# Sunnyside Division RRM Water Conservation Project

## Draft Environmental Assessment

**Yakima, Washington**

**U.S. Department of the Interior**
**Bureau of Reclamation**
**Pacific Northwest Region**

**February 2010**

## Acronyms and Abbreviations

**AF** – Acre-Feet
**APE** - Area of Potential Effect
**ARRA** – American Reinvestment and Recovery Act
**BA** - Biological Assessment
**cfs** – Cubic Feet per Second
**DPS** – Distinct Population Segments
**EA** – Environmental Assessment
**ESA** – Endangered Species Act
**ESU** - Evolutionarily Significant Unit
**ELIPS** – Enclosed Lateral Improvement Projects
**FONSI** - Finding of No Significant Impact
**ITA** - Indian Trust Asset
**MAF** – Million Acre-Feet
**MCR** - Middle Columbia River
**National Register** - National Register of Historic Places
**NEPA** – National Environmental Policy Act
**NHPA** - National Historic Preservation Act
**NOAA-Fisheries** - National Oceanographic and Atmospheric Administration-Fisheries
**NRCC** - National Research Council Committee
**NTU** - Nephelometric Turbidity Unit
**PCE** – Primary Constituent Elements
**PEIS** - Programmatic Environmental Impact Statement
**Reclamation** - Bureau of Reclamation
**RM** – River Mile
**RRM** – Rocky Ford, Ryder, and Matheson
**SDBOC** - Sunnyside Division Board of Control
**SCADA** - Supervisory Control and Data Acquisition
**SHPO** - State Historic Preservation Office
**SVID** - Sunnyside Valley Irrigation District
**TMDL** – Total Maximum Daily Load
**TSS** – Total Suspended Solids
**TWSA** - total water supply available
**USFWS** – U.S. Fish and Wildlife Service
**WDFW** – Washington State Department of Fish and Wildlife
**YRBWEP** – Yakima River Basin Water Enhancement Project

**Sunnyside Division – RRM Water Conservation Project**
**Draft Environmental Assessment**

## Table of Contents

# 1. PURPOSE AND NEED

## 1.0 Introduction

The Sunnyside Division Board of Control (SDBOC) has proposed projects in their Enclosed Lateral Improvement Projects (ELIPS) to replace approximately 67 open canals, laterals, and ditches with pipe in order to conserve water and operate the canal system in a more efficient manner. This proposal involves the piping of 3 large lateral canal systems (Rocky Ford, Ryder, and Matheson laterals) within the Sunnyside Division near the city of Grandview, Washington, during the period of April 2010 through September 2011. The proposal described in this document is referred to as the ELIPS or RRM project.

The SDBOC represents the entities receiving water from the Sunnyside Division of the Bureau of Reclamation's Yakima Project. The Sunnyside Valley Irrigation District (SVID) is the operating agent for the SDBOC. In the 1990's, conservation program efforts were expanded with Reclamation's Yakima River Basin Water Enhancement Project's (YRBWEP) Basin Conservation Program (BCP). As a result, Yakima basin irrigation districts prepared Water Conservation Plans, and performed feasibility studies, cost estimates, and estimates of irrigation water savings possible as a result of proposed conservation measures.

The SDBOC is a voluntary participant in the YRBWEP BCP. SDBOC completed a Water Conservation Plan in 1998 (Reclamation and WSDOE 1998) and a Conservation Plan Feasibility Study (Feasibility Study) in 2000 (UMA 2000). The conservation plan and Feasibility Study were designed to make the Sunnyside Main Canal irrigation system more efficient, and also use water more efficiently for fishery benefits. The SDBOC's goal has been to improve the canal and water delivery system through water conservation improvements, thereby requiring less water diversion from the Yakima River, and allowing more water for fish and irrigation purposes in the lower basin. In the early to mid 2000's, the SDBOC began to implement conservation measures that were outlined in the Water Conservation Plan and Feasibility Study, and Phase 1 of the Plan was initiated in 2004.

Title XII of the YRBWEP legislation (Sec. 1205(a) - Water Savings From Basin Conservation Program) specifies that water savings achieved through implementation of measures under the BCP should increase the YRBWEP Title XII instream target flows by 50 cfs for each 27,000 acre-feet (AF) of reduced annual water diversions by participants in the conservation program. Typically, the 50 cfs increase in target flows for every 27,000 AF of conserved water is derived by assuming that 2/3 of the annual water savings are dedicated to instream flows and 1/3 of the annual water savings are reserved for use at the discretion of the Conservation Program participant. The instream flow benefit from SDBOC's Phase 1 conservation measures noted above equates to a 54 cfs increase in instream target flows during the entire 180-day irrigation season in the mainstem Yakima River each year.

During 2009, the SVID began implementing Phase 2A of the SDBOC's Water Conservation Plan for the Sunnyside Division. It consisted of further system efficiency improvements involving the conversion of approximately 15 miles of open lateral and sub-lateral canals to fully enclosed pipeline delivery systems with in-line flow meters serving approximately 3,000 acres of agricultural land located east and west of Sunnyside, Washington. Lateral canals were enclosed by either laying pipe directly within the open channel lateral and burying, or by digging new ditches along the canal right-of-way and burying the enclosed pipeline delivery system. Installed pipelines vary in diameter from 4 to 36 inches depending on their location in the delivery network. When completed, these lateral pipeline systems are expected to conserve a total of approximately 1,660 AF of water annually, which equates to a 3 cfs (2/3rds of 1660 AF) increased instream flow in the Yakima River during the irrigation season.

As a result of Congressional passage of the 2009 American Recovery and Reinvestment Act (ARRA) legislation, Reclamation was authorized to provide funding during FY 2010 and FY 2011 for implementation of the SDBOC's Phase 2A piping project described above. Reclamation prepared an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) in September, 2009 (Reclamation 2009b) for the Phase 2A project. Reclamation is also authorized to provide ARRA funding during FY 2010 and FY 2011 for the proposed RRM project of the SDBOC Water Conservation Plan as described in this EA.

### 1.1 Purpose and Need for Action

This EA involves the proposed Rocky Ford, Ryder, and Matheson (RRM) lateral piping project, also known as ELIPS of the Sunnyside Division Water Conservation Plan. The purpose of the RRM project is to convert several large open irrigation canals and laterals to pressurized pipe systems with in-line flow meters. The need is to improve on farm control of irrigation water, reduce lateral canal water losses, improve irrigation drain water quality, reduce operation and maintenance costs, and improve instream flows for fishery benefits in the Yakima River within the project area. The action covered by this EA is the proposed piping of the existing RRM lateral canal system to be done as part of ELIPS.

### 1.2 Location and General Description of Area

The Sunnyside Division of Reclamation's Yakima Project is located in south-central Washington near Yakima, Washington in Yakima County and Benton counties (Fig. 1-1 project location map). The Sunnyside Division consists of approximately 99,244 acres of land lying mostly north of the Yakima River, and extends from the Sunnyside Diversion Dam, on the Yakima River near Parker at River Mile (RM) 103.8, to the vicinity of Benton City. Water is diverted from the Yakima River at the Sunnyside Diversion Dam and flows generally southeast through the Sunnyside Canal, which supplies the distribution system of the division. Three service areas in the Sunnyside Division receive pumped water to their lands by hydraulic turbine pumps at drops on the Sunnyside Canal.

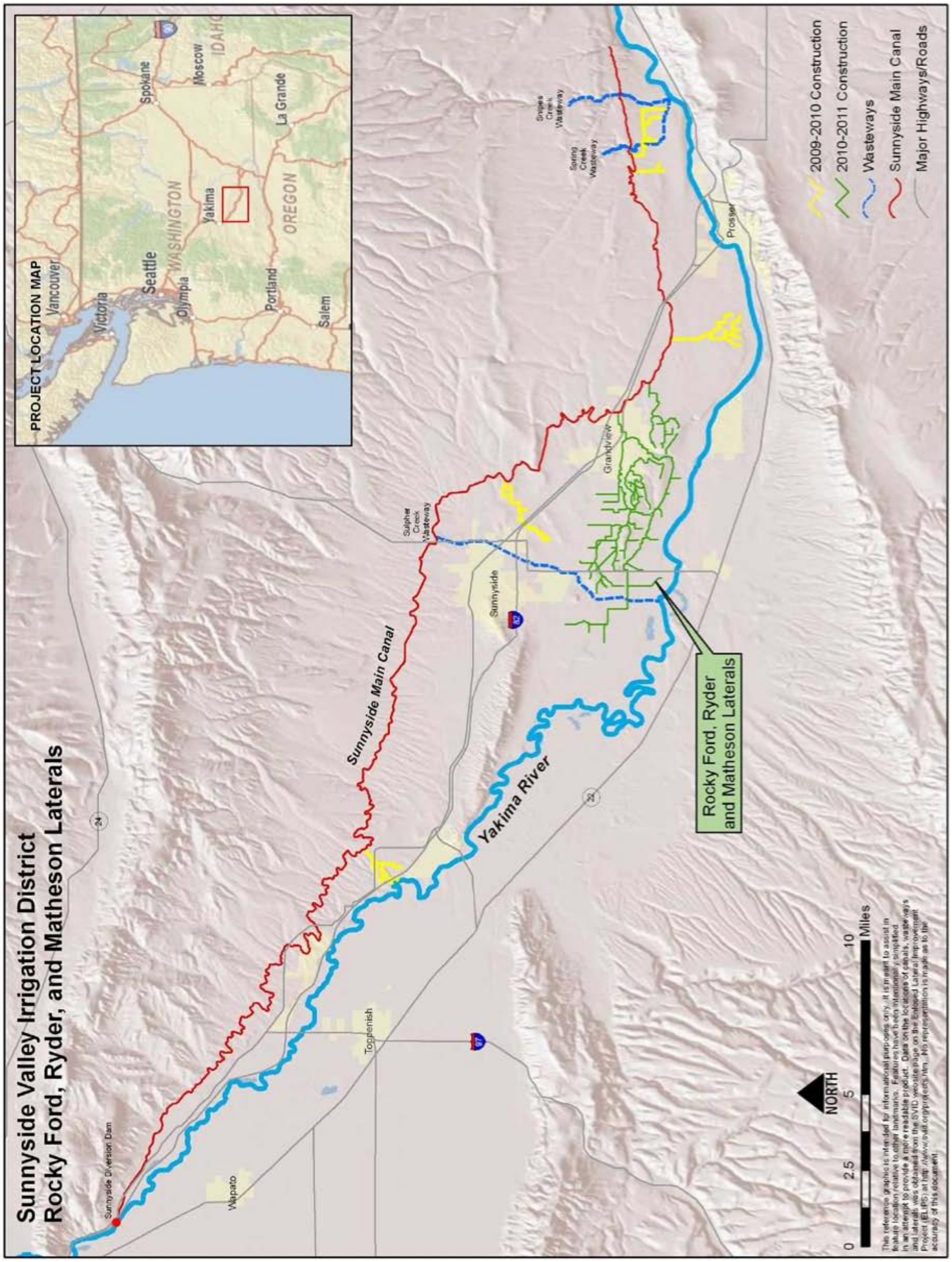
The lower Yakima River Basin has a semi-arid climate with dry, warm summers and moderately cold winters. Average precipitation for the area is 8 inches per year, about half of which is snowfall. This climate supports shrub-steppe plant communities in the undisturbed area and topography is gently rolling.

Based on long standing water rights and contractual agreements with Reclamation's Yakima Project, the Sunnyside Division diverts and supplies Yakima River water to about 99,000 acres of irrigated lands in the lower Yakima Valley.

The Yakima Project area, which includes the Sunnyside Division, is among the leading agricultural areas in the United States. It is or has ranked first in the United States in producing several crops. It is also a major center for producing beef cattle. Yakima County ranked fifth in the United States in total agricultural production.

The Sunnyside Canal has a capacity of 1,317 cfs, and is the main canal for conveying water to lands within the Sunnyside Division. The Sunnyside Canal extends over 60 miles eastward from the Sunnyside Diversion Dam near Parker to lands northeast of Prosser, and generally serves lands north and east of the Yakima River, but also includes land south of the river in the vicinity of the communities of Mabton and Prosser. The RRM lateral canal system of the Sunnyside Division is located between Sunnyside and Grandview, Washington (Figure1-1). Along with the water distribution system, a network of drains and wasteways is used to convey irrigation water return flows back to the Yakima River from the Sunnyside Canal delivery system. The lower portion of the Sulphur Creek Wasteway is located along the western boundary of the RRM lateral system within the RRM project area.

