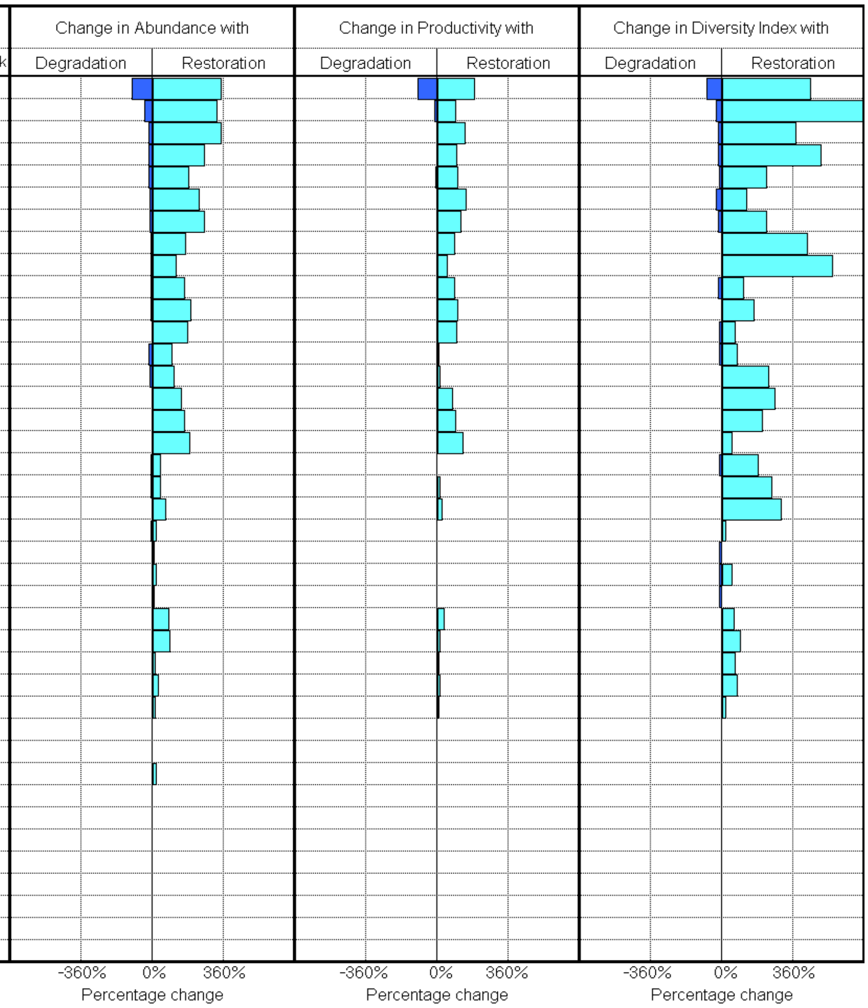
A	B	C	D & E
High (H)	Medium (M)	Low (L)	Indirect or General

Table C-5 displays the relative habitat restoration or protection benefits, and the degree of impact (high, medium, or low) on key habitat indicators for the Ahtanum Creek coho population based on the Ecosystem Diagnosis and Treatment (EDT) model analysis. Restoration/protection benefits and habitat impacts are evaluated based on the degree of habitat degradation from the historic base line and the relative importance of the specific reach for the population's life stages (migration, spawning, rearing, etc.).

Table C-6.

Relative Habitat Protection and Restoration Benefits for the Ahtanum Creek Watershed Coho Population for each EDT Model Reach

Geographic Area	Protection benefit Category	Protection benefit rank	Restoration benefit Category	Restoration benefit rank
Ahtanum, U. WIP Div - forks	A	1	A	1
Ahtanum, Marks Rd - Bach-Hat Div	B	2	B	3
Ahtanum, Bachelor return - 42nd Avenue	C	5	A	2
Ahtanum, L. WIP Div - American Fuit Rd	C	3	B	4
NF Ahtanum, Mouth - RM 2.0	C	4	C	7
Ahtanum, Hatton return - L. WIP Div	C	5	B	6
Ahtanum, Mouth - Goodman Rd	C	7	B	5
NF Ahtanum, RM 2.0 - Nasty Cr	D	13	C	9
NF Ahtanum, Nasty Cr - Foundation Cr	D	13	C	10
Ahtanum, Bach/Hat Div - U. WIP Div	C	8	C	15
Ahtanum, 42nd Avenue - Hatton return	E	16	C	8
Ahtanum, American Fruit Rd - Marks Rd	D	12	C	14
Yakima Toppenish to Sunnyside Dam	C	6	D	21
Yakima SSide Dam to Ahtanum Cr	D	11	C	17
SF Ahtanum, Mouth - RM 2.0	E	16	C	13
NF Ahtanum, Foundation Cr - MF Ahtanum	E	18	C	12
Ahtanum, Goodman Road - Bachelor return	E	19	C	11
Yakima Prosser Dam to Satus	D	9	D	22
SF Ahtanum, RM 2.0 - access limit	E	15	C	18
Nasty, Mouth - start of perennial flow	E	17	C	16
Yakima Satus to Toppenish	D	10	E	25
Yakima delta to Horn Dam	D	12	E	26
Yakima Horn Dam to Benton	E	14	E	24
Yakima Chandler Bypass Reach	D	12	E	27
Nasty, start of perennial flow - access limit	E	20	D	20
Bachelor Cr: Adult barrier at mouth	E	22	D	19
NF Ahtanum, MF Ahtanum - McLain Canyon	E	19	D	23
Foundation, Mouth - access limit	E	21	D	22
MF Ahtanum, Mouth - access limit	E	20	E	24
Yakima Benton to Powerplant	E	16	E	28
Yakima delta	E	18	E	29
Hatton Cr: Adult barrier at mouth	E	22	E	26
Ahtanum, L. WIP Diversion Dam	E	22	E	30
Ahtanum, Bach/Hat Diversion Dam	E	22	E	30
Ahtanum, Upper WIP Diversion Dam	E	22	E	30
Bachelor, Current adult rack - Spring Cr	E	22	E	30
Bachelor, potential rack just above Spring Cr	E	22	E	30
Bachelor, Spring Cr - Bach/Hat Div	E	22	E	30
Hatton, mouth - Bach/Hat Div	E	22	E	30
Spring Cr, Mouth - access limit	E	22	E	30

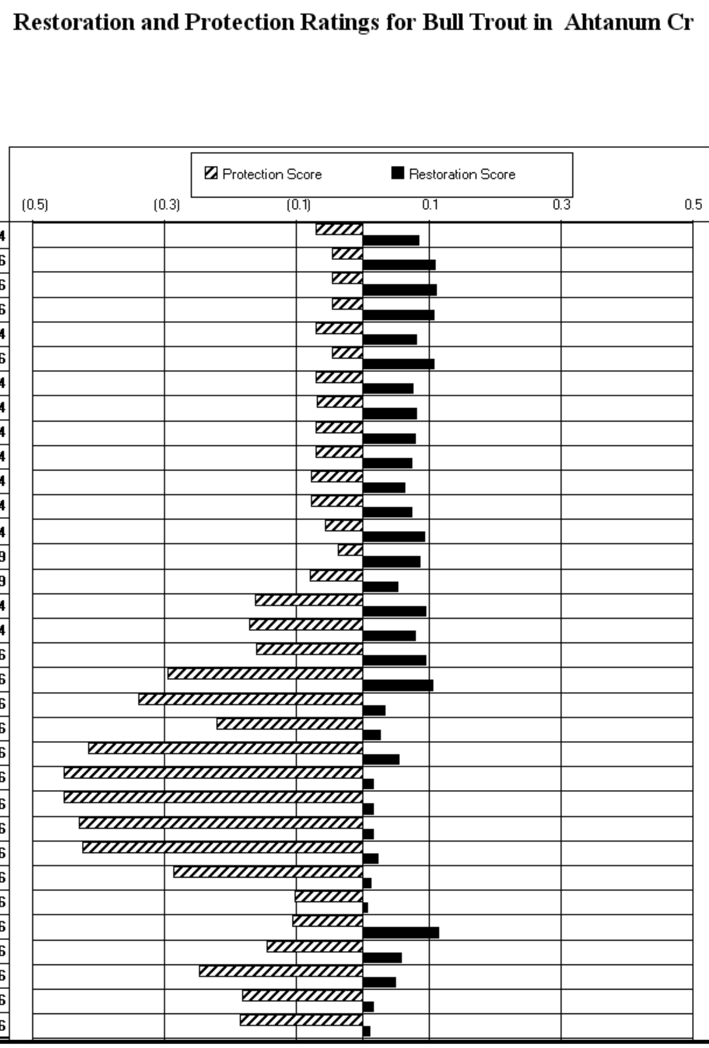


Habitat restoration and protection values are based on the impact of current habitat conditions on population abundance, productivity, and capacity relative to historic habitat conditions.

Table C-6 displays the relative changes in key population performance indicators under habitat restoration or degradation for the Ahtanum Creek coho population. Abundance denotes the expected average number of returning adults; Productivity is an estimate of the maximum number of returning adults per spawning fish; and Diversity describes the proportion of life history patterns that are self-sustaining (that result in at least one returning adult per spawner). The restoration rank is based on the increase in the performance indicators the population would experience if the reach were restored to historical conditions. The preservation rank is estimated based on the change in the population's performance that would result if the reaches were thoroughly degraded.

Table C-7.

A Description of the Relative Protection and Restoration Priorities for Ahtanum Creek Bull Trout Population Reaches