**Figure 1-1. ELIPS-RRM project location map**



## 1.3 Project History and Background

The origin of the Sunnyside Canal dates back to 1878 when the Konnewock Ditch was constructed with a point of diversion about 400 feet upstream of the Sunnyside Diversion Dam. In 1880 the Konnewock Ditch Company was formed and 35 cfs of water were diverted from the Yakima River to irrigate about 3,500 acres. Initial construction of the Sunnyside Canal, by the Northern Pacific Railroad, began in 1890 when the Sunnyside Division was formed. Several irrigation projects were undertaken during this time period. In 1900 the Sunnyside Canal was purchased by the Washington Irrigation Company, and was then sold in 1905 to the United States Bureau of Reclamation (then known as the United States Reclamation Service) which completed construction of the canal system by 1923. On March 10, 1906, the Sunnyside Water Users Association formed to provide a liaison between the federal government and the landowners. On January 22, 1917, the Sunnyside Valley Irrigation District (SVID) replaced the Sunnyside Water Users Association. Reclamation operated the Sunnyside Division until 1945.

The various entities that receive water from the Sunnyside Canal and make up Sunnyside Division include: Grandview Irrigation District, Benton Irrigation District, Sunnyside Valley Irrigation District, Piety Flat Ditch Company, Konnewock Water Users, Zillah Irrigation District, City of Sunnyside, City of Grandview, and City of Prosser. In 1945, the Sunnyside Division Board of Control (SDBOC) was established by contract between Reclamation and each of these entities. The selected operating agent for the SDBOC is SVID, which has provided operation and maintenance of these federal facilities beginning with the 1946 irrigation season. In 1958, SVID entered into a contract with Reclamation to construct a system of drain channels. Upon completion of construction, operation and maintenance of the drains was transferred to the Sunnyside Division, with SVID serving as the operating agent.

## 1.4 Water Source and Rights

The water supply source for the Sunnyside Division is the Yakima River. The Yakima River Basin has an average annual runoff of approximately 3.4 million AF. It has been a partially regulated river since completion of the storage reservoir system by Reclamation in 1933. The reservoirs have a combined storage capacity of 1.07 million AF.

To meet the water rights and contract obligations, Reclamation distributes water to the various users under the concept of total water supply available (TWSA). TWSA is the amount of water available in any year from natural flow of the Yakima River and tributaries, from storage in the various Yakima Project reservoirs, from return and from other sources. Each year the Reclamation forecast for the TWSA consists of:

- April 1 to July 31 forecast of runoff
- Plus the August to September projected runoff
- Plus the April 1 reservoir storage contents
- Plus the usable return flow above Parker

Through operating experience, Reclamation has determined that when the April 1 to September 30 TWSA forecast is less than 2.25 million AF, water shortages for irrigation are likely to occur. Under terms of a Federal Court judgment, known locally as the 1945 Consent Decree, proration of supply for junior water users takes place during years of water shortage. This proration applies during the period when storage must be released from the reservoirs to meet entitlements (storage control period). Over the past 70 years of record, the average date for starting storage control is June 24.

The water rights of all entities claiming water from the Yakima River Basin are pending final determination in the ongoing general adjudication of water rights (filed in 1977 in the Superior Court of Yakima County). The case is State of Washington, Department of Ecology vs James J. Acquavella, et. al. No. 77-2-01484-5).

The water rights comprising the Sunnyside Division are set forth in the "Sunnyside Division Water Right Settlement Agreement" as a part of the Washington State Department of Ecology v. Acquavella adjudication. Priority dates for those water rights are as follows:

June 29, 1878
June 30, 1878
September 3, 1890
July 18, 1893
May 9, 1905
May 10, 1905

The point of diversion for Sunnyside's canal system is the Sunnyside Diversion Dam located 1500 feet west and 130 feet south from the east quarter corner of Section 28, T12N, R19E, W.M.

## 1.5 Related Actions

A Programmatic Environmental Impact Statement (PEIS) was completed in January, 1999 for YRBWEP (Reclamation, 1999). This EA for the proposed RRM project, where appropriate, will tier to sections of the PEIS. Section 1508.28 of the National Environmental Policy Act (NEPA) defines tiering of NEPA documents as "coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basin-wide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared." This PEIS is available for review at the Columbia-Cascades Area Office.

In 2004, the SDBOC initiated Phase 1 of the Water Conservation Plan which consisted of the construction of 3 re-regulation reservoirs on the Sunnyside Main Canal, replacement of 28 canal check or drop structures along the canal's 60 mile alignment, and installation of a Supervisory Control and Data Acquisition (SCADA) automation system. Phase 1 is currently underway and will be completed by the year 2014. When complete, Phase 1 will result in a total of 29,162 AF of net water conservation savings. Two-thirds of this water (or 19,442 AF) will not be diverted but rather left instream to enhance instream flows in the Yakima River downstream of Sunnyside Dam (RM 103.8). Reclamation prepared an EA and FONSI in September, 2004 (Reclamation 2004) for the Phase 1 project.

During 2009, the SVID began implementing Phase 2A of the SDBOC's Water Conservation Plan for the Sunnyside Division. It consisted of further system efficiency improvements involving the conversion of approximately 15 miles of open lateral and sub-lateral canals to fully enclosed pipeline delivery systems with in-line flow meters serving approximately 3,000 acres of farm land. Lateral canals will be enclosed by either laying pipe directly within the open channel lateral and burying, or by digging new ditches along the canal right-of-way and burying the enclosed pipeline delivery system. Installed pipelines will vary in diameter from 4 to 36 inches depending on their location in the delivery network. When completed, these lateral pipeline systems are expected to conserve approximately 1,660 AF of water annually, which equates to a 3 cfs (2/3rds of 1660 AF) increased instream flow in the Yakima River during the irrigation season. Reclamation prepared an EA and FONSI in September, 2009 (Reclamation 2009b) for the Phase 2A project. This EA for the proposed RRM project will tier to the above 2009 EA.

## 1.6 Related Laws

Yakima River Basin Water Enhancement Project

Congress enacted the YRBWEP, Title XII of Public Law 103-434, on October 31, 1994. Title XII of Public Law 103-434 authorized the Secretary of Interior, acting through Reclamation, to establish and administer the Yakima River Basin Water Conservation Program, in consultation with the State of Washington, the Yakama Nation, the Yakima River basin irrigators, and other interested parties. Title XII is considered to be Phase II of the YRBWEP. The goal of this program is "to realize sufficient reductions in irrigation water diversions through implementation of water conservation measures so that additional water is available for instream flows for fish and wildlife and the water supplies for irrigation in dry years are improved."(Yakima River Basin Conservation Advisory Group, 1998.)

The purposes of Title XII are:

> (1) to protect, mitigate, and enhance fish and wildlife through improved water management; improved instream flows; improved water quality; protection, creation and enhancement of wetlands; and by other appropriate means of habitat improvement;
>
> (2) to improve the reliability of water supply for irrigation;
>
> (3) to authorize a Yakima River Basin Water Conservation Program that will improve the efficiency of water delivery and use; enhance basin water supplies; improve water quality; protect, create and enhance wetlands; and determine the amount of basin water needs that can be met by water conservation measures;
>
> (4) to realize sufficient water savings from the Yakima River Water Conservation Program so that not less than 40,000 AF of water savings per year are achieved by the

end of the fourth year [1998] of the Basin Conservation Program, and not less than 110,000 AF of water savings per year are achieved by the end of the eighth year [2002] of the program, to protect and enhance fish and wildlife resources; and not less than 55,000 AF of water saving per year are achieved by the end of the eighth year [2002] of the program for availability for irrigation;

(5) to encourage voluntary transactions among public and private entities which result in the implementation of water conservation measures, practices, and facilities; and

(6) to provide for the implementation by the Yakama Nation at its sole discretion of (A) an irrigation demonstration project on the Yakama Reservation using water savings from system improvements to the Wapato Irrigation Project, and (B) a Toppenish Creek corridor enhancement project integrating agricultural, fish, wildlife and culture resources.

American Recovery and Reinvestment Act
Congressional authorization of funding through the recent passage of the American Recovery and Reinvestment Act (ARRA) legislation has been made available for projects that can be implemented over the course of 2 fiscal years (FY10 – FY11) ending September 30, 2011. Under the ARRA legislation over 21 million dollars will be used to help fund a portion of the Sunnyside Division Phase 2 Water Conservation Plan. As a condition of ARRA funding, "stimulus package" project funds for the Phase 2 must be appropriated and completely expended prior to September 30, 2011. As a result, the implementation schedule for the Phase 2 Water Conservation Plan has been accelerated to comply with these funding and expenditure requirements. The approved Phase 2A project (Reclamation 2009b) is being implemented during FY 2010. The proposed RRM project would be implemented during FY 2010 and FY 2011.

National Environmental Policy Act
Reclamation is responsible for determining if the proposed project might have significant effects to the environment under the National Environmental Policy Act (NEPA). If Reclamation determines that effects are not significant, a Finding of No Significant Impact (FONSI) will be prepared. A FONSI would allow Reclamation to proceed with the proposed action without preparation of an Environmental Impact Statement.

Endangered Species Act
The Endangered Species Act (ESA) requires federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Section 7 of the ESA (16 U.S.C. Section 153 6[a] [2]), requires all federal agencies to consult with the National Oceanic and Atmospheric Administration-Fisheries (NOAA-Fisheries) for marine and anadromous species, or the United States Fish and Wildlife Services (USFWS) for fresh-water and wildlife species, if an agency is proposing an "action" that may affect listed species or their designated habitat. If such species may be present, the federal agency must conduct a biological assessment (BA) for the purpose of analyzing the potential effects of the project on listed species and critical habitat in order to establish and justify an effect determination.

National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966 (16 USC 470, PL 95-5 15) requires that federal agencies complete inventories and site evaluation actions to identify historic resources that may be eligible to the National Register of Historic Places (National Register), and then ensure those resources “are not inadvertently transferred, sold, demolished, substantially altered, or allowed to deteriorate significantly.” Regulations entitled “Protection of Historic Properties” (36 CFR 800) define the process for implementing requirements of the NHPA, including consultation with the appropriate State Historic Preservation Office (SHPO), potentially affected Indian Tribes, and the Advisory Council on Historic Preservation.

# 2. ALTERNATIVES

## 2.1 Alternative No. 1 – No Action

The No Action Alternative assumes that SVID will not implement the RRM project of the SDBOC Water Conservation Plan for the Sunnyside Division. SVID will continue with Phase 1 of the Water Conservation Plan, initiated in 2004, that consists of the construction of 3 re-regulation reservoirs, replacement of 28 canal check structures, and the installation of a SCADA automation system. SVID will also continue with Phase 2A of the Water Conservation Plan, initiated in 2009, which involves replacing 4 open lateral canals with pressurized pipe and water metering systems serving agricultural land located east and west of Sunnyside, Washington.

By not constructing pressurized pipelines for the Rocky Ford, Ryder, and Matheson canals and laterals under the proposed RRM project, the existing open delivery system will continue to experience water evaporation and seepage losses. This will result in continued impacts to farm control of irrigation water, water quality, and operation and maintenance costs. Also, there would be no water savings from conservation measures that would transfer to instream flow improvements in the mainstem Yakima River downstream of the Sunnyside Diversion Dam.

## 2.2 Alternative No. 2 – RRM

Under Alternative 2, three large systems of open canals and laterals, serving 11,297 acres between Sunnyside and Grandview, will be piped and in-line flow meters will be installed. Approximately 51.3 miles of lateral canals (Rocky Ford, Ryder, and Matheson) will be enclosed by burying pipe either within the existing open channel lateral or along the adjacent existing canal right of way and access road. The majority of this work would be done during the non-irrigation season, mostly in the fall and winter, with some work being implemented in summer where possible. Pipeline sizes will range from about 6 inches to 78 inches in diameter for each of the lateral systems. Refer to Figure 2-1 for proposed locations and sizes of pipe, and additional information. When completed, the RRM pipeline system would conserve a total of approximately 6,258 AF of water during the annual irrigation season. Table 2-1 identifies the existing lateral canal systems along with pertinent information about each lateral.

Under Title XII of YRBWEP, irrigation districts that conserve water may keep 1/3 of that water for their use, and 2/3 remains in the river for fisheries benefits. For the proposed RRM project, 4,168 AF will be retained in the Yakima River to increase instream flows by approximately 11.6 cfs, and the remainder (2,090 AF) can be utilized by SVID.

**Figure 2-1. Proposed RRM Lateral Pipeline System**

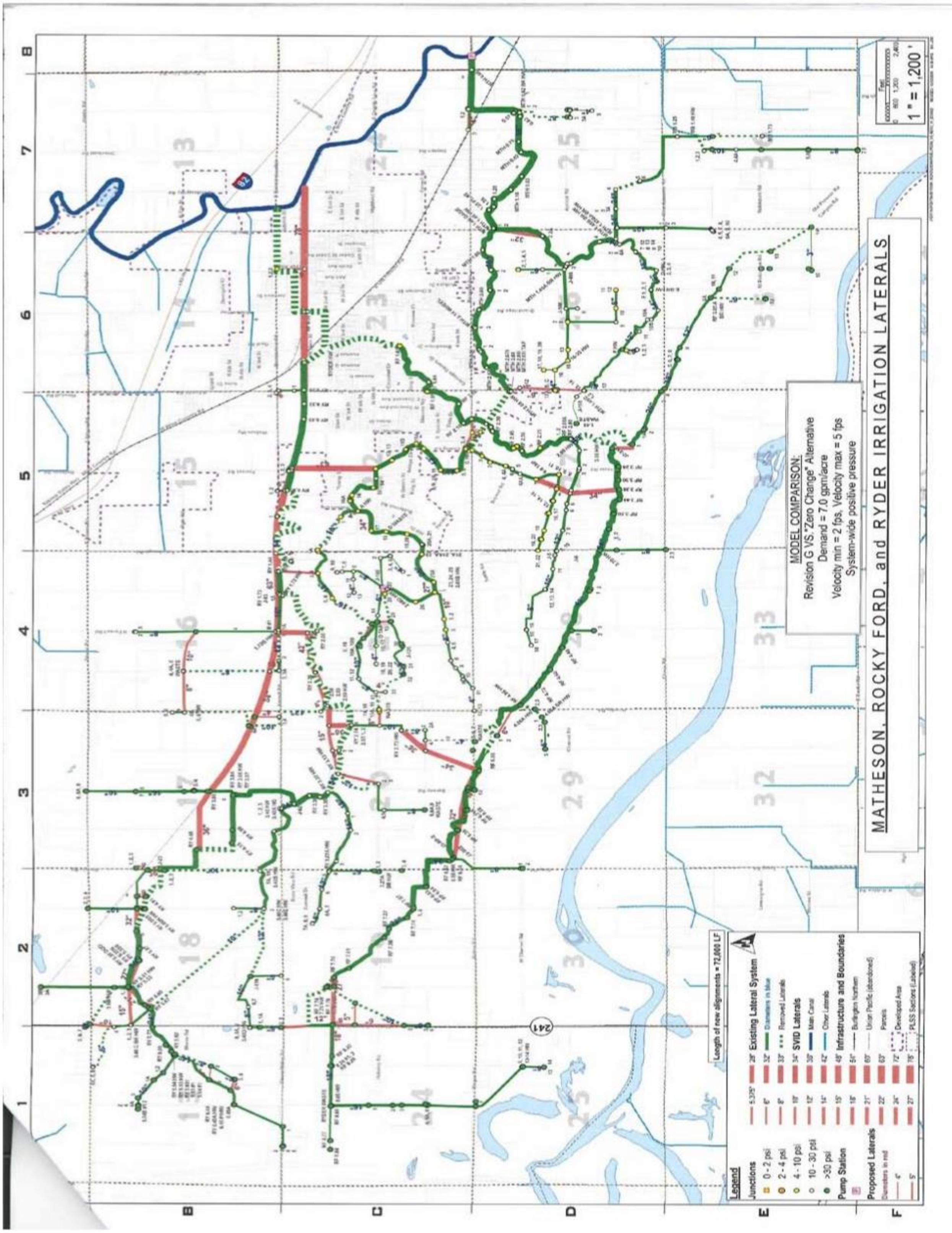


**Table 2-1. Proposed Lateral Piping for RRM of the Water Conservation Plan within the Sunnyside Division. (Data from Reclamation 2009b, UMA 2000, and Don Schramm, SVID, personal communication, 2009b).**

| Lateral Canal System | Total Length (miles) | Acres Served | Estimated Water Conservation (AF/year) |
|---|---|---|---|
| Rocky Ford | 15.5 | 3,545 | 1,965 |
| Ryder | 21.7 | 4,513 | 2,499 |
| Matheson | 14.1 | 3,239 | 1,794 |
| **Total** | **51.3 miles** | **11,297 acres** | **6,258 AF/year** |

## 3. AFFECTED ENVIRONMENT

This chapter describes resources in the study area that may be affected by the alternative implemented. Resources and related topics presented include surface water hydrology, groundwater hydrology, water quality, fisheries, vegetation and wildlife, threatened and endangered species, economics, historic properties, Indian Trust Assets (ITA), environmental justice, wetlands, and public safety.

### Issues Considered but Eliminated from Further Analysis

Recreation was analyzed in the YRBWEP PEIS (Reclamation, 1999) and no impacts were found, therefore it is not discussed here. For this document, vegetation is discussed primarily as a wetlands impact and will be addressed in that section.

### 3.1 Fisheries

The Pacific salmon species produced in the Yakima River Basin include steelhead, spring Chinook salmon, fall Chinook salmon, and coho salmon. These fish spawn and rear within the basin, migrate to the ocean to grow to adult size, and return to the Yakima system to spawn. Each species uses specific areas within the basin for its respective life stages. This discussion focuses on those aspects of salmon and steelhead migration, spawning, and rearing that could be affected by changes in instream flows, river operations, or water quality as a result of this proposed project. It focuses on the reach of the Yakima River from Parker to about Kiona and changes to flows and water quality during the irrigation season from March through October.

The river below Prosser Dam is important for fall Chinook spawning, migration, and rearing. The reach below Sunnyside Dam is used by spring Chinook and steelhead for juvenile rearing, primarily in the fall and winter when temperatures are suitable or in areas of upwelling groundwater or cooler tributary inflow. Fall Chinook spawning and rearing also occurs in this reach. Adult upstream and juvenile downstream migration of all species occurs from Sunnyside Diversion Dam to the mouth of the Yakima River.

Much of the information below is excerpted from and tiered to Reclamation's Biological Assessment (BA) for implementation of the Sunnyside Division Phase 2 Water Conservation Plan (Reclamation 2009a). The BA included fisheries information related to the ongoing Phase 2A lateral piping project and the proposed RRM canal system piping project. This information is also tiered to Reclamation's EA for the Phase 2A project (Reclamation 2009b).

#### 3.1.1 Fall Chinook

Adult Migration – The spawning run of Yakima River fall Chinook at Prosser begins in early September, peaks in late September and is usually finished by the second week of November. Run timing variability is related to flow but not water temperature; higher flows accelerate passage (NPPC 2001).

*Spawning and Incubation* – Spawning begins immediately after arrival of adults in early October and is complete by the end of November. In the lower mainstem some spawning occurs later from late December to early January. It is estimated that about 70 percent of fall Chinook spawning occurs below Prosser Diversion Dam. Incubation occurs from mid October through April.

*Emergence and Rearing* – The emergence period ranges from mid February to late April with a peak in late February to early March. Emergence occurs earliest in the Marion Drain (RM 82.6), ranging from mid-February to late March. In the cooler mainstem, emergence doesn't begin until late March, extending into the third week of April (NPPC 2001).

*Fry Colonization* – Fry colonization begins March 1 and extends through May 31. Fry rearing above Prosser are not seen in significant numbers at the juvenile bypass facilities at Prosser until smolts are observed in the last week of April or first week in May (Fast et al. 1986).

*Smolt Outmigration* – All fall Chinook outmigrate as subyearlings. Ten percent of the smolts have passed Prosser Diversion Dam by May 9; 50 percent by June 6 and 90 percent by July 1. There is considerable variability in outmigration timing, with migration ending as late as July 15.

### 3.1.2 Spring Chinook

*Adult Migration* – Adult migration into the Yakima River begins in late April (the earliest observation was April 11) continuing through late June. Cumulative passage of spring Chinook spawning run at Prosser Diversion Dam for 1983 through 2000 indicates the dates of 10, 50 and 90 percent cumulative passage are April 10, May 13 and June 3. There is considerable variability from year to year, as the run has been 90 percent complete as early as May and as late as June 24.

*Spawning and Incubation* – Spring Chinook do not spawn in the reaches potentially affected by this proposed action.

*Fry Colonization and Overwintering* –Highest juvenile densities in summer are found well below the major spawning areas in the upper parts of the Yakima basin but above Sunnyside Dam. No juveniles are found in the lower Yakima mainstem below Sunnyside because of excessive summertime water temperatures (Fast et al. 1991). An extensive downstream winter migration of pre-smolts occurs from October 1 through January 31 in response to falling water temperatures in late fall. From 10 to 35 percent of brood year juveniles migrate below Prosser Diversion Dam during winter, with the remaining juveniles overwintering in deep, low velocity portions of mainstem Yakima between Marion Drain and Prosser Diversion Dam.

*Smolt Outmigration* – Outmigration of smolts ranges from March through the end of June, with peaks occurring the second week of April.

### 3.1.3 Coho

*Adult Migration* – In 2002 the adult spawning run passing the counting facilities at Prosser Diversion Dam began the second week of September and continued through November (YKFP 2003).

*Spawning and Incubation* – Most coho spawn from early October through late December in proximity to their acclimation and release points. In the past spawning occurred in the middle Yakima River below Sunnyside Dam (from RM 95 - RM 104) near previous hatchery release sites. Spawning also has occurred in side channels in mainstem Yakima between Rosa Dam and Wapato (~ RM 100) and in Yakima Canyon (RM 129-RM 146); in the mainstem and tributaries of the Naches River; Marion Drain, and Toppenish Creek. Spawning sites also include Spring Creek and Sulphur Creek wasteways. Incubation occurs from November 1 through March. More recently, hatchery Coho are outplanted in the upper Yakima and Naches Rivers in order for them to reestablish in more favorable conditions.

*Emergence and Rearing* – Emergence occurs from March through April. Coho juveniles rear for one year in the Yakima River, from April 1 to the following April 1. It is unknown if coho juveniles enter the mainstem of the lower Yakima River during any portion of this year-long rearing period.

*Smolt Outmigration* – In 2002, coho outmigration past Prosser Diversion Dam began March 25, peaked mid-May and was completed by mid-June (YKFP 2003).

*Smolt Outmigration*. Smolt outmigration in the lower Yakima River at Prosser begins in March and ends in early July (YKFP 2003).

### 3.1.4 Fish Populations in Snipes/Spring Creek and Sulphur Wasteways

Fish from the Yakima River are able to access some areas within the SDBOC drainage networks. None of these facilities were developed for the expressed purpose of providing fish and wildlife habitat, but animals are present and using the habitat that is available. Most often salmonid use of the irrigation network occurs in lower reaches of channels carrying return water back to the Yakima River, where there is open access for fish migrating in the upstream direction. Coho and Chinook salmon and steelhead trout are present within the SDBOC drainage network and currently use select drains and wasteways for spawning and juvenile rearing. These species have been observed spawning in the drainage network for over a decade (Cuffney et al. 1997), however the extent of anadromous and resident fish distribution, and the seasonality of fish use of the wasteways has not been extensively studied. As a result, fish population information is limited for the system of wasteways and drains associated with the Roza and Sunnyside Canal network.

Spring and Snipes Creek Wasteways and Sulphur Wasteway have been the most extensively studied drainage networks associated with the SDBOC drainage network. Monk (2001) surveyed adult salmonid spawning populations and monitored juvenile production and distribution within these drainages in the most detailed study of fish use of these networks to date. Annual redd surveys for these species have also been performed in these drainage networks since 1999 (Pat Monk, SDBOC biologist, personal communication, 2006). Results of these surveys indicate that the most abundant salmonid populations in these drainages is composed of coho salmon.

Electrofishing surveys conducted in 2000 and 2001 indicated that the fish community in Sulphur Wasteway was dominated by native minnows and suckers. Very little salmonid production was observed in Sulphur Wasteway which had a reported density of only 0.07 coho fry/100 m2. Juvenile salmonids were the most abundant fish species observed in Spring and Snipes Creek Wasteways during the 2000 and 2001 surveys. Coho densities of 4.73 fry/100 m2 were observed in these drainages during the electroshocking surveys. Based on density estimates it appears that coho spawning was only marginally successful in Spring and Snipes Creek Wasteways and was extremely poor in Sulphur Wasteway (Monk 2001).