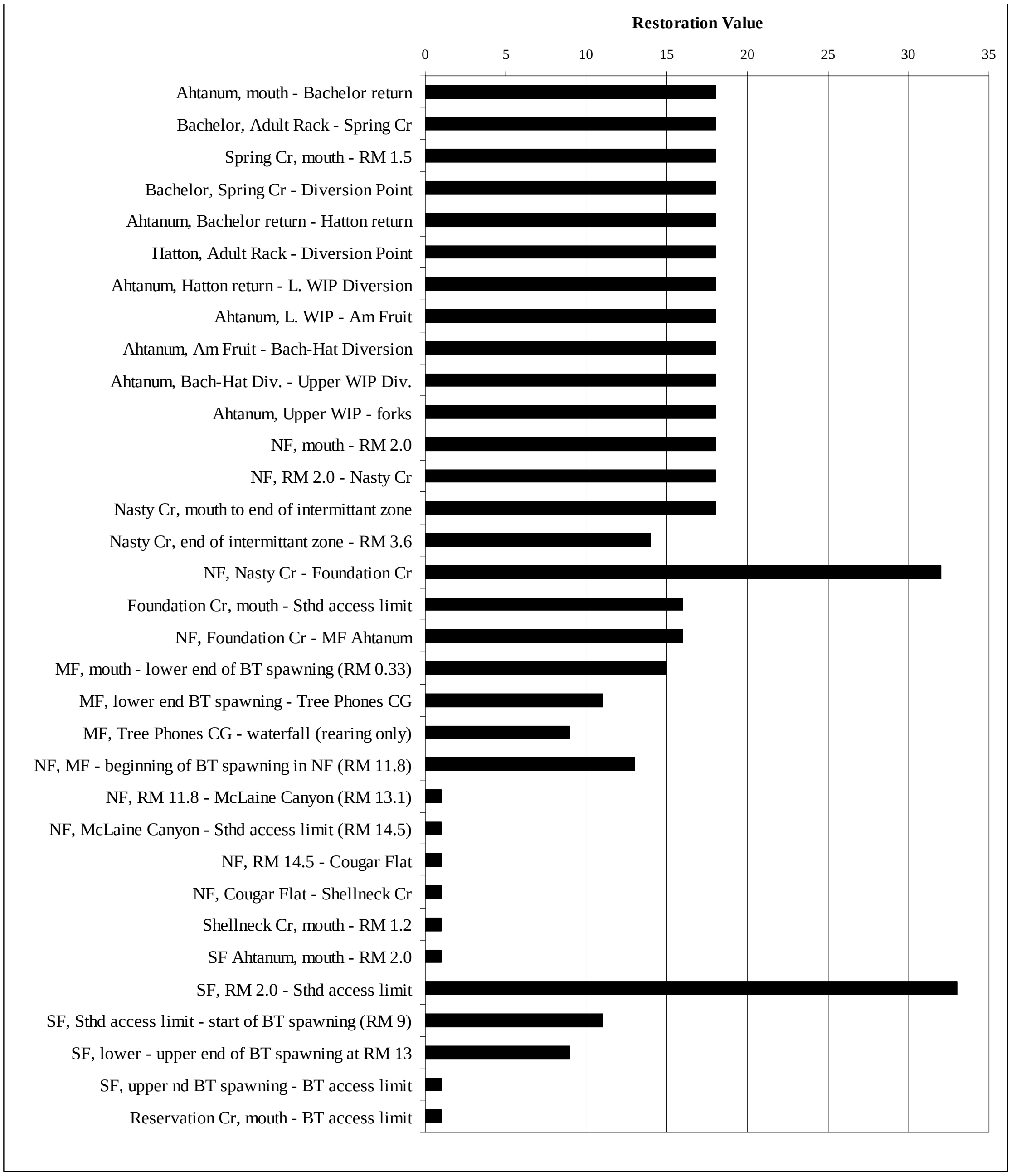


Reach Name	Protection Confidence	Restoration Confidence
Ahtanum, mouth - Bachelor return	1.24	0.87
Bachelor, Adult Rack - Spring Cr	0.86	0.68
Spring Cr, mouth - RM 1.5	0.86	0.68
Bachelor, Spring Cr - Diversion Point	0.86	0.68
Ahtanum, Bachelor return - Hatton return	1.24	0.87
Hatton, Adult Rack - Diversion Point	0.86	0.68
Ahtanum, Hatton return - L. WIP Diversion	1.24	0.87
Ahtanum, L. WIP - Am Fruit	1.24	0.87
Ahtanum, Am Fruit - Bach-Hat Diversion	1.24	0.87
Ahtanum, Bach-Hat Div. - Upper WIP Div.	1.24	0.87
Ahtanum, Upper WIP - forks	1.24	0.87
NF, mouth - RM 2.0	1.24	0.87
NF, RM 2.0 - Nasty Cr	1.24	0.87
Nasty Cr, mouth to end of intermittant zone	0.99	0.74
Nasty Cr, end of intermittant zone - RM 3.6	0.99	0.74
NF, Nasty Cr - Foundation Cr	1.24	0.87
Foundation Cr, mouth - Sthd access limit	1.24	0.87
NF, Foundation Cr - MF Ahtanum	1.36	0.93
MF, mouth - lower end of BT spawning (RM 0.	1.36	0.93
MF, lower end BT spawning - Tree Phones CG	1.36	0.93
MF, Tree Phones CG - waterfall (rearing only)	1.36	0.93
NF, MF - beginning of BT spawning in NF (RM	1.36	0.93
NF, RM 11.8 - McLaine Canyon (RM 13.1)	1.36	0.93
NF, McLaine Canyon - Sthd access limit (RM 1	1.36	0.93
NF, RM 14.5 - Cougar Flat	1.36	0.93
NF, Cougar Flat - Shellneck Cr	1.36	0.93
Shellneck Cr, mouth - RM 1.2	1.36	0.93
SF Ahtanum, mouth - RM 2.0	1.36	0.93
SF, RM 2.0 - Sthd access limit	1.36	0.93
SF, Sthd access limit - start of BT spawning (R	1.36	0.93
SF, lower - upper end of BT spawning at RM 1	1.36	0.93
SF, upper nd BT spawning - BT access limit	1.36	0.93
Reservation Cr, mouth - BT access limit	1.36	0.93

The scores were derived from the QHA process.

Table C-7 displays the relative importance of the Ahtanum Creek bull trout reaches for protection and restoration. The length of the bar corresponds to the reach's relative restoration or protection value weighted by its potential importance to bull trout. The protection and restoration confidence scores reflect the relative certainty of the ratings based on the local expert knowledge of habitat conditions for the specific reach. The higher the confidence score, the greater the confidence in the relative score of habitat protection or restoration conditions for the reach.

Table C-8.
A relative restoration of water temperature restoration priorities for Ahtanum Creek bull trout population reaches

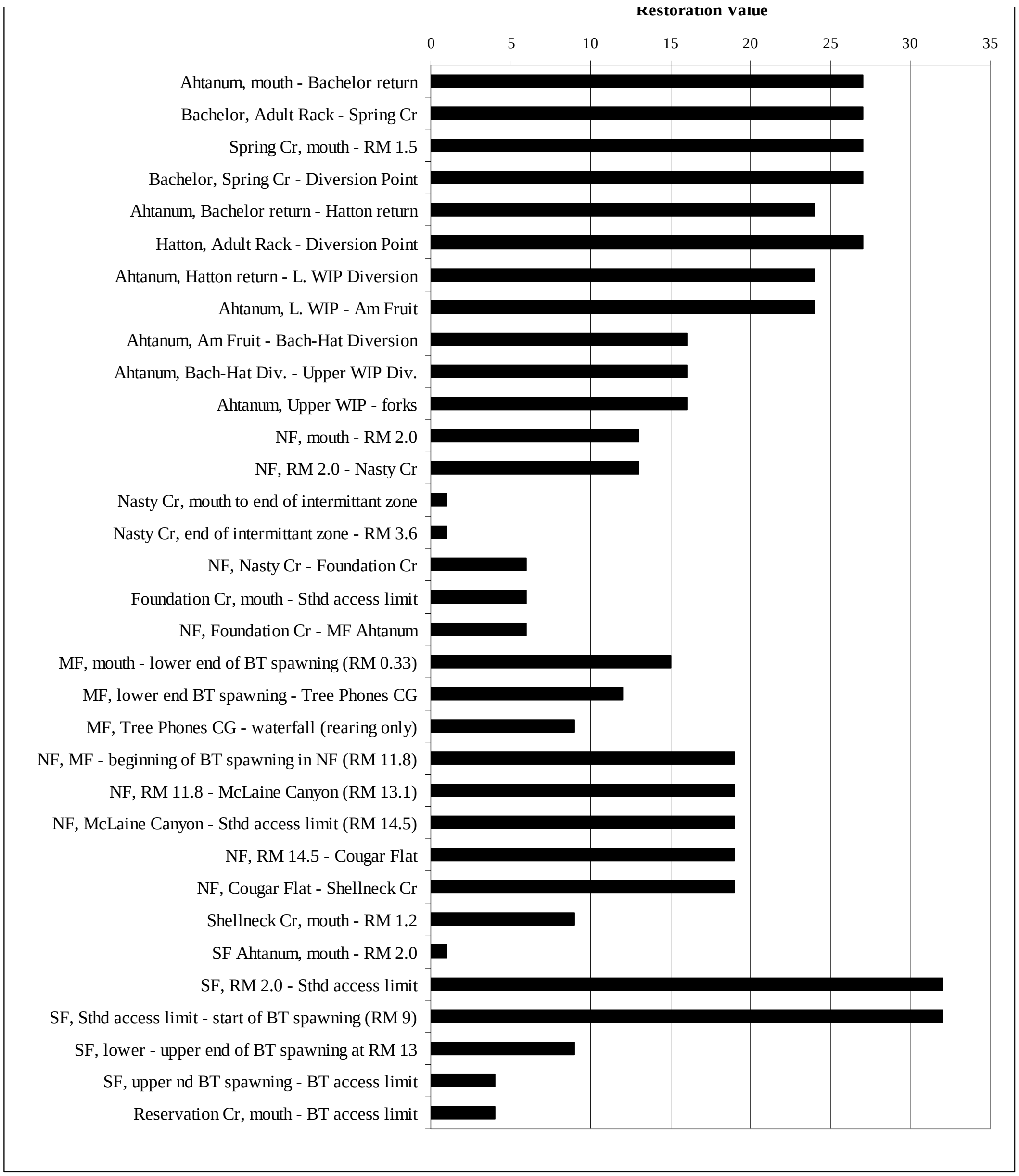


The length of the bar corresponds to the degree of degradation of the attribute weighted by its potential importance to bull trout. The relative rankings were derived from the QHA process.

Table C-8 displays the distribution of water temperature limiting conditions across all the bull trout reaches within Ahtanum Creek Watershed. The length of the bar corresponds to the degree of degradation of the attribute weighted by its potential importance to bull trout. The larger the bar, the greater the reach's restoration value for temperature.

Table C-9.

Relative Restoration of Water Pollution Restoration Priorities for Ahtanum Creek Bull Trout Population Reaches

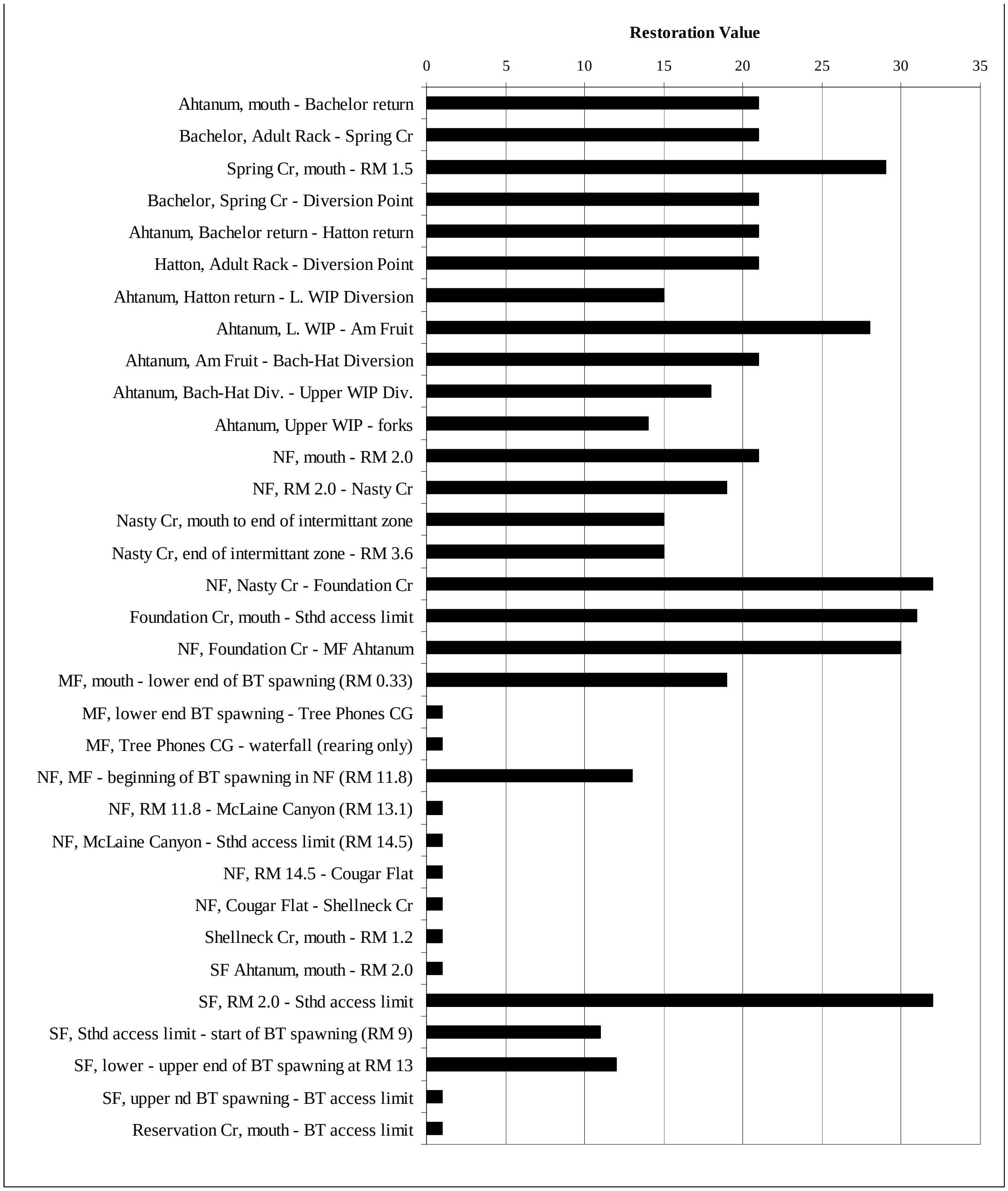


The length of the bar corresponds to the degree of degradation of the attribute weighted by its potential importance to bull trout. The restoration value scores were derived from the QHA process.

Table C-9 displays the distribution of water pollution limiting conditions across all the bull trout reaches within Ahtanum Creek Watershed. The length of the bar corresponds to the degree of degradation of the attribute weighted by its potential importance to bull trout. The larger the bar, the greater the reach's restoration value for water pollution.