Although coho and fall Chinook are the primary species utilizing these drains, steelhead are also known to use these drains and wasteways. Steelhead adults were observed in Spring and Snipes Creek Wasteways and in Sulphur Wasteway during redd surveys, but in very low numbers. One or two steelhead were observed in Sulphur Creek Wasteway on at least three occasions between February and April 2001, but spawning activity was not observed. A dead steelhead kelt was found in Sulphur Creek in June 2001 (Monk 2001). A trout redd and a spawning male rainbow trout were found in Snipes Creek Wasteway, and a rainbow/steelhead trout was seen on a redd in Spring Creek Wasteway during surveys in 2001. Additional signs of steelhead spawning activity was scarce as adult fish were not abundant in the drainages surveyed in 2001 (Monk 2001). Similar to coho salmon, very low densities of juvenile rainbow/steelhead (0.22 and 0.18 trout fry/100 m2 in Sulphur and Snipes/Spring Creeks, respectively) were observed in the drains surveyed by Monk (2001) in 2000.

High return flows that occur annually during the irrigation season and during canal shutdown in the SDBOC drainage network result in false attraction flows for adult salmonids. Salmon and steelhead that migrate into Spring/Snipes Creek and Sulphur Wasteways are allowed to spawn naturally or, in the case of Sulphur Wasteway, are removed once they reach the terminus of the drain at the anadromous barrier at RM 7.0. Some of the coho salmon have been used as broodstock for the Yakama Nation hatchery, while the surplus have been released in the Yakima River upstream of Sulphur Creek Wasteway.

The Yakama Nation has been seining and removing adults from these drains since 2000. Numbers of fish removed ranged from 47 coho and four steelhead in 2003 to 379 coho and 17 steelhead in 2006. The number of returning adult salmon into Sulphur Creek has often been a significant portion of the total adult run into the Yakima River. For example, coho salmon migrants entering Sulphur Creek in 2000 was estimated at over 600 fish (Monk 2001). The coho run in 2000 to the Yakima River was approximately 5,700 in 2000; thus over 10% of returning adults were attracted from the Yakima River to the wasteway where spawning habitat is unsuitable.

In 2007, the SDBOC and Reclamation funded the construction of an adult velocity-barrier at RM 1.0 of Sulphur Creek Wasteway. As a result of this barrier construction, adult salmon and steelhead that enter the wasteway are prevented from migrating further into the drainage network. Fish that are stopped by the velocity barrier volitionally migrate back to the Yakima River to continue their upstream migration. Since its installation, no fish salvage has been necessary in the wasteway below the barrier.

### 3.1.5 Fish Habitat Conditions in Sulphur Wasteway and Snipes/Spring Creek Wasteways

Anadromous fish have access to several miles of drain and wasteway habitat in the SDBOC drainage network and are only limited in their distribution by impassible culverts at road crossings or barriers created by drop structures associated with the drainage network. Sulphur Wasteway has approximately 1 mile of accessible salmonid habitat, while Spring Creek and Snipes Creek wasteways have 0.4 and 3.8 miles of available habitat, respectively. Based on redd survey data and fish population investigations, anadromous salmonids are currently distributed in all areas downstream of anadromous barriers and use available habitat to varying degrees (Monk 2001).

A study was conducted on the SDBOC drainage network in 2001 by Romey and Cramer (2001) to characterize available habitat conditions and to determine the networks potential to support salmon and steelhead life history characteristics including; migration, spawning, egg incubation, and juvenile rearing. This study focused on Sulphur Wasteway as well as the Snipes and Spring Creek Wasteways.

Stream habitat was found to be generally unsuitable for salmonids in Sulphur Wasteway. Areas consisting of pool and riffle habitat types were scarce while less productive glide habitat dominated. High levels of fine sediment (45-80%) and highly embedded substrates (average of 64%) in the drain were indicative of a drainage channel that flowed through agricultural areas with highly erosive silt and sand deposits (Romey and Cramer 2001). The habitat survey also indicated that channel gradients were very low (0.3% to 0.4%). Romey and Cramer (2001) concluded that the low stream gradients and high sedimentation rates observed in Sulphur Wasteway would result in extremely poor spawning or egg incubation success rates for any species that spawned in this irrigation return flow channel. Negative effects from sedimentation are particularly high for fall spawning species, as sediment loads tend to drop out and settle on channel substrates when water levels decrease at the end of the irrigation season (mid-October). A readily observable layer of fine sediment accumulates and covers most substrate areas in Sulphur Wasteway during most years (Pat Monk, SDBOC biologist, personal communication).

In contrast, Romey and Cramer (2001) observed that stream habitat conditions were fair to good for natural production of salmonids in both Snipes and Spring Creek Wasteways. These natural channels had gradients around 1%, flowed through areas of basalt geology, and had suitable amounts of gravel and cobble substrates. Habitat types were dominated by highly productive riffles (44-75% by area) with large areas of suitable spawning gravels. The remainder of habitat types consisted of pool and some glides (Romey and Cramer 2001). Stream habitat was more complex and was more likely to support juvenile salmonid rearing than that observed in Sulphur Wasteway. However, substrate embeddedness and levels of fine sediment in streambed gravels were also found to be high in Snipes and Spring Creek Wasteways. Embeddedness ratings were commonly measured in the 20% to 30% range, while percent fine sediments was often reported to be between 20 and 40% in some reaches of Snipes and Spring Creeks.

Water temperatures in all drains generally remained within ranges tolerated by salmonids (Romey and Cramer 2001), although high temperatures could result in growth reduction and sub-lethal stress during the warmest periods observed in summer. During the irrigation season, temperatures reached daily averages as high as 23$^{\circ}$ C; 21$^{\circ}$C is the temperature where detrimental effects will occur. Average summer temperatures are 16-21$^{\circ}$C in Sulphur Wasteway and 18-23$^{\circ}$C in Snipes Creek and Spring Creek wasteways.

### 3.2 Water Quality

Much of the information below is excerpted from and tiered to Reclamation's BA for implementation of the Sunnyside Division Phase 2 Water Conservation Plan (Reclamation 2009a). The BA included information on hydrology and water quality related to the ongoing Phase 2A lateral canal piping project and the proposed RRM canal system piping project. The information below is also tiered to Reclamation's EA for the Phase 2A project (Reclamation 2009b).

#### 3.2.1 Hydrology of SDBOC Drains and Wasteways

The surface water supply for the Sunnyside Division is obtained from the unregulated flow of the Yakima River and its tributaries, return flows, and stored waters from the Yakima Project's storage division. The average annual unregulated flow of the Yakima River Basin near Parker totals about 3.4 million acre-feet (MAF), and ranges from 5.6 MAF (1972) to 1.5 MAF (1977). Annual average irrigation diversion by entities in the basin totals approximately 2.2 MAF (period of record, 1961-1990). These entitlements do not include other requirements for water in the basin, including instream flow, hydroelectric generation, and municipal and industrial uses. The five major reservoirs that comprise the Yakima Project's Storage Division provide most of the capacity to store and release water to meet Yakima Project purposes. Total storage capacity of the five reservoirs equals 1.07 MAF.

Annual regulated runoff in the Yakima River in the reach that runs adjacent to the Sunnyside Division averaged about 2.1 MAF (sum of Sunnyside diversion and Yakima River near Parker) for the period of record between 1939 and 1978. Water is diverted into the Sunnyside Main Canal just upstream of the Sunnyside Diversion Dam near Parker, Washington (River Mile 103.0; 1500 feet west and 130 feet south of the east quarter corner of Section 28, T12N, R19E, W.M.). SVID diverts between 600 and 1,300 cubic feet per second (cfs) of water during the irrigation season. At Kiona, just below the last influence of project return flows, the Yakima River averaged about 2.6 MAF per year for the same period. The gain in this reach is due to natural inflow and irrigation return flow from diversions taken upstream.

Flows in drains during the irrigation season are several times higher than during the non-irrigation season. Source of water for the drains during October 21 through March 14 (non-irrigation season) is mostly emerging groundwater. During the non-irrigation season flows range between drains from approximately 1 cfs in Snipes Creek Wasteway to near 90 cfs in Sulphur Wasteway. During the irrigation season flows are greatest in Sulphur Wasteway and average between 276 and 375 cfs. Irrigation season flows in Snipes and Spring Creek Wasteways generally range from 30 to 60 cfs (Romey and Cramer 2001). However, with implementation of the Phase 1 Water Conservation Plan by the SDBOC, irrigation season flows in these drains and wasteways have been reduced to 350 cfs and 15 cfs for Sulphur and Spring/Snipes Creek Wasteways, respectively.

### 3.2.2 Water Quality in the Lower Yakima River and SDBOC Drains and Wasteways

There have been significant improvements to the water quality of the four major SDBOC irrigation return flow waterways (drains and wasteways) to the Yakima River. The waterways are the Granger Drain, Sulphur Wasteway, Spring/Snipes Creek, and several small cumulative drains.

Water quality data has been collected for the following parameters: temperature, pH, dissolved oxygen, specific conductance, discharge, turbidity, total suspended solids, fecal coliform, total phosphorus, nitrate+nitrite, and total Kjeldahl nitrogen. The data shows definite seasonal patterns that are strongly influenced by the excess spill water which dilutes the drain return flow during the irrigation season. The irrigation districts have implemented measures aimed at bringing return flows into compliance with current water quality standards. The SDBOC water quality program and efforts by conservation groups such as the South Yakima Conservation District has resulted in significant improvements in the quality of water being returned to the Yakima River. For example, in Granger Drain turbidity concentrations have been reduced 74% from historic levels, and 75% in Sulphur Creek Wasteway. Spring Creek Wasteway has decreased 60% and Snipes Creek Wasteway has decreased 5% in turbidity from 1997 to 2008 (Zuroske 2009).

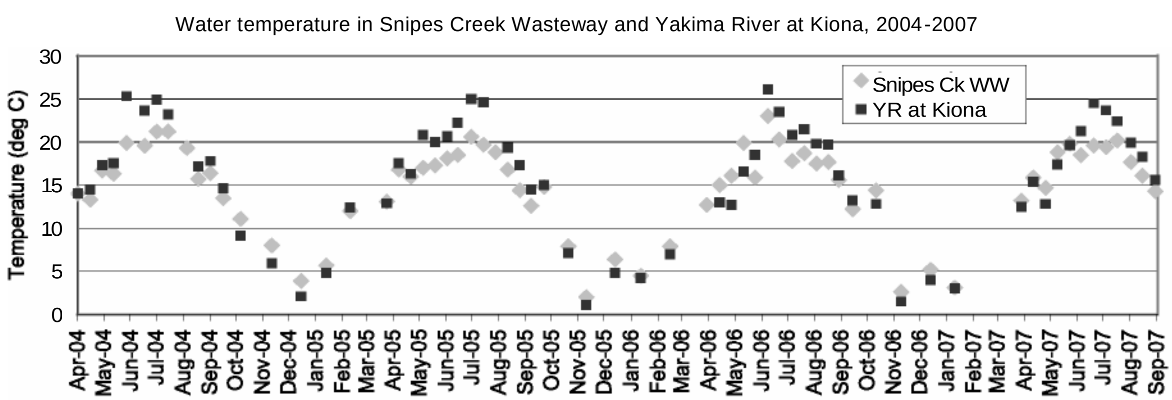
Evaluating median values by year, Snipes Creek Wasteway had the lowest concentrations of most parameters and lowest instantaneous discharge. In most years, Granger had the highest concentrations or values of total suspended solids, turbidity, fecal coliform, and total phosphorus. Fecal coliform concentrations were the most variable. Nitrate+ nitrite concentrations were higher in Sulphur and Granger than in Spring and Snipes in every year. Instantaneous discharge was higher in Sulphur than the other waterways: it had the largest drainage area and received more operational spill water than Spring or Snipes. The patterns in changes in total dissolved solids and nitrate+nitrite concentrations between years were often similar; suggesting nitrate+nitrite was behaving somewhat conservatively.