Table C-10.

A Relative Restoration of Habitat Diversity Restoration Priorities for Ahtanum Creek Bull Trout Population Reaches



The length of the bar corresponds to the degree of degradation of the attribute weighted by its potential importance to bull trout. The restoration value scores were derived from the QHA process.

Table C-10 displays the distribution of habitat diversity limiting conditions across all the bull trout reaches within Ahtanum Creek Watershed. The length of the bar corresponds to the degree of degradation of the attribute weighted by its potential importance to bull trout. The larger the bar, the greater the reach's restoration value for habitat diversity.

Table C-11. Assumptions Used to Develop Restoration Scenarios

Reach	Problems	Restoration Measures	Comments
NF Ahtanum: McLain Canyon to access limit	Few problems except for road-related sediment delivery to downstream reaches. Local biologists report good habitat complexity, cool water temperatures and stable banks and stream bed. A protection area.	Relocation of ~1 mi of NF road ("relocation" defined as > 200 ft from stream).	Can use DNR 1998 Watershed Analysis to calculate precise mileage of roads to be relocated/decommissioned.
NF Ahtanum: MF Ahtanum to McLain Canyon	Major road-related sediment delivery area, with relatively minor local problems related to confinement & high temperature.	Relocation of NF road from MF to McLaine Canyon (entire reach)	
MF Ahtanum	Streamside roads & recreationists/campground contribute substantial sediment to lower watershed, but cause only modest problems locally. Largest local problems are riparian degradation and high temperature.	Relocate ~2.5 miles of streamside road, relocate campground, cottonwood/willow riparian plantings (entire reach)	Width of planted corridor and density of plantings within corridor remain to be defined. Mileage of planting can be estimated from Terraserver aerial photos. Fencing considered necessary only on grazed areas or areas of heavy recreational use.
NF Ahtanum: Foundation Cr to MF Ahtanum	Important restoration reach. Land uses and bridge confine channel, insufficient LWD and road with 100-200 ft of stream entire length of reach (local and downstream sediment source). In descending order of severity, major problems are: confinement (roads, bridges), high temp, obstructions; lack of LWD; riparian degradation.	Road relocation entire reach; LWD addition; riparian planting (exclosures); weir fishways at problematic bridges (bull trout problems).	Objective of LWD addition is to add 1 piece of LWD per channel width on average throughout the wood-deficient reach provided it is not a natural transport reach.
Foundation Creek	Suffers from same problems as "NF, Foundation to MF", but problems are more severe. Most severe is road-related confinement; high temp next; habitat complexity (LWD) next; & riparian degradation next.	Road relocation for all but lower 0.7 mi; fenced riparian planting entire reach (grazing); LWD addition; bank stabilization.	
NF Ahtanum, Nasty Cr to Foundation Creek	Major impact to incubation primarily from local sedimentation (bank sloughing) with significant contributions by high temp, bed scour & lack of spawning gravel. Causes: primarily road/bridge confinement, riparian degradation, lack of LWD.	Major addition of LWD (perhaps 2 pc/CW); limited road relocation (only where fill slopes would be OK); riparian planting	Use DNR Watershed Analysis to identify road section to relocate.
Nasty Creek	Lower portion dries up; upper portion primarily impacts incubation because of sediment, bed scour/bank instability, high temp and lack of spawning gravels. Road within floodplain entire length.	Very difficult and expensive fix. There could be some benefit from LWD addition, there are a couple of places where side channels could be enhanced or created, but even those are pretty difficult spots.	4th top restoration potential reach for steelhead
NF Ahtanum, RM 2.0 to Nasty Creek	Loss of alluvial fan area/function causing scour/bank sloughing where confined (NF road, John Cox & Shaw diversions) & routing increased bedload downstream. Channelization below NF road to Shaw-Knox increases energy and sediment transport downstream. Result is major impact to incubation primarily from sedimentation with significant impacts from temperature and scour/fill.	Rework NF bridge/John Cox diversion: change grade control structures at bridge/diversion to allow bedload movement downstream. Consolidate John Cox/Shaw Knox to eliminate need for channelization below NF Bridge; relocate ~ 1 mi of road within 200 ft of stream; riparian plantings in devegetated areas (as per aerials).	3rd top restoration potential for steelhead

Table C-11. Assumptions Used to Develop Restoration Scenarios (continued)

Reach	Problems	Restoration Measures	Comments
NF Ahtanum, mouth to RM 2.0	Problems like reach above.	Actions for reach above affect this reach as well. Within this reach, more emphasis on riparian planting.	Respective restoration potential for steelhead, coho and spring Chinook: 5th, 7th, 5th
SF Ahtanum, RM 2.0 to steelhead/coho access limit	Large amounts of new angular bedload coming off the South Facing hills, severely impacting coho & steelhead incubation from sedimentation. To some degree, this is natural, but it is exacerbated by floodplain roads.	Relocate roads within 100 ft of stream.	2nd top restoration potential reach for steelhead. Very little published habitat data for SF.
SF Ahtanum, mouth to RM 2.0	Confinement by residential uses; considerable riparian damage from residential development, some from grazing. Major sediment impact to incubation for coho & steelhead; substantial temperature impact to steelhead incubation. Lack of spawning gravel for both species.	Fenced riparian plantings, decommissioning/relocation of ~1 mi of road (not the SF Road), perhaps the hydraulic reconnection of 3 NF-to-SF distributaries (creating fry rearing habitat, lessening scour problems because of increased conveyance capacity).	5th top restoration potential reach for steelhead. Very little published habitat data for SF.
Ahtanum Creek, upper WIP to forks.	Channel constriction at Herke causes aggradation upstream, instability in the constriction itself, increased erosion downstream & massive erosion & riparian degradation in the adjacent floodplain. Riparian degradation more severe than any other reach of drainage. Upstream of the Narrows the channel has lost sinuosity/gone through regrade due to increased bedload from upstream. The reach immediately above the Narrows is a significant upwelling area. Steelhead incubation severely impacted by temperature and sediment, less impact from scour/fill. Coho sub-yearling and winter rearing severely impacted by low habitat diversity (primarily lack of LWD) and lack of key habitat (pools, off-channel habitat). Spring Chinook adult holding compromised by excessive temperature and lack of key habitat (pools); & incubation compromised by sediment.	1) Rework Herke reach: Build Herke a new, longer bridge, and re-meander channel through Herke area and upstream (decreases scour/bank sloughing). The real cause of scour/bank sloughing is loss of area on the alluvial fan, which shifts deposition downstream. Fixing the NF bridge helps some but really need to recover floodplain from ~John Cox to the forks. 2) Addition of large quantities of LWD (2 pc/CW) really helps habitat complexity, pool formation & sediment storage. The area ~ from the Mission to Herkes has significant upwelling of cool groundwater & addition of structural complexity from LWD would be very beneficial. 3) Yakama Nation has identified 1.1 mi of side channel that could be reconnected here (juvenile rearing habitat). 4) Riparian planting/fencing urgently needed throughout reach, but especially in upper half. 4) Rework Herke's as above; 2) major fenced riparian planting; 3) retrofit upper WIP diversion to allow BH to be used as flood control channels & to allow bedload to move into BH.	Number 1 restoration reach for spring Chinook, coho and steelhead. Note: 3.1 mi riparian fencing already installed by Yakama Nation, 0.8 mi of side channel just re-connected.

Table C-11. Assumptions Used to Develop Restoration Scenarios (continued)

Reach	Problems	Restoration Measures	Comments
Ahtanum Creek, Bachelor-Hatton Diversion to upper WIP Diversion	Chronic channel instability/channel widening/aggradation & associate severe riparian degradation caused partly by upstream actions on Herke, partly by grazing, &partly by the WIP and Bachelor/Hatton diversions themselves. Impacts steelhead incubation (mainly high temperature, but also sediment & scour/fill); coho sub-yearling rearing (lack of pool/off-channel habitat, high temp) & incubation (sediment, scour/fill), and spring Chinook adult holding (pools & temp) & spawning (temperature). Temperature impacts dominate.	1)	Restoration potential for steelhead and spring Chinook = 10th & 7th, respectively. Yakama Nation recently fenced 1.6 mi of riparian corridor here.
Ahtanum Creek, American Fruit to Bachelor-Hatton Diversion	Reach suffers from 1) high temperatures and low flows (temp driven partly by low flow, partly by lack of shading, partly by temp of incoming water); 2) channel instability caused by 3500 ft of channelization/leveeing upstream of Diversion 14 (950 ft above Am Fruit Rd); 3) bed aggradation above confinement caused by Diversion 14 (950 ft above Am Fruit Rd) and erosion below Div 14; 4) channel incision below Lynch Lane 5) Levees, old roads & groins that prevent access to floodplain on the Reservation side, forcing creek toward Hatton channel; 6) few pools, little LWD. Severe impacts to steelhead incubation from temp, major impacts from sediment & scour/fill; Severe impacts to coho sub-yearling rearing from lack of key habitat (pools/off-channel habitat) & scour/fill, low flow, food and habitat diversity, and to coho winter rearing because of low habitat complexity (LWD) and lack of pools/off-channel habitat; and severe impacts to spring Chinook adult holding & spawning because of temperature, with lesser but large impacts from low flow, low habitat complexity (LWD) and low key habitat (pools).	1) Increase flow (probably impossible w/o Pine Hollow); 2) Continue floodplain/riparian restoration at and below the mission; 3) Purchase property from Am Fruit Rd to 3500 ft above Div 14 to re-meander channel & add LWD (to create pools) & to regrade banks to eliminate incision and increase bank stability (reduce sediment input).	Restoration potential for steelhead, coho and spring Chinook, respectively, 8th, 3rd, 2nd. Yakama Nation recently constructed 0.34 mi of fenced riparian in reach.
Ahtanum Creek, Lower WIP to American Fruit Road	1) Channel straightening throughout all but ~ 1 mi has resulted in major incision/bank instability, floodplain disconnection and loss of riparian vegetation; 2) Critically low flows in this reach; 3) excessive temperatures (shading & flow related).	1) Raise the channel back up through engineered re-meandering and grade control (made easier by a lack of residential development through altered sections). This would obviously require purchase of property; 2) Riparian planting/fencing; 3) Addition of LWD throughout re-meandered reach (1 pc/CW).	Restoration potential for steelhead, coho and spring Chinook, respectively, 9th, 4th, & 4th. Yakama Nation recently constructed 0.34 mi of fenced riparian in reach.

Table C-11. Assumptions Used to Develop Restoration Scenarios (continued)

Reach	Problems	Restoration Measures	Comments
Ahtanum Creek, Hatton return to Lower WIP	1) Although channel stability is generally good, the riparian zone is virtually denuded in about 60-70% of reach. 2) Low flows 3) The channel is straightened and incised for About over about a 1,000 ft section upstream of 62nd. 4) High temperatures due to lack of shading, low flow & temp of incoming water. These conditions have severe impacts on steelhead incubation (mainly temperature, but large impacts from scour/fill & sediment as well) and sub-yearling rearing (low flow, temperature & lack of pools); main coho impact is to sub-yearling rearing (lack of pools, low flow & temperature) and main impact to spring Chinook is to (mainly lack of pools and temperature but also large impact of low flow)	1) Main action is to plant riparian; 2) Install LWD (1 pc/CW); 3) Re-meander lower 1,000 ft	Restoration potential for reach for coho & spring Chinook is 6th & 8th, respectively.
Ahtanum Creek, Bachelor return to Hatton return	1) Low flows 2) Riparian zone damage, partially due to low flows (channel denuded for a 1/2 mi section below Hatton return) 3) High temperatures (due to riparian damage, low flows, temperature of incoming water) 4) Incision/channelization at Emma Lane/42nd. Impacts to steelhead: severe impacts to incubation from temperature with lesser but still major impacts from scour/fill and sediment. Impacts to coho: major impacts to sub-yearling rearing from lack of pools with lesser but still large impacts from low flow and temperature. Impacts to spring Chinook: Major impacts to adult holding from low flow, lack of habitat complexity, high temperature and lack of pools.	1) Riparian plantings, especially in upper half mile; 2) Remeander at Emma Lane; 3) Add LWD (1 pc/CW); 4) increase flows (impossible without Pine Hollow)	Restoration potential for reach for coho & spring Chinook is 2nd & 3rd, respectively.
Ahtanum Creek, mouth to Bachelor return	1) Low flows (but not so low as upstream, because of groundwater upwelling and Marquis ditch inflow from Wide Hollow Cr) 2) Extensive channelization alongside Fulbright Park 3) Channel aggradation and associated sediment problems from the mouth to the Ag Museum bridge. 4) Severe riparian vegetation damage in the lower 1/2 and upper 1/4 of the reach and an associated lack of LWD & pools. 5) High temperatures (although impact is mitigated by Marquis ditch inflow and groundwater upwelling). Impacts to steelhead: severe impacts to incubation from sediment & temperature, with lesser but still large impacts from scour/fill. Impacts to coho: Major impact to sub-yearling rearing from lack of pools, habitat complexity & temperature, as well as major impacts to incubation from sediment and scour/fill. Impacts to spring Chinook: Major impacts to adult holding from low flow, low habitat complexity (LWD), high temperature and lack of pools, as well as severe impacts to incubation from sediment and lesser but still major impacts from temperature.	1) Re-meander creek along Fulbright Park 2) Take out adult rack at mouth of Bachelor Cr, replace it just upstream of Spring Cr (allows use of cool lower Bachelor and Spring Cr) 3) riparian plantings throughout 3/4 of reach 4) Add LWD throughout reach (1 pc/CW)	Restoration potential for reach for coho & spring Chinook is 5th & 7th, respectively.

APPENDIX D – SURFACE WATER ANALYSIS OF RESERVOIR OPERATIONS

Surface Water—Analysis of Reservoir Operations

This appendix includes the information on the analysis conducted on the reservoir operations. The analysis was conducted using the flow routing model developed for the *Ahtanum Creek Watershed Assessment*, Golder Associates (2004). The model uses GoldSim software to evaluate the impacts of a proposed reservoir on surface water supply and instream flows. The model simulates flows through reaches of the watershed based on the following:

- Surface water flows – The model routes historical average daily stream flows (1947-1984) for the North and South Forks of Ahtanum Creek from the upper watershed to the mouth of the mainstem creek, under a variety of user input conditions. The model period of record (1947-1984) was chosen based on the availability of weather data used to simulate local runoff to the lower Ahtanum Creek system.
- Runoff – Each reach of the creek modeled is assigned a tributary area and a curve number based on ground cover. The model then applies the Natural Resource Conservation Service (formerly Soil Conservation Service) curve number method and weather data to calculate the runoff that enters the stream in each reach.
- Groundwater – The interaction between the surface water in Ahtanum Creek and groundwater is simulated as a gain or loss in each reach. Each reach was assigned a loss or gain based on stream flow measurements and calibration of the flow routing model. The model also calculates gains or losses in Bachelor and Hatton Creeks and makes an allowance for return flows from Bachelor and Hatton Creeks to the mainstem. However, conveyance of irrigation water through a piped system would significantly reduce flows in Bachelor and Hatton Creeks and minimize their impact on the overall water budget.
- Irrigation diversions – A crop water model was developed that calculates surface water demand for both the AID and WIP based on a variety of user input crop and irrigation parameters. The crop model is linked to the flow routing model, so that demands are calculated and applied to the routing model.
- Instream flow targets – The flow routing model enables the user to specify instream flow targets for the North Fork and mainstem of the Ahtanum Creek. The routing model gives priority to maintaining these flows when filling and releasing water from the proposed reservoir.
- Storage – The flow routing model has the ability to simulate storage of water in a 24,000-acre-foot off-stream reservoir in Pine Hollow. The user specifies whether the reservoir is to be used for a particular scenario. The model assumes that the reservoir will be supplied through an expanded (160-cfs capacity) Johncox Ditch. Diversion of flow from the North Fork to fill the reservoir is limited by maintenance of instream flow targets and channel-forming flows. The routing model specifies maintenance of a 350-cfs channel-forming flow, meaning that diversion to the reservoir is interrupted if the average daily flow in the North Fork exceeds 350 cfs for period of 1 to 6 days so that the channel-forming flows remain in the stream. Water is withdrawn from the reservoir to maintain instream flow targets specified for the mainstem of the Ahtanum Creek and meet surface water demand calculated for the AID and WIP. Withdrawals are limited by a maintaining a 2,000 acre-feet minimum reservoir volume for dead storage as outlined in the *Ahtanum Creek Watershed Assessment* (Golder, 2004) and other previous studies.

Alternative 2 was evaluated using the flow routing model to simulate the following conditions:

- The reservoir would provide all out-of-stream water use within the reservoir service area for the entire irrigation season.
- There would be no individual creek diversions within the reservoir service area.
- Water from the reservoir would be used to augment flow in Ahtanum Creek when natural flows cannot meet target flows.
- The WIP canals would be lined or piped.
- All water from the reservoir would be delivered through a piped system.

Several scenarios were evaluated that included variations of the following parameters:

- Irrigation Demand – The *Ahtanum Creek Watershed Assessment* (Golder, 2004) estimated that between groundwater and surface water supplies, a total of 46,400 acre-feet was required to adequately irrigate the current (2002) crop acreages. This level of demand was established as the current, or baseline demand condition. If conservation measures are implemented, as specified for Alternative 2, efficiencies would reduce the total amount of water required to irrigate the same crop acreage to approximately 33,100 acre-feet. That level of demand was evaluated by the routing model to determine the long-term impacts of Alternative 2 on surface water supply and flows. Different ratios of groundwater and surface water demand were evaluated. Based on the storage capacity of the reservoir and the assumption that most of the surface water demand will shift to the summer when supplied by a reservoir, it was estimated that 19,600 acre-feet of the total 33,100 acre-feet of water needed would be supplied by surface water.
- Instream flow targets – Alternative 2 assumes that water from the reservoir would be used to augment stream flow in Ahtanum Creek when natural flows cannot meet target flows. A variety of instream flow targets were evaluated. The evaluation included analysis of historical flows and comparison of historical flow statistics to previous instream flow target recommendations. Different instream flow targets were also evaluated with the routing model. Based on input from the Ahtanum Core Group, the analysis ultimately focused on the ability of the reservoir to maintain instream flow targets in the North Fork and mainstem of the Ahtanum Creek equal to those flows recommended by Simmons (USFWS, 1993) developed with the Instream Flow Incremental Methodology (IFIM) ; those instream flow targets are shown below in Table D-1.

Table D-1. Ahtanum Creek Instream Flow Targets

Location	Monthly Instream Flow Target (cfs)											
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
North Fork	20	20	30	70	110	80	20	20	20	20	20	20
Mainstem	25	30	50	90	140	100	20	20	25	25	25	25

Note: Based on IFIM Methodology (Simmons, 1993)

The results of the evaluation of Alternative 2 using the flow routing model are shown in Table D-2 and Figures D-1 and D-2. Table D-2 summarizes the instream flow targets and distribution of demands assumed for the scenario that provided the most beneficial results, based on the demand conditions and instream flow targets noted previously. Also listed, for comparison, are the results of evaluations completed for the *Ahtanum Creek Watershed Assessment* (Golder, 2004) to evaluate natural flow conditions, current flow conditions, and flow conditions resulting from use of the proposed reservoir to supply surface water demand and augment instream flows after July 10.

The evaluation results indicate the following:

- Improvements in efficiency resulting from conservation measures, including installation of a piped distribution system and more efficient on-farm irrigation systems, could reduce the total amount of water needed annually to approximately 33,100 acre-feet. This represents a reduction of approximately 29 percent in the total annual demand of 46,400 acre-feet that was estimated as the current (2002) demand condition in the *Ahtanum Creek Watershed Assessment* (Golder, 2004). This also represents an increase in on-farm efficiency from approximately 70 percent to 82 percent, and an increase in conveyance efficiency from approximately 75 percent to 95 percent.
- Installation of a “smart” diversion and upgrade of the capacity of Johncox to 160 cfs would allow the diversion of streamflow from the North Fork to the proposed Pine Hollow Reservoir. As shown in Figure D-1, approximately 17,000 acre-feet per year could be diverted on average from the North Fork of Ahtanum Creek while meeting in-stream flow targets and channel maintenance flow criteria.
- Assuming that 19,600 acre-feet of that total demand is surface water demand, a 24,000-acre-foot reservoir will have the capacity to meet the surface water demand and supplement instream flows to meet the IFIM instream flow target with a reliability of approximately 72 percent. The reliability represents the percentage of days that the reservoir would be able to supply surface water demand for irrigation and meet instream flow requirements under the natural surface flow and weather conditions defined for the model period (1947-1984). The results indicate that a 24,000 acre-foot reservoir would, on average, be able to yield approximately 15,000 acre-feet of surface water for irrigation and instream flow supplement. The 15,000 acre-foot yield is less than the estimated 17,000 acre-foot diversion described above because of conveyance losses estimated for deliveries in an upgraded Johncox Ditch and seepage and evaporation losses from the reservoir. The estimated 15,000 acre-foot yield supports the conclusion made during the evaluation of reservoir sizing outlined in the *Pine Hollow Reservoir Project Overview* (Dames & Moore, 2000).
- Evaluation of different scenarios indicated that greater reliability would result from application of lower instream flow targets. For example, reducing the instream flow target to a constant year-round 20 cfs for the North Fork and 25 cfs for the mainstem would increase the reliability of the reservoir from 72 percent to 80 percent. The change would also increase the amount of flow available from the reservoir, on average, from approximately 15,000 acre-feet to more than 16,000 acre-feet annually. This is shown in Figure D-3. Greater reliability would also result from shifting more of the overall demand to groundwater to reduce surface water demand.

Table D-2. Alternative 2 – Flow Routing Model Analysis Results

	ISF Target		Crop Water Model									Demand On Proposed Reservoir[3] (AF)	Demand Supplied By Proposed Reservoir[4] (AF)		Flow Occurrences					
			Surface Water			Groundwater			TOTAL						North Fork		A. Cr. R2[6]		A. Cr. R5[7]	
Model Scenario	N Fk (cfs)	Aht. Cr. (cfs)	Apr-Jun Demand (AF)	Jul-Oct Demand (AF)	Total Demand (AF)	Apr-Jun Demand (AF)	Jul-Oct Demand (AF)	Total Demand (AF)	Apr-Jun Demand (AF)	Jul-Oct Demand (AF)	Total Demand (AF)			Reservoir Reliability[5]	Days <20 cfs	Days >350 cfs	Days <20 cfs	Days >350 cfs	Days <20 cfs	Days >350 cfs
ACWA - Natural	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	N/A	14.2%	1.7%	6.4%	3.8%	23.4%	3.2%
ACWA - Current	IFIM[1]	0	13,800	4,600	18,400	17,700	10,300	28,000	31,500	14,900	46,400	0	0	N/A	18.9%	1.6%	8.0%	3.5%	40.3%	1.9%
ACWA - Demand C	IFIM[1]	35[2]	14,800	10,500	25,300	22,200	7,000	29,200	37,000	17,500	54,500	10,500	10,500	96%	14.4%	1.3%	3.5%	2.0%	10.8%	1.9%
EIS Alternative 2	IFIM[1]	IFIM[1]	9,100	10,700	19,800	10,700	2,600	13,300	19,800	13,300	33,100	19,800	15,000	72%	14.4%	1.1%	5.9%	1.5%	27.5%	1.5%

NOTES:

ACWA=*Ahtanum Creek Watershed Assessment* (Golder, 2004)

Model Scenario Description:

- ACWA – Natural simulates the natural stream flows that would have occurred during the model period (1947-1984) if the streams had not been regulated by irrigation diversions.
- ACWA – Current simulates the stream flows that would have occurred during the model period (1947-1984) under current (2002) cropping and irrigation demands.
- ACWA Demand C – simulates the stream flows that would have occurred during the model period (1947-1984) under a higher level of surface water demand defined in the ACWA. Surface water demands would be met by the reservoir after July 10.
- EIS Alternative 2 – simulates the stream flows that would have occurred during the model period (1947-1984) under the 2002 cropping and irrigation demands with conservation measures implemented and a portion of the surface water demand shifted to the late summer.

1) Indicates that IFIM Analysis (Simmons, 1993) recommendations were used as target flows.

2) 35 cfs was used as target flow to dictate reservoir withdrawals from Jul-Oct. During the rest of the year the target was set at 0 cfs.

3) Indicates the level of surface water demand that the scenario assumes will be provided by the proposed Pine Hollow Reservoir.