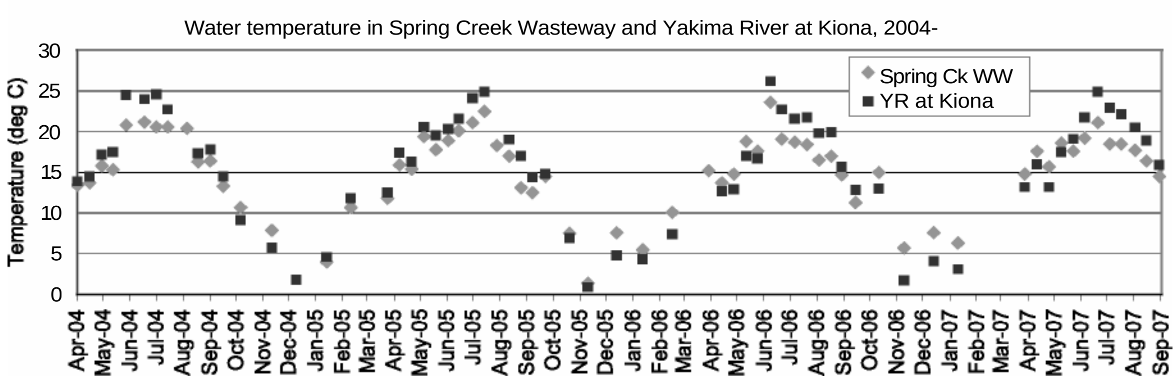
### 3.2.3 Water Temperature

High water temperature in the lower Yakima River has been widely recognized as adversely affecting anadromous salmonids (YSPB 2005). High temperatures at the mouth of the Yakima River may delay adult steelhead migrations (YSFWRB 2008). Water temperature is a particularly difficult variable to change because it reflects the aggregate uses of the landscape, the amount of streamside shading, and many other factors. Vaccaro (1986) modeled water temperature in the Yakima River with four scenarios: (1) 1981 operations; (2) 1981 estimated unregulated or "natural" stream flows without storage or diversions; (3) reductions in irrigation diversions and irrigation return flows over the entire basin; or (4) similar reductions, but limited to the Yakima River below Parker. Vaccaro's model estimated that reducing return flows by 50 percent and subsequently leaving such flows instream would result in a slight increase in water temperatures at Prosser during the high water temperature period because, in late summer, major irrigation return flows are generally cooler than the Yakima River at the point of return. Reducing irrigation return flow volume by a relatively small amount though is unlikely to produce a measurable change in thermal dynamics of the Yakima River during summer. The relatively cool irrigation return flows will, however, create localized pockets of lower temperature where the flows enter the main river (Appel 2008).

From 2004 through 2007, a continuous water quality monitor at Kiona was deployed in the Yakima River for another study (Wise et al, 2009). Comparing the temperature in the river at the same 15-minute interval as SDBOC's discrete sampling found that Spring and Snipes, located 12 miles upstream from Kiona, were cooler than the river in summer and warmer than the river in winter (Figure 3-1); the median and upper 90th percentile differences were 1.4 and 3.6 °C in Spring and 1.2 and 3.8 °C in Snipes. In this 12-mile stretch of the Yakima River, water temperatures in late summer 2008 were found to be generally homogenous: differences between left and right transects were typically less than 0.5 °C; those between near-surface and near-bed temperatures were negligible; and differences between a stationary probe at Kiona and a probe pulled longitudinally through the river were typically less than 0.5 °C (Marcella Appel, Benton Conservation District, unpublished data, 2008). Thus, the Kiona temperatures could be used with confidence to define river temperatures nearer to the mouth of Spring/Snipes Creek Wasteways (Zuroske, 2009).

**Figure 3-1. Continuous Water temperatures in Snipes Creek Wasteway and Spring Creek Wasteway comparisons to the Yakima River at Kiona 2004 – 2007 (from Zuroske 2009)**.



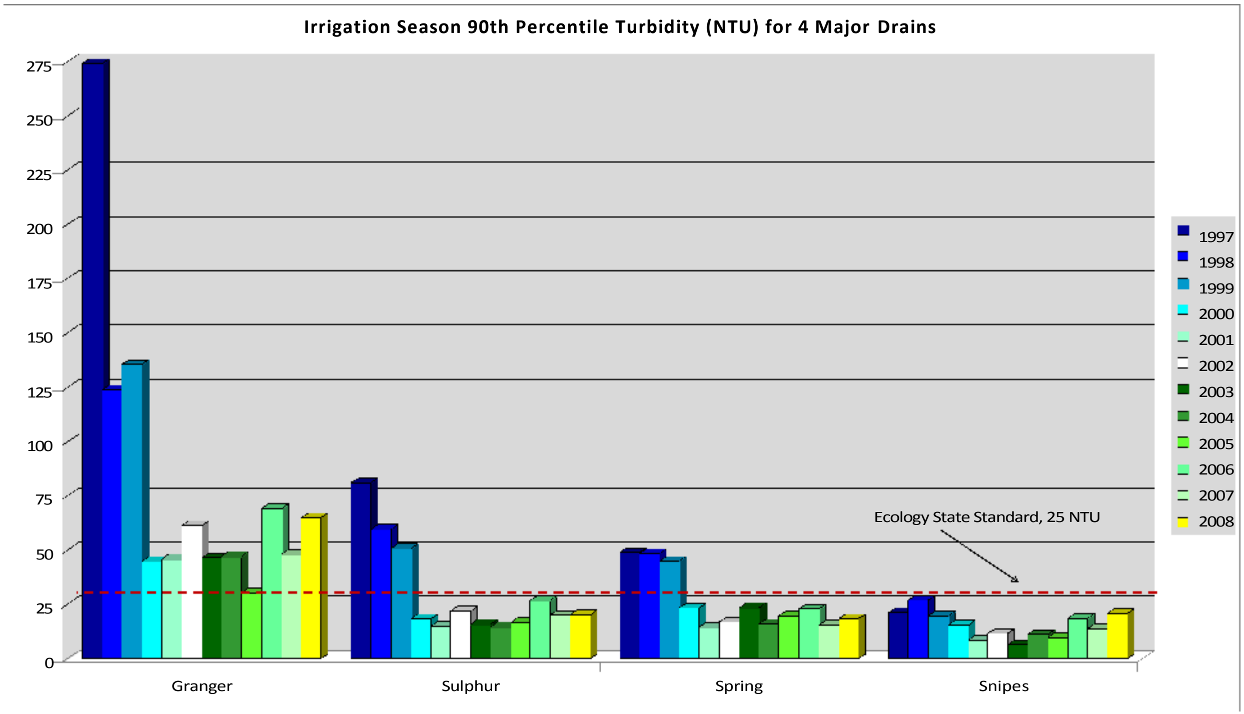



### 3.2.4 Turbidity, TSS, and Sediment Loads

As mentioned the SDBOC began a water quality monitoring program in 1997. Significant water quality improvements have been made in the Yakima River and in return flow irrigation drains as a result of implementation of the SDBOC's water quality management plan/policy (SDBOC 2004). For example, significant Total Suspended Solids (TSS) reductions have been realized since the 1997 assessment as a result of this water quality improvement program. To limit the transport of sediment and pesticides to the Yakima River, a goal of the SDBOC is to bring irrigation return flows into compliance with current state water quality standards and recent total maximum daily load (TMDL) goals for the lower Yakima River set by the Department of Ecology (Joy and Patterson 1997) and the Environmental Protection Agency under the Clean Water Act. Table 2.14 shows turbidity values recorded between 1997 and 2009, before and after the SDBOC implemented their water quality program. The SDBOC adopted the TMDL target turbidity goal of 25 NTU as its water quality goal for project waterways within its area of jurisdiction (SDBOC 2004). All irrigation runoff discharged to project waterways either directly or indirectly from lands within SDBOC boundaries had to comply with the water quality goal established by the SDBOC by the year 2002. Landowners completed conservation measures on farm to comply with the water quality plan/policy.

At the inception of the SDBOC water quality monitoring program in 1997, a significant increase in turbidity was observed at locations where agricultural return flow entered the Yakima River via major drains: Granger Drain, Sulphur Creek Wasteway, and Spring/Snipes Creek Wasteways. In 1997, turbidity values ranged from a low of 20 to a high of 275 NTU Ranges have decreased in recent years. In 2002, means and median turbidity values were 11 NTU at Snipes Creek, 22 NTU at Sulphur Creek, and 61 NTU at Granger Drain (Figure 3-2). Most of these values met the Department of Ecology's Total Suspended Solids TMDL 2002 goals. Turbidity levels have remained at relatively stable and low levels since 2001 or 2002. All drains and wasteways in the lower Yakima River basin have turbidity levels established by state standards since 2001 with the exception of Granger Drain.

**Figure 3-2. Annual 90th percentiles for turbidity measurements made in Granger Drain and in Sulphur, Spring and Snipes Creek Wasteways: 1997 to 2008. This graph shows that the SDBOC has met 5 year goals set by the Washington State Department of Ecology.**




By combining the flow of each drain with the levels of turbidity observed, tons of sediment per day discharged into the Yakima River by these four major drainage outlets can be calculated (i.e. TSS loading). In 2002, the four major drains discharged between 1 and 23 tons/day to the lower Yakima River. This is a marked contrast from loading values estimated for 1997, when between 4 and 152 tons/day was discharged. The reduced water quality of return flows has been associated with the impairment of biological communities of fish, invertebrates, and algae in return drains and portions of the mainstem Yakima River (Morace et al. 1999).

As illustrated above, the SDBOC water quality program has resulted in significant improvements in the quality of water being returned to the Yakima River. In Granger Drain, the 90th percentile turbidity has been reduced 74% since 1997 (Zuroske 2009). As water quality conditions of return flows to the Yakima River improve due to the SDBOC efforts, adverse effects to aquatic resources will likely diminish.

Water quality conditions (temperature and dissolved oxygen), particularly during the irrigation season, may limit juvenile salmonid rearing in some wasteways and drains. Additional research is required to determine the suitability of the water quality of the SDBOC drainage network with respect to fisheries.

### 3.3 Threatened and Endangered Species

The Endangered Species Act (ESA) requires Federal agencies to consult with FWS and NOAA Fisheries, as appropriate, to ensure that actions they authorize, fund, or carry out do not jeopardize the existence of a listed species or result in the adverse modification or destruction of their critical habitat. Reclamation has prepared a BA to assess impacts to ESA-listed species from this proposed action (Reclamation 2009a).

The following lists those species listed by FWS and NOAA Fisheries as threatened or endangered within the project area:

**Federal Listed**

**Endangered**
None

**Threatened**
Bull trout (Salvelinus confluentus)
Steelhead trout (Oncorhynchus mykiss)
Ute Ladies'-tresses (Spiranthes diluvialis), plant

#### 3.3.1 Steelhead Trout

The Middle Columbia River (MCR) Evolutionarily Significant Unit (ESU) of inland steelhead (Oncorhynchus mykiss) was listed as "Threatened" by NOAA-Fisheries on March 25, 1999. The MCR ESU includes all naturally spawned populations of steelhead in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington (64 FR 14517). Steelhead from the Snake River Basin are excluded from this ESU. In 2006, NOAA-Fisheries issued its final listing determinations for 10 Distinct Population Segments (DPS) of West Coast Steelhead (71 FR 834). The Middle Columbia River steelhead DPS remained listed as threatened in this document.

##### 3.3.1.1 General Life History and Yakima River Population Characteristics

Steelhead are phylogenetically and ecologically complex, exhibiting perhaps the most diverse life history patterns of any Pacific salmonid species (Shapovalov and Taft 1954, Barnhart 1986). O. mykiss display varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations (Busby et al. 1996).

Steelhead on the west coast of the United States have experienced declines in abundance in the past several decades as a result of natural and human factors (NMFS 1996, NMFS 1998). Forestry, agriculture, mining, and urbanization have degraded, simplified, and fragmented habitat (NRCC 1996). Water diversions for agriculture, flood control, domestic, and hydropower purposes have greatly reduced or eliminated historically accessible habitat. Loss of habitat complexity, such as reductions in wetlands and deep pools, has contributed to the decline of steelhead (NMFS 1996). Studies estimate that during the last 200 years, the lower 48 states have lost approximately 53 percent of all wetlands and the majority of the rest are severely degraded

(Dahl 1990, Tiner 1991). Washington and Oregon's wetlands are estimated to have diminished by one-third, while California has experienced a 91 percent loss of its wetland habitat (Dahl 1990, Jensen et al. 1990, Barbour et al. 1991, Reynolds et al. 1993). In national forests in Washington, there has been a 58 percent reduction in large, deep pools due to sedimentation and loss of pool-forming structures such as boulders and large wood (Federal Ecosystem Management Assessment Team (FEMAT). Similarly in Oregon, the abundance of large, deep pools on private coastal lands has decreased by as much as 80 percent (FEMAT 1993). Sedimentation from land use activities is recognized as a primary cause of habitat degradation in the range of west coast steelhead.

All steelhead in the Columbia River Basin upstream from the Dalles Dam are summer-run, inland steelhead (Schreck et al. 1986). Life history information for steelhead of this DPS indicates that most Middle Columbia River steelhead smolt at 2 years and spend one, two, or rarely, three years in the ocean (i.e., 1-salt, 2-salt, or 3-salt fish, respectively) prior to re-entering fresh water. Adult steelhead on their spawning migration enter the Columbia River in mid-May and pass over Bonneville Dam between July and August. Summer-run steelhead adults remain up to a year in fresh water prior to spawning.