4) Indicates the level of surface water demand that can actually be provided by the reservoir under each scenario according to the routing model.

5) The reliability represents the percentage of days during the model period (1947-1984) that the reservoir was able to supply surface water demand[3] for irrigation and meet instream flow requirements. The ACWA – Demand C model scenario has a very high reliability as only demands occurring after July 10 were supplied by the reservoir.

6) A. Cr. R2 represents the flow in Ahtanum Creek at a point just below the proposed inflow from Pine Hollow Reservoir and upstream of the current WIP and AID diversions.

7) A. Cr. R5 represents the flow in Ahtanum Creek at a point near American Fruit Road. Low flows would typically occur in the late summer and early fall.

Figure D-1.
Alternative 2 – North Fork Flows and Diversion to Reservoir

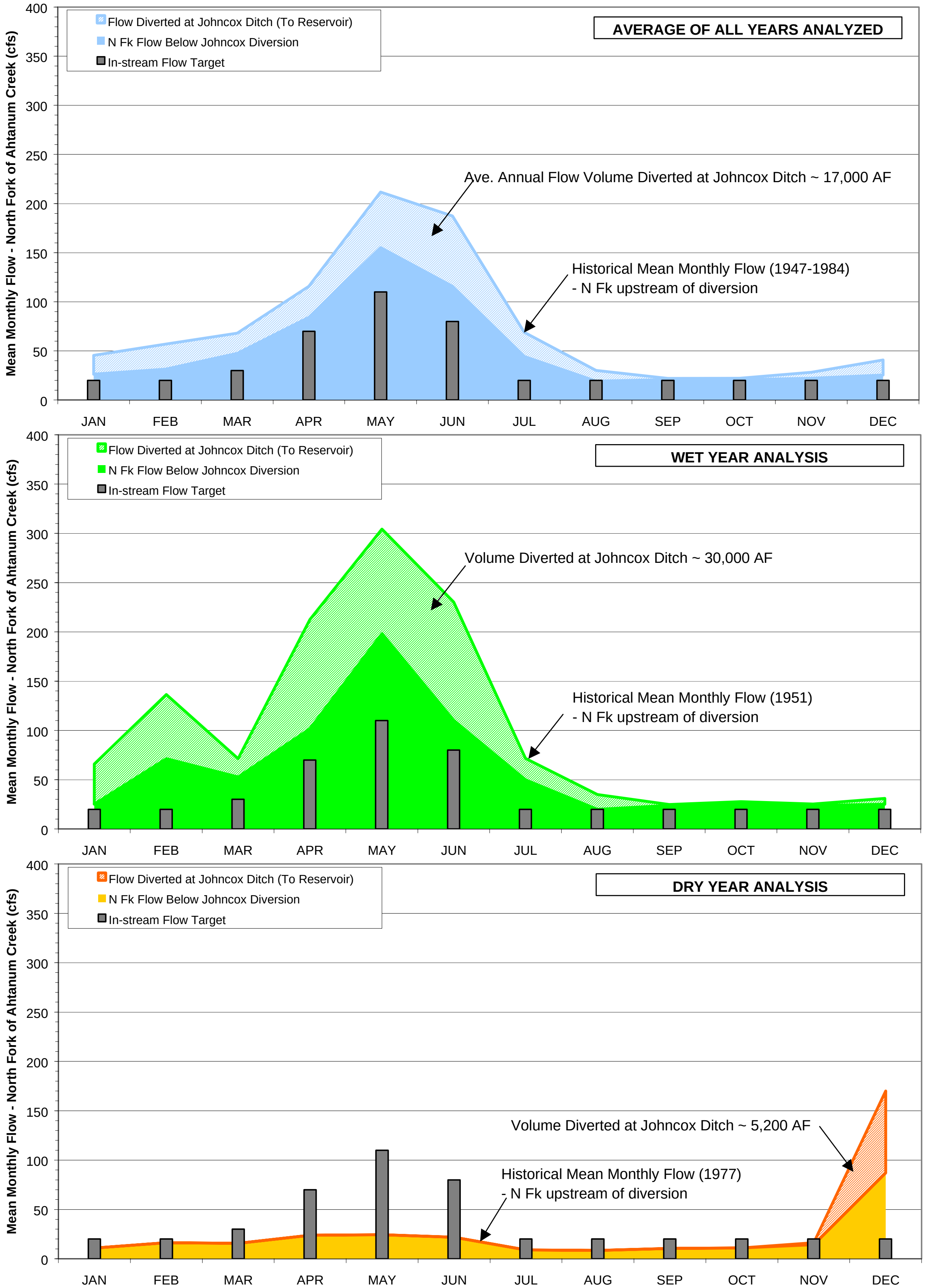
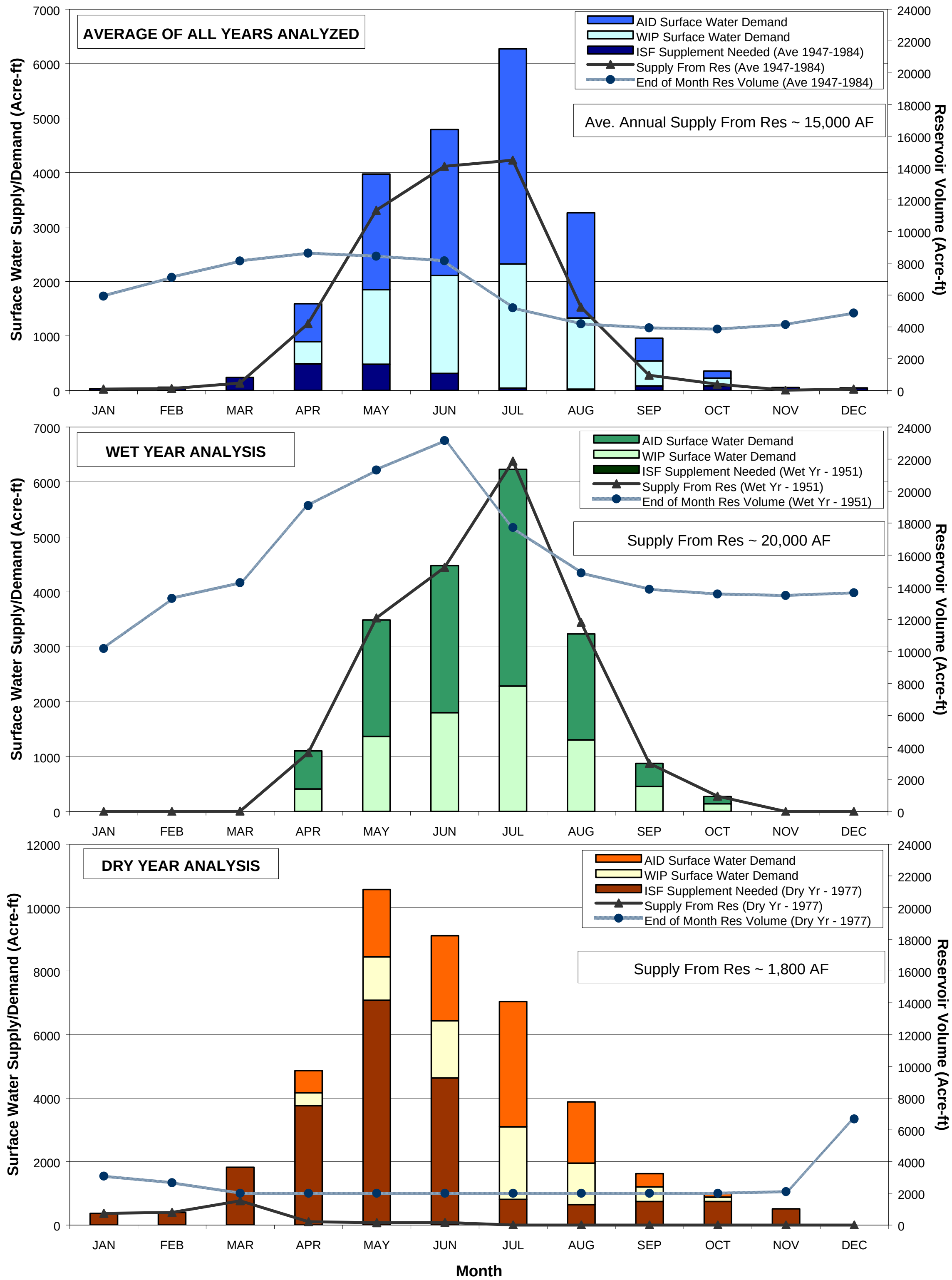
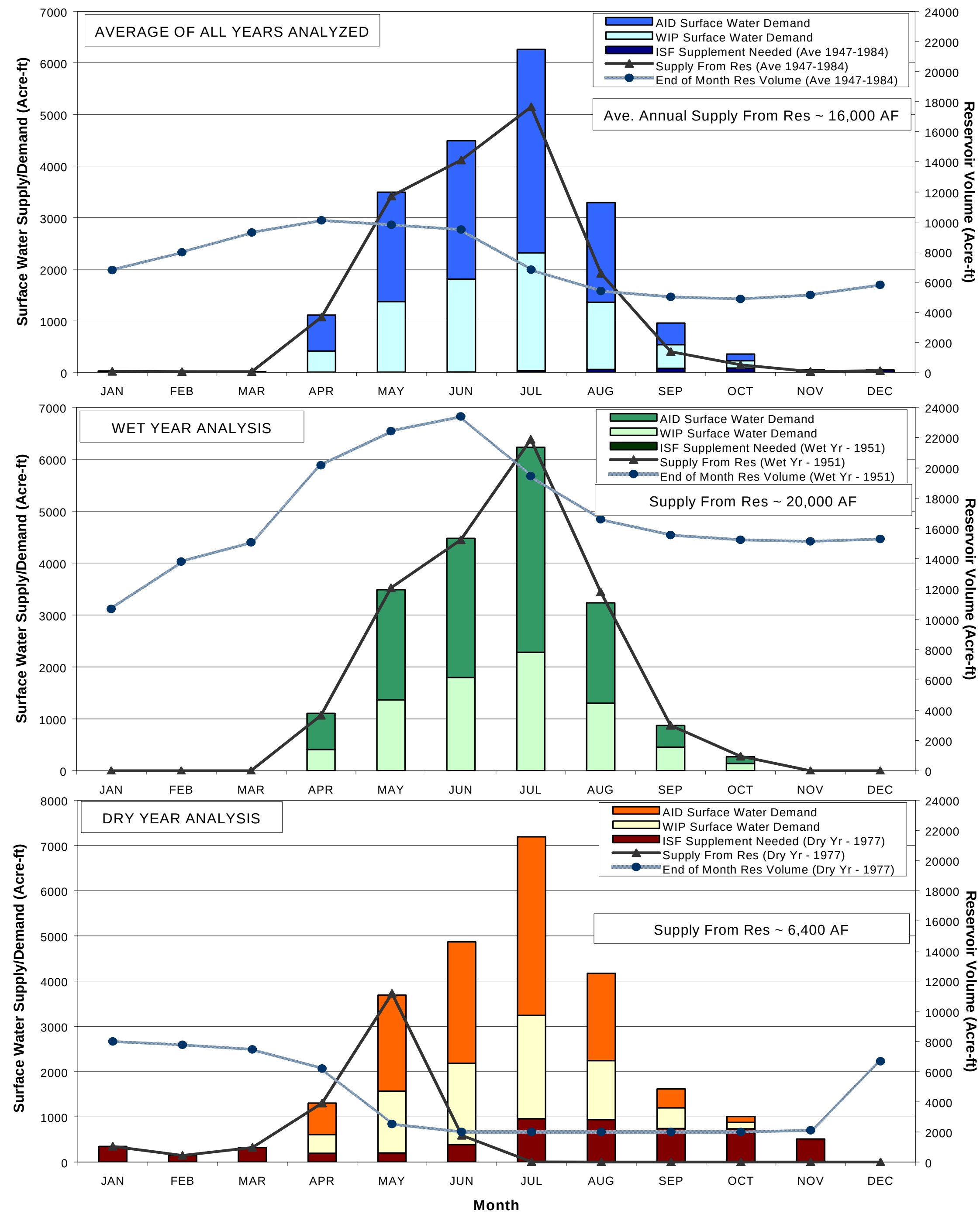


Figure D-2.
Alternative 2 – Surface Water Demand vs. Supply From Reservoir



NOTES:
1) WIP and AID Surface Water Demand calculated by crop water model based on providing surface water to acreages and crop types that are currently served by surface water (Estimated 11,100 acres served partially or exclusively by surface water). Calculated demand applied to all years within the model period of record.
2) ISF Supplement Needed calculated by flow routing model as difference between modeled flow in Ahtanum Creek and in-stream flow target.
3) Supply From Reservoir, Flow Into Reservoir, and End of Month Reservoir Volumes also calculated by flow routing model.

Figure D-3.
Alternative 2 – North Fork Flows and Diversion to Reservoir
(Instream Flow Targets Reduced to 20 cfs year-round on N. Fork and 25 cfs year-round on mainstem)



NOTES:
1) WIP and AID Surface Water Demand calculated by crop water model based on providing surface water to acreages and crop types that are currently served by surface water (Estimated 11,100 acres served partially or exclusively by surface water). Calculated demand applied to all years within the model period of record.
2) ISF Supplement Needed calculated by flow routing model as difference between modeled flow in Ahtanum Creek and in-stream flow target.
3) Supply From Reservoir, Flow Into Reservoir, and End of Month Reservoir Volumes also calculated by flow routing model.

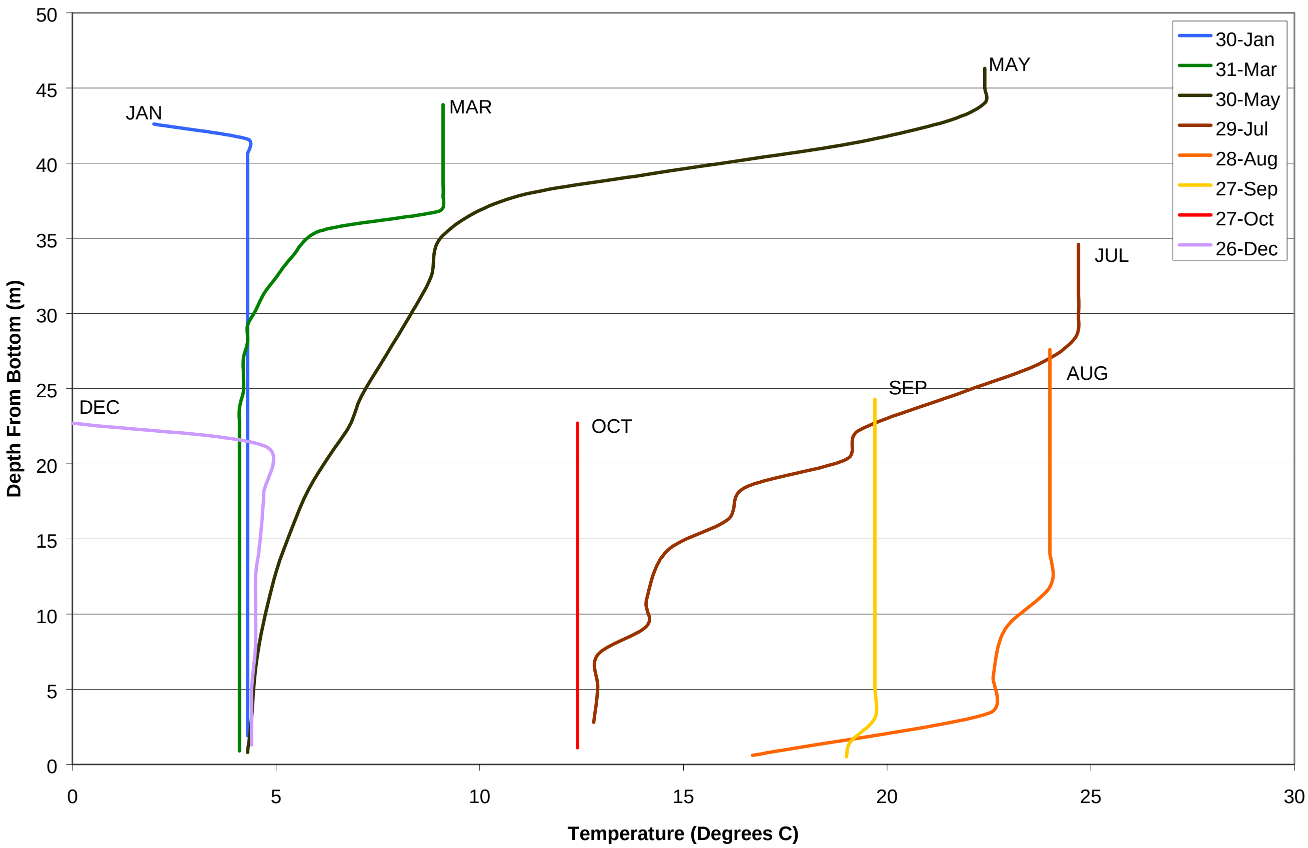
- In general, reliability of surface water supply is currently lowest during the late summer and early fall when stream flows are low. Currently, AID cannot divert water from the creek after July 10, and irrigators have to rely on other sources of water for irrigation during the late summer and early fall. The WIP diverts flow for irrigation throughout the summer, but the reliability of diversions is limited by the flow in the creek. Under Alternative 2, both AID and WIP would divert water for irrigation between April and October directly from the reservoir.
- On average, the reservoir would be able to augment instream flow and provide surface water to meet most of the demand for surface water in the AID and WIP during the spring and early summer. During the late summer and early fall, the reservoir would be drawn down and would not be able to supply as much of the irrigation demand.
- During a wet year, the reservoir would remain nearly full and be able to supply all surface water demands. Very little supplementation of natural instream flows would be required to meet instream flow targets.
- During a very dry year, the reservoir would be drawn down throughout most of the year and would have very little capacity to meet irrigation demands or supplement instream flows on the mainstem of Ahtanum Creek. As evaluated, the reservoir would provide limited benefit to surface water supply during a drought year. If the very dry year was preceded by a wetter than average year, some carry over storage would be available during the early part of the year to augment instream flows and supply irrigation.
- On average, use of the reservoir to maintain instream flow targets in the North Fork and supplement instream flows in the mainstem of the Ahtanum Creek would reduce the number of days with low flow below the point of discharge from the reservoir. Under current conditions, average daily flow in the mainstem of the Ahtanum Creek below the AID and Upper WIP diversions falls below 20 cfs on approximately 40.3 percent of the days during the model period. Alternative 2 could reduce that number to approximately 27.5 percent. Analysis indicated that under natural flow conditions, without any diversions, that number would be approximately 23.4 percent.

The modeling results indicate that flow conditions under Alternative 2 would compare favorably against current flow conditions. The evaluation that was described in the *Ahtanum Creek Watershed Assessment* (Golder, 2004) suggested that the reservoir could operate at an even higher reliability under a scenario where surface water demands and instream flow supplement would only be supplied by the reservoir from July to October. That scenario assumed that the annual surface water demand would be approximately 25,300 acre-feet and that overall demand would be approximately 54,500 acre-feet. Those demands are higher than those supplied under Alternative 2 and would result from irrigation of higher value crops. Of the 25,300 acre-feet surface water demand, only 10,500 acre-feet would be supplied by the reservoir. The scenario presented in the *Watershed Assessment* also assumed that the surface water demand before July would be met by diversions from the creek. Although that scenario would result in a higher reliability for the reservoir, it would not supply as much surface water from the reservoir as would be provided by the reservoir under Alternative 2. That scenario does not sufficiently evaluate the ability of the mainstem to meet surface water demand before July while diverting water from the North Fork to fill the reservoir. In addition to evaluating the impact that

Alternative 2 could have on the quantity of surface water flow and supply, a model was developed to evaluate the impact that Alternative 2 would have on surface water temperatures. The model was developed using the CE-QUAL-R1 model developed by the U.S. Army Corps of Engineers. The model has the capability of simulating the vertical distribution of temperature throughout a reservoir and the outflow temperature from the reservoir. The simulation requires input of flow data, incoming water temperature data, geometry of the reservoir and outlet, and weather data. A year of flow data selected as typical from the flow routing model was used as inflow for the temperature model. Recent water temperature measurements taken along the North Fork of Ahtanum Creek were used to generate a curve representing typical inflow temperatures. The proposed geometry of the reservoir was input as described in the *Pine Hollow Reservoir Project Overview* (Dames & Moore, 2000). It was assumed that the reservoir would have a common outlet at a point near the base of the dam. A year of weather data were also assembled and input.

Figure D-4 illustrates temperature profiles that were generated by the model of the proposed reservoir through a typical year. The temperature standard for streams with salmon and trout spawning, core rearing, and migration (formerly Class AA waterbody) is 16 degrees Celsius (°C). Results of the modeling indicate temperatures exceeding 16° C will occur for releases from the reservoir in August and September. Since modeling was performed for a typical year, release temperatures would exceed temperature standards earlier during a dry year with less water in the reservoir and later during a wet year. State water quality standards allow the target temperature criteria for streams to be the natural temperature plus 0.3° C. Reservoir releases may be managed to meet that criteria; however, because Ahtanum Creek temperatures typically exceed 16° C during the summer, releases could not be made in August and September to prevent an increase in stream temperatures. However, it would be the decision of resource agencies whether or not water is released from the reservoir into the stream when it exceeds the temperature criteria.

Figure D-4. Simulated Monthly Temperature Profiles – Pine Hollow Reservoir



APPENDIX E – ECONOMIC MODELING

Economic Modeling

This Appendix describes the methods by which the total regional economic impacts are projected from the initial direct effects of the project, including the input/output modeling, data adjustments, and localizing impacts. The economic analysis of direct and indirect impacts is included.

Baseline Projections

Input-Output Models

An input-output model simulates the relationships of an economy. These relationships, or linkages, are measured by the dollar value of purchases or sales among the various industrial and commercial sectors. Thus the model links the microeconomics of diverse businesses to the total interactions of the local economy. Economists have used the input-output analysis for 40 years to evaluate changes in inter-industry flows of goods and services and resulting changes in output, employment, and income.

The input-output model is based upon a specification of production relationships within an economy; such a specification shows the magnitude of each industry's purchases from other industries. These production relationships are combined with measures (regional purchase coefficients) that reflect the extent of local purchases in each input category. Any direct expenditure can be multiplied by the coefficient of the affected industry to find the first round of indirect effects. In turn, this first round will generate other rounds of indirect effects that can be determined in a similar manner to direct effects. Subsequent rounds of indirect spending eventually become negligible for the various categories, which allows for a determination of total indirect impact. A similar iterative process using household incomes provides an estimate of induced effects. Totals of direct, indirect, and induced effects enable calculation of a multiplier.

The primary strength of the input-output model is its level of detail, which allows for estimates of industry-specific impacts. There are several non-survey models and modeling services available for use when time and financial constraints preclude obtaining full survey data.

The models are relatively inexpensive and are considered to be reasonably accurate. One widely used non-survey model is the U.S. Forest Service IMPLAN (Impact Analysis for Planning) model, which adapts a national input-output table to the local economy by using national production coefficients and local levels of sectorial employment and final demand. After consideration of the advantages and shortcomings of a number of non-survey input-output models, the IMPLAN coefficients were selected for this project that were derived in the analysis of a similar project for Yakima County (Mack and Robison, 1995; Bruckner, Hasting and Latham, 1987).

Direct expenditures from the various categories of activities were programmed into the input-out model in order to generate indirect and induced impacts. These are various categories of construction and operation and maintenance. The generation of estimates for the expenditures requires adjustments for time, function, and geography. As sufficiently detailed construction cost estimates were not available, data from 30 Bureau of Reclamation projects constructed in the region since 1984 were used to apportion total cost estimates into detailed IMPLAN sectors. In addition, regional contractors were consulted to determine likely sources of subcontractor activities. These contractors were: Mountain States Construction of Sunnyside, George A. Grant of the Tri-Cities, Pellinger Enterprises of the Tri-Cities, MRM Construction of Ellensburg, and Kiewitt-Pacific Company of Concord, California. Detailed estimates of these expenditures were obtained from the consultants who developed the plans for the *Ahtanum Creek Watershed Assessment* (Golder, 2004).