Middle Columbia River steelhead population size is substantially lower than historic levels, and at least two extinctions are known to have occurred in the DPS. Based on historic estimates, the run size of the MCR DPS could have been in excess of 300,000 fish (Busby et al. 1996) although this figure may be an overestimate since it is largely based on historical estimates of steelhead returns to the Yakima River basin. Other crude estimates, based on the size of the Yakima watershed and salmon and steelhead harvest in the Columbia River (Chapman 1986) lead to lower estimates of historical abundance for the entire MCR DPS. Similarly, there is uncertainty about how many steelhead existed in the Yakima River basin historically. Although run size estimates vary, numerous early surveyors and visitors to the Yakima Basin reported a robust and widespread steelhead population (Bryant and Parkhurst 1950; Davidson 1953; Fulton 1970; NPPC 1986; McIntosh et al. 1990). The Washington Department of Fisheries (WDF 1993) estimated that the Yakima River had annual run sizes of 100,000 steelhead prior to development. However, other historic run size estimates are substantially lower than this figure. For example, Cramer et al. (2003) suggests that production of steelhead in the Yakima River was less than 50,000 fish based on various estimates. Kreeger and McNeil (1993) estimated the historic run of steelhead to the Yakima River was about 20,800 adults based on Columbia River harvest statistics and amount of area the Yakima watershed occupies within the Columbia Basin.

Despite the variation in these historic estimates for the MCR DPS and the Yakima River, all estimates are higher than current abundance levels. Within the Yakima River Basin, wild adult steelhead returns have averaged 1,818 fish (range 505 to 4,491) over brood years 1985-2007 as monitored at Prosser Dam (RM 47.1; YSPB 2005, brood year 2007 data from Yakima-Klickitat Fisheries Program (YKFP), available at: www.ykfp.org). The relative number and timing of wild adult steelhead returning during the fall and winter-spring migration periods varies from year to year (Reclamation 2000; NPPC 2001). Generally, adult MCR steelhead migration into the Yakima Basin peaks in late October and again in late February or early March.

Minimal numbers of adult steelhead pass Prosser Dam during July and August, with numbers beginning to increase in September. Peak passage timing above Prosser Dam occurs in October and November when a combined 50% of the steelhead run occurs at this location. Steelhead abundance over Prosser Dam declines slightly in December and early-January due to the onset of cold water temperatures, however, adult migration resumes in February through April, coincident with the spawning run. Adult steelhead migration is essentially completed at Prosser Dam by early-April.

Most adult steelhead over-winter in the Yakima River between Prosser (RM 47.1) and Sunnyside Dams (RM 103.8) before moving upstream into tributary or mainstem spawning areas (Hockersmith et al. 1995). The Yakima River upstream of Prosser Dam is known to be occupied by steelhead as well as resident rainbow trout and provides important habitat for adult steelhead migration and holding, as well as for juvenile rearing for this species. In addition, the upper sections of the Yakima River and the entire Naches River basin contains important spawning habitat for steelhead and rainbow trout (Campton and Johnson 1985, NPPC 2001).

The historical distribution of Yakima steelhead is thought to have included all reaches of the Yakima River mainstem and its tributaries that supported spring Chinook salmon (O. tshawytshca), as well as many other tributaries (YIN et al. 1990). As steelhead spawners are capable of utilizing smaller streams with steeper gradients than spring Chinook, most accessible permanent streams and some intermittent streams may have once supported spawning steelhead. Currently, Yakima River steelhead are found in nearly all mainstem and tributary reaches, however, access to portions of the headwaters of the Yakima River and some tributaries are blocked by dams and other passage barriers. As a result, anadromous steelhead cannot access the entire Yakima River watershed.

Hockersmith et al. (1995) identified the following spawning populations within the Yakima Basin: upper Yakima River above Ellensburg, Teanaway River, Swauk Creek, Taneum Creek, Roza Canyon, mainstem Yakima River between the Naches River and Roza Dam, Little Naches River, Bumping River, Naches River, Rattlesnake Creek, Toppenish Creek, Marion Drain, and Satus Creek. Of 105 radio-tagged fish observed from 1990 to 1992, Hockersmith et al. (1995) found that well over half of the spawning occurred in Satus and Toppenish Creeks (59%), with a smaller proportion in the Naches drainage (3 2%), and the remainder in the mainstem Yakima River below Wapato Dam (4%), mainstem Yakima River above Roza Dam (3%), and Marion Drain (2%), a Wapato Irrigation Project drain tributary to the Yakima River. Electrophoretic analyses have identified four genetically distinct spawning populations of wild steelhead in the Yakima Basin: the Naches, Satus, Toppenish, and Upper Yakima stocks (Phelps et al. 2000).

Steelhead spawning varies across temporal and spatial scales in the Yakima Basin, although the current spatial distribution is significantly decreased from historic conditions. Yakima Basin steelhead spawn in intermittent streams, mainstem and side-channel areas of larger rivers, and in perennial streams up to relatively steep gradients (Hockersmith et al. 1995; Pearsons et al. 1996). Within the Naches Basin, most steelhead spawning (85%) occurred in the Naches River mainstem, primarily from river mile 2.7 (Cowiche Creek confluence) to the Little Naches River, with the remainder distributed in lower reaches of the Bumping River, Little Naches River, and Rattlesnake Creek (Cramer et al. 2003). Recent steelhead redd surveys conducted by the U.S.

Forest Service indicate that steelhead redds were distributed throughout the Naches basin, particularly in Naches River tributaries such as Oak, Nile, Rattlesnake Creeks and in the Bumping, American, and Little Naches Rivers (Gary Toretta, USFS, unpublished data, 2004-2007).

Typically, steelhead spawn earlier at lower, warmer elevations than higher, colder waters. Overall, most spawning is completed within the months of January through May (Hockersmith et al. 1995), although steelhead have been observed spawning in the Teanaway River (RM 176.1), a tributary to the Upper Yakima into July (Todd Pearsons, Washington Department of Fisheries and Wildlife (WDFW), personal communication). In the Naches, as elsewhere in the basin, spawning begins earliest at the lowest elevations. From radio tagging data and records of the first observations of steelhead fry, steelhead spawn in the lower Naches (below Tieton) and its tributaries from early March through mid May. In the upper Naches, the spawning period is from late March through late May. In the higher elevation tributaries of the upper Naches (the Little Naches River, Bumping River, Rattlesnake Creek), spawning occurs from late April through late May, with peak in early May.

Steelhead eggs take about 30 days to hatch at 50 degrees Fahrenheit, and another two to three weeks before fry emerge from the gravel. However, time required for incubation varies significantly with water temperature. Fry emergence typically occurs between mid to late May, and early July, depending on time of spawning and water temperature during incubation.

Juvenile steelhead utilize tributary and mainstem reaches throughout the Yakima and Naches Basins as rearing habitat, until they begin to smolt and emigrate from the basin. Smolt emigration begins in November, peaking between mid-April and May. Busack et al. (1991) analyzed scale samples from smolts and adult steelhead and found that the smolt transformation typically occurs after two years in the Yakima system, with a few fish maturing after three years and an even smaller proportion reaching the smolt stage after one year. When compared to spawning distribution and run timing, these data suggest that various life stages of listed steelhead may be present throughout the Yakima Basin and its tributaries virtually every day of the calendar year.

Water temperatures in the lower Yakima River may contribute to lower survival of smolts and kelts during summer months (Vaccaro 1986; Lichatowich and Mobrand 1995; Lichatowich et al. 1995; Pearsons et al. 1996; Lilga 1998). Steelhead kelts and smolts have been observed at the Chandler Juvenile Enumeration Facility (RM 47.1) into the middle of July, when water temperatures can become lethal. Conditions in the lower Yakima River become suitable once again for salmonids in early fall, near the end of the irrigation season (NPPC 2001).

#### 3.3.1.2 Yakima River Basin Steelhead Critical Habitat

The final rule designating critical habitat for 12 Evolutionarily Significant Units (ESUs) of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho was published in the Federal Register on September 2, 2005, and became effective on January 2, 2006 (70 Fed. Reg. 52630). This rule designated over 20,630 miles of lake, riverine, and estuarine habitat in Washington, Oregon, and Idaho, as well as approximately 2,312 miles of marine nearshore habitat in Puget

Sound, Washington. Critical habitat within the Middle Columbia River (MCR) steelhead DPS was designated as part of this Federal Register final rule notification, including the entire mainstem Yakima River from the confluence with the Columbia River to the upstream limits of migration at storage dams or tributary headwater streams. Also designated as critical habitat was the lower sections of several Yakima River tributaries and irrigation drains including approximately the lower one mile of Sulphur Creek Wasteway.

Critical habitat for steelhead in the Lower Yakima River and tributaries consists of primary constituent elements (PCEs) that support steelhead freshwater rearing, and migration habitat (NMFS 2004, 70 Fed. Reg. 52630). NMFS has determined that critical habitat PCEs exist in the Lower Yakima River as well as several tributaries but that they may vary "by site and biological function such that the quality of the elements may vary within a range of acceptable conditions" (70 Fed. Reg. 52630). Reclamation concurs with NMFS that streamflows and habitat conditions in the lower Yakima River currently support critical habitat PCEs for steelhead rearing, and migration in the environmental baseline, and that these PCEs exist in the Lower Yakima River and in Sulphur Creek Wasteway in the reach immediately downstream of the project area boundaries.

### 3.3.2 Bull Trout

On June 10, 1998, USFWS (USFWS 1998) listed the Columbia River population segment of bull trout, which includes the Yakima basin, as threatened. On June 10, 1998, the U.S. Fish and Wildlife Service (USFWS) listed the Columbia River population segment of bull trout, which includes the Yakima basin, as threatened. A final rule designating critical habitat for the Columbia River population segment of bull trout was published in the Federal Register on September 26, 2005 (70 Fed. Reg. 56211) and the designation became effective on October 26, 2005. A proposed rule revising the currently designated critical habitat was published in the Federal Register on January 14, 2010 (75 FR 2270).

#### 3.3.2.1 General Life History and Yakima River Population Characteristics

Bull trout populations within this population segment have declined from historic levels and are generally considered to be isolated and remnant. Bull trout were likely widely dispersed throughout the Yakima River drainage, limited only by natural passage and thermal barriers. The historical range may have approximated that of spring, summer, and fall Chinook salmon (*Oncorhynchus tshawytshca*), much as may have been the case in Idaho (Thurow 1987; Rieman and McIntyre 1993). The distribution of bull trout may parallel the distribution of potential prey such as whitefish and sculpins.

Yakima Basin studies indicate that bull trout typically occur in the upper reaches of several tributaries, in small populations that are mostly isolated from each other (Goetz 1994, Wissmar and Craig 1998, WDFW 1998). Studies have indicated that bull trout are most likely to occur, and to be strong in cold, high elevation, low- to mid-order watersheds with low road density (Rieman et al. 1997, Goetz 1994, MacDonald et al. 1996).

Bull trout have some of the most demanding habitat requirements of any native trout species mainly because they require water that is especially cold and clean. As a result, water temperature is a critical habitat characteristic for bull trout. Bull trout have demonstrated a unique adaptation for spawning, incubating, and rearing in colder water than salmon and steelhead which has allowed this species to survive in habitat areas that may be unsuitable for most other species of fish. Ratliff and Howell (1992) note that in many of the cold streams where bull trout spawn, they are the only fish present. McPhail and Murray (1979) demonstrated that survival of bull trout eggs was 80-9 5 percent to hatching at temperatures of 2-4°C and dropped to 0-20 percent at temperatures of 8-10°C. Buchanan et al. (1997) report observations from throughout Oregon and the published literature, and concluded that, while optimum temperatures for juvenile growth are between 4-10°C, the optimum for adult bull trout is near 12-15°C. Temperatures above 15°C (59° F) exceed bull trout physiological preferences and are therefore thought to limit their distribution (Fraley and Shepard 1989).

Bull trout reach sexual maturity after 4 of more years and live up to 10 to 12 years. They typically spawn during September through November, in relatively cold streams that are clean and free of sediment. The incubation period for bull trout is extremely long, and young fry may take up to 225 days to emerge from the gravel (Craig 1997, USFWS 1998). Because of this long incubation period, eggs are particularly vulnerable to siltation problems and bed load movement in rivers and streams where spawning occurs. Any activity that causes erosion, increased siltation, removal of stream cover, or changes in water flow or temperature affects the number of bull trout that hatch and their ability to survive to maturity (Knowles and Gumtow 1996).

Bull trout exhibit both migrant and resident life history strategies. After rearing as juveniles for 2-4 years in their natal streams (Meehan and Bjornn 1991), migrant bull trout emigrate to larger rivers or lakes, whereas resident fish complete their entire life cycle within their natal stream. Migrant forms, including both fluvial (downstream migration to larger rivers) and adfluvial (downstream migration to lakes) grow rapidly, often reaching over 20 inches in length and 2 pounds by the time they are 5-6 years old. Migratory bull trout live several years in larger rivers or lakes, where they grow to a much larger size than resident forms before returning to tributaries to spawn. Growth differs little between forms during their first years of life in headwater streams, but diverges as migratory fish move into larger and more productive waters (Rieman and McIntyre 1993).