Data Adjustment

The analysis began with estimates of direct spending for subcomponents of each alternative from the *Ahtanum Creek Watershed Assessment* (Golder, 2004). These data were adjusted for a number of local factors before the input-output analysis coefficients were applied. First, expenditures for each alternative were calculated for each year of the 2007 to 2040 period; the *Ahtanum Creek Watershed Assessment* (Golder, 2004) was the preliminary source of costs. All values were adjusted for inflation and stated in 2004 dollars. For simplicity, these data were aggregated into four time periods--the years surrounding 2010, 2020, 2030, and 2040. The results are shown in Tables E-1 through E-5 below. The tables detail aggregated expenditures for Alternatives 2, 3, and 4, respectively. There are two tables for Alternatives 2 and 3, with a high and a low estimate for each. These ranges reflect the relatively broad range of values derived for habitat enhancement and stream channel improvements, as calculated in the *Ahtanum Creek Watershed Assessment* (Golder, 2004). Because the magnitude of the range was significant, separate calculations were made for each rather than creating a single value by averaging.

Table E-1. Alternative 2 Activity Timeline: Low Range of Estimates Direct Spending in Thousands of 2004 dollars

	2010	2020	2030	2040	Total
Construction					
Reservoir	$81,996				$81,996
Pressurized Pipe	22,856				22,856
Farm Connections	29,212				29,212
Farm Improvements	399	1,197	1,064		2,660
Habitat	2,624	3,936			6,560
Stream Channel Improvements	3,240	4,860			8,100
Operation and Maintenance	2,164	4,863	4,869	4,869	16,765
Farm Profits	21,728	48,888	48,888	48,888	168,392
Net Downstream Flows	3,584	8,064	8,064	8,064	27,776
Totals	$167,803	$71,808	$62,885	$61,821	$364,317

*Time intervals
2010 Denotes activities from 2007-2013 inclusive
2020 Denotes activities from 2014-2022 inclusive
2030 Denotes activities from 2023-2031 inclusive
2040 Denotes activities from 2032-2040 inclusive

Table E-2. Alternative 2 Activity Timeline: High Range of Estimates Direct Spending in Thousands of 2004 dollars

	2010	2020	2030	2040	Total
Construction					
Reservoir	$81,996				$81,996
Pressurized Pipe	22,856				22,856
Farm Connections	29,212				29,212
Farm Improvements	399	1,197	1,064		2,660
Habitat	4,264	6,396			10,660
Stream Channel Improvements	6,436	9,654			16,090
Operation and Maintenance	2,164	4,863	4,869	4,869	16,765
Farm Profits	21,728	48,888	48,888	48,888	168,392
Net Downstream Flows	3,584	8,064	8,064	8,064	27,776
Totals	$172,639	$79,062	$62,885	$61,821	$376,407

*Time intervals 2010 Denotes activities from 2007-2013 inclusive
2020 Denotes activities from 2014-2022 inclusive
2030 Denotes activities from 2023-2031 inclusive
2040 Denotes activities from 2032-2040 inclusive

Table E-3. Alternative 3 Activity Timeline: Low Range of Estimates Direct Spending in Thousands of 2004 dollars

	2010	2020	2030	2040	Total
Construction					
Farm Improvements	$399	$1,197	$1,064		$2,660
Habitat	2,624	3,936			6,560
Stream Channel Improvements	3,240	4,860			8,100
Totals	$6,263	$9,993	$1,064	$0	$17,320

*Time intervals 2010 Denotes activities from 2007-2013 inclusive
2020 Denotes activities from 2014-2022 inclusive
2030 Denotes activities from 2023-2031 inclusive
2040 Denotes activities from 2032-2040 inclusive

Table E-4. Alternative 3 Activity Timeline: High Range of Estimates Direct Spending in Thousands of 2004 dollars

	2010	2020	2030	2040	Total
Construction					
Farm Improvements	$399	$1,197	$1,064		$2,660
Habitat	4,264	6,396			10,660
Stream Channel Improvements	6,436	9,654			16,090
Totals	$11,099	$17,247	$1,064	$0	$29,410

*Time intervals 2010 Denotes activities from 2007-2013 inclusive
2020 Denotes activities from 2014-2022 inclusive
2030 Denotes activities from 2023-2031 inclusive
2040 Denotes activities from 2032-2040 inclusive

Table E-5. Alternative 4 Activity Timeline:
Direct Spending in Thousands of 2004 dollars

	2010	2020	2030	2040	Total
Construction					
Reservoir	$81,996				$81,996
Pressurized Pipe	22,856				22,856
Farm Connections	29,212				29,212
Farm Improvements	399	1,197	1,064		2,660
Operation and Maintenance	2,164	4,863	4,869	4,869	16,765
Farm Profits	21,728	48,888	48,888	48,888	168,392
Net Downstream Flows	3,584	8,064	8,064	8,064	27,776
Totals	$161,939	$63,012	$62,885	$61,821	$349,657

*Time intervals 2010 Denotes activities from 2007-2013 inclusive
2020 Denotes activities from 2014-2022 inclusive
2030 Denotes activities from 2023-2031 inclusive
2040 Denotes activities from 2032-2040 inclusive

As noted in Tables E-1 through E-5, construction activities in the first period are, in aggregate, the most significant expenditures across the 35 years of the analysis. The “operation years,” after construction is completed in 2010, have significantly less financial magnitude than do the construction years. The largest “activities” listed during the operations years are farm profits and net downstream flows. For different reasons each of these two sources of economic flows will be segregated from the more traditional analysis and presented in a later section. Farm profits will be treated separately because they are highly speculative and depend solely upon the manner in which the reservoir and conveyance components are financed. As explained in Golder (2004), profits will be negative unless the preponderance of capital cost is borne by entities other than the farmer. The federal or state government would likely be the institutions looked to for bearing much of the capital cost. Because of the responsibility for capitol costs of the projects is unknown, farm profits should not be a component of the main body of the analysis. This is particularly the case because of their magnitudes. At $5.3 million per year, if this analysis were to include these speculative profits, they would dwarf those categories of economic flows that are far more probable.

Similarly, the question of the value of net downstream flows has also resulted in their segregation from the major body of the analysis. This is because the value of the flows and their impact upon the local economy would depend upon their use, and this has not been fully determined. That is, allocation of the flows to an easily quantified use such as agriculture would have more quantifiable local economic impact than their allocation to a less easily quantifiable use, such as the enhancement of fish runs, even if the value, or benefit, of the two uses is the same. Even if the increase in return flows do increase fish population in a quantifiable and predictable manner, the most common means of assigning value is through surveying or imputing recreational values. Because steelhead are a listed species, they would not be subject to sport fishing. Therefore, there would be no associated recreational value for increases in steelhead.

Note that in absence of farm profits and increases in downstream flows, the remaining expenditures during the operational period are very small compared to those of the construction period, as shown in Tables E-1 through E-5. Activities associated with habitat and stream channel improvements will require a ten-year period to complete, and accordingly stretch across the 2010 and 2020 periods. The nature of work involved with this category combines some activities that are clearly construction oriented, such as moving access roads, with activities that are very labor intensive and so resemble operations and maintenance functions. For these reasons, habitat and stream channel improvements appropriately are stretched across both the construction and the operations periods.

One other potential source of impacts deserves discussion, impacts from recreation. At the time of this analysis there is not sufficient information on the planned operations and management of the reservoir and the results of habitat improvements to be able to estimate recreational impacts with any degree of confidence. It is expected that non-motorized recreational boating and some fishing will be permitted on the reservoir. However, the intent of agencies involved with stocking the reservoir for sport fisheries is not known, nor are the explicit plans for the timing of or the degree of reservoir drawdown. Similarly, as reservoir management policies are unknown, the nature and extent of a warm water fishery of bass or blue gills in the reservoir are beyond comfortable speculation. Those recreational impacts that may result from the habitat improvements are likely to be very small. This is primarily because steelhead are a listed species, and any sport fishery for steelhead within the timeframe of the analysis is highly unlikely. Furthermore, the steepness of the reservoir banks may prevent access once the draw-down period begins. This factor, coupled with the very short period that the reservoir would be full as well as the restrictions against motorized boating, would likely limit boating recreation significantly. Accordingly, no attempt to estimate recreational impacts can be prudently made at this juncture.

Localizing Impacts

All spending was adjusted for the degree that local industries could provide inputs; this created two scenarios involving whether a local or outside contractor would receive the bid to construct the reservoir and install the pressurized pipe and the farm connections. Table E-6 shows estimates of the degree to which local contractors and suppliers would be involved under the assumption that the primary construction contracts were granted to local firms or to outside firms. Typically, the patterns of local spending and incomes are sensitive to that choice. Because the difference between the choice of contractors was only 3 percent, this EIS analysis used the assumption of an out of area contractor. A 3 percent lower estimate was built into the analysis.

Table E-6. Assuming Outside and in-Region Contractors

	Out-of-Region Contractor	In-Region Contractor
Description	Yakima	Yakima
Dimension Stone	100%	100%
New Utility Structures	100%	100%
New Highway and Streets	40%	100%
Concrete Block & Brick	100%	100%
Ready-Mixed Concrete	100%	100%
Fabricated Metal Structures	60%	80%
Wholesale Trade	60%	60%
Eating and Drinking	100%	100%
Miscellaneous Retail	90%	100%
Insurance Agents & Brokers	40%	100%
Hotels & Lodging Places	100%	100%
Computer & Data Processing Svcs.	25%	80%
Auto Repair & Services	80%	80%
Engineering & Architectural Svcs.	35%	70%
Accounting & Auditing	15%	60%
Management & Consulting Svcs.	27%	70%
Research, Development, Testing	35%	70%
Other Gov't Enterprises	100%	100%

A second paring of expenditures involved the critical question of the percentage of expenditures that result in local incomes. In order to calculate direct income impacts, expenditures for each industry were adjusted for the percent of incomes derived from each dollar of expenditures. This was based upon the number of supplier and contractor inquiries that were explained above.

Direct Impacts

Tables E-7 and E-8 show the allocation of expenditures into specific sectors of the local economy for the construction period and the operations period, respectively. As explained above, this allocation of the total direct expenditures shown in Tables E-7 through E-8 into specific economic sectors was based upon the estimates in Golder (2004) combined with experiences with similar projects in the region. In addition to allocating expenditures into economic sectors, the tables also show the results of adjusting for an out of area contractor availability, as explained in the section above.

Table E-7. Construction Period Expenditures, Earnings, and Jobs by Sector for Alternatives 2, 3, and 4. Expenditures and Earnings in Thousands of 2004 Dollars.

	Alternative 2						Alternative 3						Alternative 4		
	High			Low			High			Low					
Description	Expenditures	Earnings	Jobs	Expenditures	Earnings	Jobs	Expenditures	Earnings	Jobs	Expenditures	Earnings	Jobs	Expenditures	Earnings	Jobs
Dimension Stone	$ 667.18	$ 266.87	8	$ 645.28	$ 258.11	7	$ 50.26	$ 20.11	1	$ 28.36	$ 11.34	0	$ 618.73	$ 247.49	7
Sand & Gravel	326.22	130.49	4	315.52	126.21	4	24.58	9.83	0	13.87	5.55	0	302.53	121.01	3
New Utility Structures	8,254.52	3,301.81	93	7,983.57	3,193.43	90	621.86	248.74	7	350.91	140.36	4	7,655.02	3,062.01	86
New Highway & Streets	564.05	225.62	6	545.54	218.21	6	42.49	17.00	0	23.98	9.59	0	523.09	209.23	6
Concrete Block & Brick	418.83	167.53	5	405.08	162.03	5	31.55	12.62	0	17.80	7.12	0	388.41	155.36	4
Ready-Mixed Concrete	1,831.06	732.43	21	1,770.96	708.38	20	137.94	55.18	2	77.84	31.14	1	1,698.08	679.23	19
Fabricated Metal Structures	1,452.22	580.89	16	1,404.55	561.82	16	109.40	43.76	1	61.74	24.69	1	1,346.75	538.70	15
Wholesale Trade	27.78	11.11	0	26.87	10.75	0	2.09	0.84	0	1.18	0.47	0	25.76	10.31	0
Eating and Drinking	181.00	72.40	2	175.06	70.02	2	13.64	5.45	0	7.69	3.08	0	167.86	67.14	2
Miscellaneous Retail	392.10	156.84	4	379.23	151.69	4	29.54	11.82	0	16.67	6.67	0	363.62	145.45	4
Insurance Agents & Brokers	163.32	65.33	2	157.96	63.18	2	12.30	4.92	0	6.94	2.78	0	151.46	60.58	2
Hotels & Lodging Places	277.82	111.13	3	268.70	107.48	3	20.93	8.37	0	11.81	4.72	0	257.64	103.06	3
Computer & Data Process Svcs.	104.18	41.67	1	100.76	40.30	1	7.85	3.14	0	4.43	1.77	0	96.61	38.65	1
Auto Repair & Services	94.29	37.72	1	91.19	36.48	1	7.10	2.84	0	4.01	1.60	0	87.44	34.98	1
Engineering & Architectural Svcs	240.88	96.35	3	232.97	93.19	3	18.15	7.26	0	10.24	4.10	0	223.39	89.35	3
Accounting & Auditing	88.71	35.48	1	85.80	34.32	1	6.68	2.67	0	3.77	1.51	0	82.27	32.91	1
Management & Consulting Svcs.	309.70	123.88	3	299.54	119.81	3	23.33	9.33	0	13.17	5.27	0	287.21	114.88	3
Research, Development, Testing	298.34	119.33	3	288.54	115.42	3	22.48	8.99	0	12.68	5.07	0	276.67	110.67	3
Other Government Enterprises	534.59	213.83	6	517.04	206.82	6	40.27	16.11	0	22.73	9.09	0	495.76	198.30	6
Total	$ 16,226.81	$6,490.72	183	$ 15,694.16	6,277.66	177	$ 1,222.46	$488.98	14	$ 689.82	$275.93	8	$ 15,048.29	$6,019.32	170

Table E-8. Operations Period Expenditures, Earnings, and Jobs by Sector for Alternatives 2, 3, and 4. Expenditures and Earnings in Thousands of 2004 Dollars.

	Alternative 2						**Alternative 3**						**Alternative 4**		
	High			Low			High			Low					
Description	**Expenditures**	**Earnings**	**Jobs**	**Expenditures**	**Earnings**	**Jobs**	**Expenditures**	**Earnings**	**Jobs**	**Expenditures**	**Earnings**	**Jobs**	**Expenditures**	**Earnings**	**Jobs**
Dimension Stone	$ 12.19	$ 4.88	0	$ 9.50	$ 3.80	0	$ 6.78	$ 2.71	0	$ 4.10	$ 1.64	0	$ 6.25	$ 2.50	0
Sand & Gravel	12.19	4.88	0	9.50	3.80	0	6.78	2.71	0	4.10	1.64	0	6.25	2.50	0
New Utility Structures	12.19	4.88	0	9.50	3.80	0	6.78	2.71	0	4.10	1.64	0	6.25	2.50	0
New Highway & Streets	14.63	5.85	0	11.40	4.56	0	8.14	3.26	0	4.91	1.97	0	7.49	3.00	0
Maintenance & Repair	451.02	180.41	7	351.61	140.64	5	250.93	100.37	4	151.52	60.61	2	231.07	92.43	3
Concrete Block & Brick	12.19	4.88	0	9.50	3.80	0	6.78	2.71	0	4.10	1.64	0	6.25	2.50	0
Ready-Mixed Concrete	12.19	4.88	0	9.50	3.80	0	6.78	2.71	0	4.10	1.64	0	6.25	2.50	0
Fabricated Metal Structures	7.31	2.93	0	5.70	2.28	0	4.07	1.63	0	2.46	0.98	0	3.75	1.50	0
Wholesale Trade	65.82	26.33	1	51.32	20.53	1	36.62	14.65	1	22.11	8.85	0	33.72	13.49	0
Eating and Drinking	12.19	4.88	0	9.50	3.80	0	6.78	2.71	0	4.10	1.64	0	6.25	2.50	0
Miscellaneous Retail	10.97	4.39	0	8.55	3.42	0	6.10	2.44	0	3.69	1.47	0	5.62	2.25	0
Insurance Agents & Brokers	4.88	1.95	0	3.80	1.52	0	2.71	1.09	0	1.64	0.66	0	2.50	1.00	0
Hotels & Lodging Places	12.19	4.88	0	9.50	3.80	0	6.78	2.71	0	4.10	1.64	0	6.25	2.50	0
Computer & Data Process Svcs.	3.05	1.22	0	2.38	0.95	0	1.70	0.68	0	1.02	0.41	0	1.56	0.62	0
Auto Repair & Services	9.75	3.90	0	7.60	3.04	0	5.43	2.17	0	3.28	1.31	0	5.00	2.00	0
Engineering & Architectural Svcs	4.27	1.71	0	3.33	1.33	0	2.37	0.95	0	1.43	0.57	0	2.19	0.87	0
Accounting & Auditing	1.83	0.73	0	1.43	0.57	0	1.02	0.41	0	0.61	0.25	0	0.94	0.37	0
Management & Consulting Svcs.	3.29	1.32	0	2.57	1.03	0	1.83	0.73	0	1.11	0.44	0	1.69	0.67	0
Research, Development, Testing	4.27	1.71	0	3.33	1.33	0	2.37	0.95	0	1.43	0.57	0	2.19	0.87	0
Other Government Enterprises	426.64	170.65	6	332.60	133.04	5	237.36	94.95	3	143.33	57.33	2	218.58	87.43	3
Total	$ 1,093.04	$ 437.22	16	$ 852.13	$340.85	12	$ 608.13	$ 243.25	9	$ 367.22	$146.89	5	$ 560.01	$224.00	8

TableE-7 shows this allocation for Alternatives 2, 3 and 4 during the construction years. The expenditures in these tables are normalized to show average expenditures for a typical year in the construction period. Since Alternatives 2 and 3 have high and low ranges of estimates that derive from the Golder (2004) estimates for habitat and stream channel improvements, a high and a low allocation are shown in the table for both Alternative 2 and Alternative 3. As seen in the table, adjusting for the high and low estimates makes considerably more difference than does allocating for local versus out of area contractors. Although almost an order of magnitude smaller, expenditure proportions for Alternative 3 closely parallel those of the two reservoir-building alternatives. This is because of the amount of material moving associated with changes in road routings and bank alterations. The two reservoir-building alternatives, 2 and 4 show significant expenditures in the categories of Utility Structures, Streets (roads), Concrete, and Metal Structures.

Table E-7 also portrays earnings flows and job creation during the construction period for each of the alternatives. The earnings flows were derived from expenditures, based upon a number of telephone inquiries of providers and suppliers in each sector to determine the expenditure to earnings conversion factors. Employment impacts by sector for the construction period, noted on the table as “Jobs,” were derived in a similar manner, depending upon the earnings/job relationship for each sector. Clearly, the preponderance of jobs is generated in the construction sectors. The other sectors that would experience significant job impacts are in project management and consulting services. Spillover of job creation into other service sectors is primarily due to the retail support of new workers. The high level of activities under the sector “Other government enterprises” occurs because irrigation district employment falls under that category. Again, because of the lesser magnitude of expenditures associated with Alternative 3, earnings flows are accordingly smaller.

Direct expenditures, earnings and jobs for the post construction operations period are detailed by sector in Table E-8. The table portrays the sectorial impacts for each of the alternatives for a typical year in the post-constructive period. Impacts in all categories are far less than those in the typical construction year, particularly after farm profits and downstream flows have been segregated out, leaving only this most probable, but minor set of expenditures, earnings, and jobs. Unlike the direct expenditures in the construction period that differed by an order of magnitude among the alternatives, the operations period manifests an approximately equal distribution of impacts across the three alternatives. Because the operations period is very labor intensive, most of the impacts fall into the categories of Maintenance and Repair and Other Government Enterprises (irrigation district employment). As expected, the number of jobs created is small, ranging from 8 to 16.

Direct and Total Impacts

Table E-9 summarizes the aggregated direct and total impacts for each alternative for a typical year in the construction phase. As for direct impacts, each entry is a column aggregation of all sectors shown in the previous impact tables (Tables E-7 and E-8) Because of its inclusiveness of activities, Alternative 2 will have the greatest direct impacts in terms of expenditures, earnings and jobs. This is particularly the case when the high estimate for habitat and stream channel improvements is used as part of Alternative 2. The direct jobs created by the reservoir-related alternatives, ranging from 170 to 183, are reasonable in comparison to similar projects.

Table E-9 also shows aggregations of total income and total job impacts in the construction phase. The total impacts represent the sum of direct impacts plus the indirect impacts. Indirect impacts are the result of the multiplier effects; they arise from the circulation and recirculation of incomes and expenditures throughout the local economy. For the construction period the income multiplier ranges as high as 1.75, depending upon sector. For example, the $6.019 million of direct earnings associated with Alternative 4 are coupled with $4.514 million of indirect and induced earnings generated to become the $10.533 million total earnings shown Table E-9 as total earnings impacts of Alternative 4.

Table E-9. Construction Period Annual Impact for a Typical Year 2007-2015, in Thousands of 2004 Dollars, Jobs. Margined for Out of Area Contractor

	Direct Impacts			Total Impacts	
Alternative 2					
	Expenditures	Earnings	Jobs	Earnings	Jobs
High	$ 16,226.81	$ 6,490.72	183	$11,358.76	311
Low	$ 15,694.16	$ 6,277.66	177	$10,985.91	301
Alternative 3					
	Expenditures	Earnings	Jobs	Earnings	Jobs
High	$ 1,222.46	$ 488.98	14	$ 806.82	22
Low	$ 689.82	$ 275.93	8	$ 455.28	13
Alternative 4					
	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 15,048.29	$ 6,019.32	170	$10,533.81	289

Table E-10 portrays a parallel set of outcomes for the typical operations year, after construction is completed. Again both direct and total impacts are shown for each alternative. Although the multipliers are smaller, total impacts still reflect a range of 8 to 14 jobs. These total impacts include the effects of operation expenditures that cycle and recycle through the economy plus the induced effects of the recycling the spending of operations-related incomes.

Table E-10. Operations Period Impact for a Typical Year 2014 – 2040, in Thousands of 2004 Dollars, Jobs. Margined for Out of Area Contractor

	Direct Impacts			Total Impacts	
Alternative 2					
High	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 1,093.04	$ 437.22	16	$ 699.55	24
Low	$ 852.13	$ 340.85	12	$ 545.36	19
Alternative 3					
High	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 608.13	$ 243.25	9	$ 357.58	13
Low	$ 367.22	$ 146.89	5	$ 215.92	8
Alternative 4					
	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 560.01	$ 224.00	8	$ 362.88	14

Tables E-11 and E-12 show the impact of assuming that capital costs of the reservoir and the delivery systems are assumed by an outside institution, and that, accordingly, all gains resulting from changes in cropping patterns accrue as farm profits. Thus, for each alternative, the tables reflect the combination of undertaking the alternative plus the impact of additional incomes that result from the significantly increased farm profits, $5.3 million dollars per year in 2003 dollars. The assumption of farm profits not only raises the earnings columns for Alternatives 2 and 4, but, because of the induced effects of these higher earnings, raises the total earnings impacts as well. This has a marked effect in the operations period because of the magnitude of these farm earnings relative to earnings associated with operation of the reservoir, delivery, and habitat improvements.

Table E-11. Construction Period Annual Impact for a Typical Year 2007-2015, in Thousands of 2004 Dollars, Jobs. Margined for Out of Area Contractor Assuming Farm Profits.

	Direct Impacts			Total Impacts	
Alternative 2					
High	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 16,226.81	$11,922.72	336	$20,864.76	572
Low	$ 15,694.16	$11,709.66	330	$20,491.91	562
Alternative 3					
High	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 1,222.46	$ 488.98	14	$ 806.82	22
Low	$ 689.82	$ 275.93	8	$ 455.28	13
Alternative 4					
	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 15,048.29	$11,451.32	323	$20,039.81	549

Table E-12. Operations Period Impact for a Typical Year 2014-2040, in Thousands of 2004 Dollars, Jobs. Margined for Out of Area Contractor Assuming Farm Profits.

	Direct Impacts			Total Impacts	
Alternative 2					
	Expenditures	Earnings	Jobs	Earnings	Jobs
High	$1,093.04	$5,869.22	213	$9,390.75	324
Low	$ 852.13	$5,772.85	210	$9,236.56	319
Alternative 3					
	Expenditures	Earnings	Jobs	Earnings	Jobs
High	$ 608.13	$ 243.25	9	$ 357.58	13
Low	$ 367.22	$ 146.89	5	$ 215.92	8
Alternative 4					
	Expenditures	Earnings	Jobs	Earnings	Jobs
	$ 560.01	$ 224.00	8	$ 362.88	14