Although both the Fish and Wildlife Service (USFWS 2002) and the Washington Department of Fish and Wildlife (WDFW 1998) recognize the existence of a mainstem Yakima River sub-population of bull trout, very little information exists to document the abundance or status of this fish in the mainstem Yakima River. Bull trout have been sporadically caught during electrofishing surveys in the upper Yakima River by the WDFW and adult bull trout have been observed migrating upstream through the Roza Diversion Dam fish ladders between the years of 1999 and 2003. In addition, inconsistent spawning activity has been reported in the reach between Keechelus Dam and Lake Easton in the upper basin. Bull trout observations in the lower Yakima River are more infrequent, consisting of a single adult fish captured in the mainstem Yakima River near Benton City by WDFW biologists in 1997. No bull trout have ever been captured at the juvenile sampling facility at the Chandler Canal screen site, and no bull trout have ever been recorded using the ladders at Prosser Diversion Dam.

Based on this information, it seems that the mainstem Yakima River is primarily used as migratory or rearing habitat for small numbers of adult and sub-adult bull trout. This may be the extent of the historic usage of the mainstem river by these fish. The lack of juvenile and sub-adult bull trout in the mainstem river indicates that bull trout are not and have not been reproducing successfully in the mainstem Yakima River. Given the fact that habitat conditions are not suitable for bull trout in the lower river, particularly high water temperatures during the summer, it is not surprising that few fish have been observed in the lower sections of the mainstem Yakima River.

#### 3.3.2.2 Yakima River Basin Bull Trout Critical Habitat

No critical habitat for bull trout has been designated on the Yakima River below the mouth of Ahtanum Creek which is above the area potentially affected by the proposed project. The recently proposed revisions to bull trout critical habitat include the entire lower Yakima River mainstem.

### 3.3.3 Ute Ladies' tresses

The Ute ladies' tresses plant is a member of the orchid family and is found in wetland, riparian areas, spring habitats, mesic to wet meadows, river meanders, and floodplains. The plant occurs between an elevation range of 1,500 to 7,000 feet and at lower elevations in the western part of its range. The orchid generally occurs below montane forests, in open areas of shrub or grassland, or in transitional zones. It is considered a lowland species, typically occurring beside or near moderate gradient, medium to large streams and rivers. The plant is not found on steep mountainous parts of a watershed, nor out in the flats along slow meandering streams. This species tends to occupy grass, rush, sedge and willow sapling dominated openings. There are no known populations of Ute Ladies' tresses in the Yakima Basin.

## 3.4 Cultural Resources

Cultural Resources are the manifestations of archaeological, historical, and traditional human uses of the project area. Historic Properties are cultural resource sites which are eligible for inclusion to the National Register of Historic Places (National Register), and therefore warrant consideration under the National Historic Preservation Act.

Human occupation in the southern Columbia Plateau, of which the Yakima River Basin is a part, began well over 10,000 years ago. The earliest human occupants, during the Windust and Vantage phases (11,000 to 6,500 BC) were nomads and occupied temporary camps. Windust Phase peoples relied on hunting mammals and birds, and the gathering of wild plants. The Vantage Phase showed an increased reliance on riverine resources such as fish. After 3,200 B.C. people were increasingly living in pithouses and re-occupying locations for salmon harvesting. After 1,900 B.C. populations in the area had increased and settled villages had been established along the rivers. By at least 1,000 A.D. large winter villages consisting of semi-subterranean pithouses and larger longhouses had been established which revolved around a heavy reliance on salmon runs. Many of these winter villages were still occupied at the time of European contact.

The architecture and layout of winter villages became even more permanent with the introduction of the horse in the early 1700s. The indigenous peoples which had settled in the winter villages in the Yakima River Basin include the: Yakama, Palouse, Pisquouse, Wenatshapam, Klikatat, Klinquit, Kow-was-say-ee, Li-ay-was, Skin-pah, Wish-ham, Shyiks, Ochechotes, Kah-milt-pay, and Se-ap-cat. They are among the tribes and bands that are officially known today as the Confederated Tribes and Bands of the Yakama Nation, hereafter referred to as the Yakama Nation. The Yakama Nation is made up of the tribes and bands that signed the Treaty of 1855 ceding over six million acres to the white settlers. The modern Yakama Indian Reservation is located immediately west of the project area.

Euro-American occupation is most noticeable as related to irrigation agriculture. The Sunnyside Canal began as a private enterprise and, at the end of its initial construction 1891-1906, was "the largest private canal system in Washington" (56 miles of canal, 75 miles of laterals) (Pfaff 2002:13). Reclamation purchased the Sunnyside Canal irrigation system (i.e., Sunnyside Division) on June 23, 1906. This purchase included reservoirs, dams, the main canal and "all branch canals, laterals, and associated features such as flumes, headgates, and ditchriders' houses" (Pfaff 2002:34).

The Sunnyside Canal, when purchased by the Federal Government, was 56 miles long, had a capacity of 650 cubic feet per second at intake, supplied water to about 36,000 acres, and included mostly wooden control structures that were badly deteriorated and leaking. The system also included two main laterals (Snipes Mountain and Rocky Ford), with a combined length of about 25 miles, and about 50 miles of smaller laterals (Pfaff 2002:37).

The following historic properties within the Sunnyside Division have been determined eligible for the National Register: Sunnyside Diversion Dam and Canal Headworks, Grandview Irrigation District, and Zillah Wasteway. The Sunnyside Irrigation System, whose primary feature is the Sunnyside Canal, was determined eligible to the National Register.

## 3.5 Wetlands

Wetlands are critical ecological systems of importance to fish and wildlife. Within the Yakima River Basin, existing acreages of wetland habitat are reduced compared to historical conditions. Existing wetlands include wet meadows, seeps, small shallow ponds and lakes, marshes, and riparian wetlands along streams. Wetlands have also formed from artificial water sources such as reservoirs, sewage lagoons, stock ponds, irrigation canals, and irrigated cropland runoff. Within the RRM project area, wetlands and potential wetland impact areas were identified using National Wetland Inventory maps, together with initial field investigations and reviews of aerial photographs.

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

Approximately 5.7 acres of wetlands were identified within the RRM project area. These wetlands have been formed over the years primarily due to the influence of irrigation activities. The soils associated with the wetlands within the project area are mesic (balanced moisture soils) to xeric (dry soils) moisture regime, which cannot naturally support wetland conditions. No naturally occurring wetlands were identified in the areas of existing canals and proposed pipelines within the project area.

### 3.6 Wildlife

Wildlife within the RRM project boundary will be the same species observed during surveys for the Phase 2A portion of the project. The following species were noted in the EA for Phase 2A (Reclamation, 2009b): magpies, Red-wing and Yellow-headed blackbirds, killdeer, sparrows, finches Yellow-bellied marmots (Marmota flaviventris), and Beechey ground squirrels (Spermophilus beecheyi). There may also be deer, coyotes, and other wildlife in the area that were not observed during the Phase 2A project fieldwork.

### 3.7 Indian Trust Assets

Indian Trust Assets (ITAs) are legal interests in property held in trust by the United States for federally-recognized Indian tribes or individual Indians. ITAs may include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with trust land. Beneficiaries of the Indian trust relationship are federally-recognized Indian tribes or individuals with trust land, the U.S. acting as trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the U.S.

The U.S. DOI Departmental Manual Part 512.2 defines the responsibility for ensuring protection of ITAs to the heads of bureaus and offices (DOI, 1995). DOI is required to “protect and preserve Indian trust assets from loss, damage, unlawful alienation, waste, and depletion” (DOI, 2000). It is the responsibility of Reclamation to determine if the proposed project has the potential to affect ITAs.

The Sunnyside Division is within lands ceded in the Yakama Treaty of June 9, 1855. This treaty established the Yakama Reservation and reserved rights and privileges to hunt, fish, and gather roots and berries on open and unclaimed lands to the fourteen Tribes and bands who signed that treaty.

Indian Trust Assets of concern for this action may include the rights and privileges to fish.

### 3.8 Environmental Justice

Executive Order 12898 requires each Federal agency to consider environmental justice as part of its decision making process by identifying and addressing disproportionately high adverse human health or environmental effects, including social and economic effects, of its programs and activities on minority populations and low-income populations of the United States.

Environmental justice requires Reclamation programs, policies, and activities affecting human health or the environment to not exclude minorities and low income groups from participation in or the benefits of programs or activities based on race or economic status.

People are the primary resource for social assessment, and the vast majority of the people that comprise the affected communities reside within the Yakima and Benton County areas. Also included in the affected area is the Yakama Indian Nation.

The area in and around the project area has a relatively high population of minorities (approximately 42 percent in Yakima County and approximately 14 percent in Benton County compared to approximately 18 percent statewide). According to the 2000 census, in Benton County, the Hispanic population is 12.5% of the total population and the Indian population is 0.8% of the total population. In Yakima County, the Hispanic population is 3 5.9% of the total population and the Indian population is 4.5% of the total population. The Yakama Nation Reservation boundary is located within the project area.

### 3.9 Sacred Sites

Executive Order 13007, Indian Sacred Sites (May 24, 1996), directs executive branch agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites on Federal lands. The agencies are further directed to ensure reasonable notice is provided of proposed land actions or policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites. The EO defines a sacred site as a "specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion."

### 3.10 Public Safety

#### 3.10.1 Transportation

The existing Rocky Ford, Ryder, and Matheson lateral canals are located adjacent to, and/or intersect numerous transportation facilities in Benton County and within and near the city of Grandview, Washington. Under the proposed RRM piping project, many of these open canals will be replaced with buried pipe which will generally follow the original canal alignments. Refer to Figure 2-1 for information about the proposed pipelines, including locations and sizes of pipes to be installed, in relation to existing transportation facilities in the project action area.

There are approximately 60 locations (new and existing) where proposed pipelines would cross or intersect major and arterial roads used by vehicles within the project action area. These potentially affected roads are located in rural areas of Benton County and in urban areas within the City of Grandview. There would also be approximately 5 pipeline locations that may affect State Highway 241 (SR-241) within the project area. Proposed pipelines would intersect at 2 locations (by crossing under) the existing tracks and Right of Way (ROW) of the Burlington Northern – Santa Fe (BNSF) railway within and near the City of Grandview (personal communication, Don Schramm, 2009b). There would also be 5 to 6 pipeline intersections with the ROW for the abandoned Union Pacific railway tracks within the action area (RH2, 2009b).

### 3.10.2 Air Quality

There are most likely numerous pollutants and sources of pollution that affect the existing ambient air quality within the project action area. These may include windblown dust from area agricultural fields and open lands, outdoor and agricultural burning, woodburning stoves and fireplaces, wildfires, industrial sources, and motor vehicle emissions along State highways and local roads (Yakima River Basin Water Storage Feasibility Study Final PR/EIS, Reclamation 2008). Implementation of the proposed RRM piping project would involve construction activities, use of heavy equipment and vehicles, and other related actions that may temporarily affect existing air quality conditions in the project area during construction. Short-term emissions, such as equipment engine exhaust, from construction sites are exempt from air quality permitting requirements. Construction site emissions would vary from day to day, depending on the timing and intensity of construction.

### 3.10.3 Noise

Within the project action area, existing ambient noise level source areas include agricultural, commercial, industrial, recreational, and residential sites. Existing noise levels are attributable to motor vehicles, industrial and commercial operations, railroad transportation, and agricultural operations. Specific ambient noise sources include motor vehicle traffic on highways and major arterial roads, railway activities and equipment, road grading and construction activity, power tools, stationary mechanical equipment such as heating and air conditioning units, and industrial activities such as product loading and transfer, outdoor warehousing operations, and unscreened commercial and industrial facilities (Yakima River Basin Water Storage Feasibility Study Final PR/EIS, Reclamation 2008). The proposed RRM piping project would involve construction activities, use of heavy equipment and vehicles, and other related actions that may temporarily affect existing noise conditions during construction in the project area.

## CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

This section analyzes impacts of the action alternative compared with the No Action Alternative. Impacts are those that result from implementation of the action alternative relative to the no action alternative.

### 4.1 Fisheries

Much of the information below is excerpted from and tiered to Reclamation's BA for implementation of the Sunnyside Division Phase 2 Water Conservation Plan (Reclamation 2009a). The BA included fisheries information related to the ongoing Phase 2A lateral canal piping project and the proposed RRM lateral system piping project. This information is also tiered to Reclamation's EA for the Phase 2A project (Reclamation 2009b).

#### 4.1.1 Fisheries and Hydrology Effects in the mainstem Yakima River

Instream flow improvements resulting from implementation of Alternative 2 will take place during the irrigation season (April to October), and will increase target flows in the Yakima River between the point of diversion of the Sunnyside Canal and Sulphur Creek Wasteway, or will have neutral effects to mainstem Yakima River flows downstream of the project area. During the storage control period, instream flows in the Yakima River will be increased by approximately 12 cfs when the conservation measures in Alternative 2 are implemented for the RRM project. This 11.7 cfs increase will be added to the existing Title XII minimum instream target flow requirements of 300 to 600 cfs at Sunnyside and Prosser Diversion Dams (depending on TWSA calculations each year). For the reach between Sunnyside Dam and Sulphur Creek Wasteway, the full amount of the 11.7 cfs diversion reduction will be realized as instream flow increases in the mainstem Yakima River. However, flow benefits will begin to decrease in the reach adjacent to the RRM project area and downstream (i.e. from Sulphur Creek Wasteway to the Yakima River at Kiona) because the amount of flow in the Yakima River will be reduced slightly due to return flow reductions that will result from water conservation savings.

Impacts to fish resulting from the implementation of YRBWEP conservation programs are documented in Section 4.6 of the PEIS (Reclamation 2002). The water conservation associated with this action will contribute to the achievement of the positive impacts listed. The reduction in diversion will enhance flows between the Sunnyside Diversion Dam and the confluence with the Sulphur Creek wasteway, particularly during critical base flow periods. This should benefit adult and juvenile spring Chinook, fall Chinook and coho which move through this reach of the river during portions of the irrigation season. It may also benefit fall Chinook juveniles who rear for a short time during the irrigation season in this reach. These benefits help fulfill one of the purposes of YRBWEP. Below the Sulphur Creek wasteway confluence, the river flows will be slightly decreased, in all cases by less than 1 percent, due to reduced spills as a result of improved irrigation system efficiency. The instream flow benefits in the river reach from the Sunnyside Diversion Dam to the mouth of the Sulphur Creek wasteway would more than offset any negative impacts to river flow below the mouth of the Sulphur Creek wasteway.

### 4.1.2 Fisheries and Hydrology Effects in Project Return Flow Drains

Timing of return flow impact is somewhat dependent upon the nature of the conservation. Operational savings will affect return flow in the same time period the diversion reduction occurs. For the purposes of this analysis it was assumed that seepage return flow impacts would be uniformly distributed throughout the year. This is not precisely correct, but given the gross time divisions used in the analysis, the assumption is adequate.

Impact locations were classified into three categories based on the probable return flow location: Sulphur Creek Wasteway, Snipes/Spring Creek Wasteway, or cumulative small drains. Within the RRM project area, operational spill savings from enclosing and piping open-channel laterals will accumulate in either the Sulphur Creek Wasteway or in several small cumulative drains along SDBOC managed lands. Modeling performed by UMA Consultants Inc (UMA 2000) and more recently by RH2 Consultants (Don Schramm, SVID, personal communication, 2009a) provided the data for these return flow locations. Table 4-1 summarizes the impacts to return flows for the three categories discussed. The flow in Sulphur Creek Wasteway would be reduced by an average of approximately 6 cfs during the irrigation season. Flows in Spring Creek and Snipes Creek wasteways would not be affected by water conservation changes from implementing the RRM project. Another source of flow reduction that will occur as a result of piping the open channel laterals will be from flow decreases occurring in various small drains and groundwater inflow locations within the SDBOC drainage network. It is estimated that water conservation measures in Alternative 2 will reduce these flows by approximately 4.3 cfs during the irrigation season. Cumulatively, these flow reductions for the Sulphur Creek Wasteway and various small drains will reduce return flows to the Yakima River by approximately 10.6 cfs during the irrigation season (Table 4-1).

**Table 4-1. Summary of Hydrologic Impacts to Irrigation Return Flow Drains and Wasteways from Implementing Water Conservation Measures from the RRM project of the Sunnyside Division Water Conservation Plan. Data from Mr. Don Schramm, SVID, personal communication, 2009b.**

| Category | Existing Average Flow (cfs) | Reduced Operation Spill (cfs) | Average Flow with RRM piping (cfs) | Percent Flow Reduction |
|---|---|---|---|---|
| Sulphur Creek WW -Typical Average Spill Year | | | | |
| Non-irrigation (19 Oct-31 Mar) | 91 | - | - | - |
| Irrigation (1 Apr to l8Oct) | 224 | 6.3 | 217.7 | 3% |
| Snipes/Spring Creek WW - Typical Average Spill Year | | | | |
| Non-irrigation (19 Oct-31 Mar) | 5 | N/A | N/A | N/A |
| Irrigation (1 Apr to l8Oct) | 18 | - | - | - |
| Cumulative Small Drains and Groundwater Discharge | | | | |
| Non-irrigation (19 Oct-31 Mar) | 32 | - | - | - |
| Irrigation (1 Apr to l8Oct) | 53 | 4.3 | - | - |
| Total - Typical Average Spill Year | | | | |
| Non-irrigation (19 Oct-31 Mar) | 128 | - | | - |
| Irrigation (1 Apr to l8Oct) | 295 | 10.6 | 284.4 | 4% |

Conversion of open channel laterals to fully enclosed buried pipelines could result in a slight reduction in winter baseflows through the SDBOC drainage network. The magnitude of non-irrigation season flow reductions associated with Alternative 2 was so small that it could not be estimated with the model (Table 4-1).

Implementation of proposed conservation measures will reduce flows in Sulphur Creek Wasteway by approximately 6 cfs during the irrigation season as measured for a typical year. Non-irrigation season discharge rates will essentially remain unchanged as a result of the proposed action. This rate of flow reduction will have minimal effects on anadromous fish since it will not limit or restrict access for adult fish into the Sulphur Creek Wasteway, and it will not significantly reduce spawning or juvenile rearing habitat currently available in the wasteway. In addition, water quality parameters will not change substantially as a result of the conservation measures so there should be little affect to adult or juvenile fish from altered water chemistry or physical conditions in the Sulphur Creek Wasteway.

It is likely that adult coho and fall Chinook salmon will continue to be falsely attracted to Sulphur Creek Wasteway because there will still be sufficient water available in the drain to provide attraction flow even with the full suite of conservation measures implemented. This assertion is supported by the fact that adult salmon species have been observed migrating into Sulphur Creek Wasteway during the non-irrigation season when this wasteway is typically at or approaching its lowest baseflow discharge. Since baseflow conditions during the winter period will not change as a result of the proposed action, conditions that permit false attraction and migration into Sulphur Creek Wasteway will remain. A contributing factor to the likelihood of continued false attraction in this drain is that a large component of the discharge in Sulphur Creek Wasteway is derived from Roza Canal operational spills. Because Roza Canal operational spill will continue to occur at the current rate into Sulphur Creek Wasteway, and the fact that this return flow to the river is derived from the upper Yakima River, salmonids (especially coho), will continue to be attracted to this water source.

### 4.2 Water Quality

Much of the information below is excerpted from and tiered to Reclamation's BA for implementation of the Sunnyside Division Phase 2 Water Conservation Plan (Reclamation 2009a). The BA included information on hydrology and water quality related to the ongoing Phase 2A lateral piping project and the proposed RRM lateral system piping project. The information below is also tiered to Reclamation's EA for the Phase 2A project (Reclamation 2009b).

#### 4.2.1 Hydrology of SDBOC Drains and Wasteways

Reductions of flows in the Sulphur Creek Wasteway and the cumulative small drains will occur during the irrigation season. This reduction will mean that there will be less good quality irrigation water to dilute the groundwater entering the drains. As a result the concentration of contaminants, such as nitrates, that are carried into the wasteways and drains by groundwater will increase. The increases would vary depending on the constituent or part of irrigation season. Turbidity, TSS, and total phosphorus could decrease in concentration since the spill water is higher in these constituents than the base flow in the wasteways. Specific conductance and nitrate would increase during the irrigation season due to loss of dilution water from spills. Given the decreases in return flows that are expected, ranging from 4.3 to 6.3 cfs, these water quality changes are expected to be negligible. No change in concentrations for any parameter would occur during the non-irrigation season as no changes in flow are expected.

#### 4.2.2 Water Quality in the Lower Yakima River and SDBOC Drains and Wasteways

The SDBOC, of which the SVID is a member, began a water quality monitoring program in 1997. While data collection is on-going, the data for 1997 through 2003 was available for this study for various drains, the spillways and both main canals. Water quality data has been collected for the following parameters: temperature, pH, dissolved oxygen, specific conductance, discharge, turbidity, total suspended solids, fecal coliform, total phosphorus, nitrate+nitrite, and total Kjeldahl nitrogen. In this analysis most parameters were modeled based on simple concentration/dilution concepts. The remaining parameters do not follow these rules and their changes are not easily calculated. The proposed reduction in spills and seepage should not significantly affect dissolved oxygen, pH, or fecal coliform. Water temperature could change in the drains, but prediction of the resulting temperature was not attempted in this study.
Impacts to return flow water quality during construction will be minimal because the pipelines will be constructed mainly during the non-irrigation season. Once completed, the pipelines will

isolate the irrigation water from any stormwater runoff that might occur from the lands disturbed during construction. Best management practices will be used to limit any such runoff.

The water quality impact on the Yakima River will depend on location. Upstream of the confluence with Sulphur Creek Wasteway, water quality would remain essentially the same under the proposed conservation measures. Just below the confluence with Sulphur Creek Wasteway, the increased river flow due to reduced diversion is approximately 1 cfs greater than the reduction in return flows from the wasteway and small drains, therefore the constituent concentration would be principally unchanged.

## 4.3 Threatened and Endangered Species

### 4.3.1 Steelhead

The physical components of the SDBOC water conservation plan (e.g. conversion of open-channel laterals to fully enclosed pipeline distribution systems), and the hydrologic and water quality impacts (mainly increases in Yakima River flows and flow decreases in drains and wasteways) resulting from implementation of the RRM project will be phased in over a 1.5 year time frame to reach full implementation. Construction activities related to the installation of the pipeline system will be located far from the mainstem Yakima River in dry canal or lateral alignments, and will have little direct and immediate impact on biology or habitat features in the Yakima River for any steelhead life history form.

### 4.3.2 Bull Trout

Implementation of Phase 2 will have no affect on bull trout in the project area because of the extremely low numbers of bull trout presently inhabiting or using the lower Yakima River. Bull trout would likely not be found in the project area, particularly below the mouth of Spring Creek Wasteway, where slight decreases in summer flows are projected. If present in the reach from Sunnyside Diversion Dam to the Spring Creek Wasteway, which is also unlikely, the increase in flows might benefit bull trout but any benefits would be immeasurable. To the extent bull trout might use the reach of the lower Yakima River below the Sunnyside Diversion Dam it would be as a migration corridor or overwintering area. Proposed critical habitat in the lower Yakima River currently may support these activities on a seasonal basis. The slight changes in stream flows with the proposed action would have no effect on the ability of the proposed critical habitat to support these activities.

### 4.3.3 Ute Ladies' tresses

Ute Ladies' tresses habitat consists of wetland, riparian areas, spring habitats, mesic to wet meadows, river meanders, and floodplains. As part of the wetland field investigations of sites where Ute Ladies' tresses may occur within the Phase 2A project area, no rare plants were observed. The potential impact area for the proposed RRM piping project is similar to the area for the Phase 2A project, therefore no Ute ladies' tresses are expected to occur within the proposed project area. There are no known populations of Ute Ladies' tresses in the Yakima

Basin. Therefore, we conclude that the proposed RRM project would have no impacts to Ute ladies' tresses.

### 4.4 Cultural Resources

This Project is subject to the requirements of Section 106 of the National Historic Preservation Act. Under Section 106 requirements, assessment as to whether or not a cultural resource is potentially eligible for the National Register, and whether the project will cause effects, must be completed.

A cultural resources inventory of the proposed RRM piping project was conducted in order to determine whether any historic properties would be impacted by the project. The survey for this project assumed that the Area of Potential Effect (APE) is within a potentially eligible historic district, and cultural resources greater than 50 years of age associated with irrigation had to be assessed for eligibility to the National Register both as individual properties and as contributing elements to a rural landscape. Prehistoric archaeological deposits and isolated finds in the vicinity of the project area are concentrated along the banks of the Yakima River and in the uplands (e.g., Rattlesnake Hills). Recorded cultural resources of interest within the APE or project vicinity are the prehistoric Morgan Lake Site (45YA608), the Cornell Farmstead/Marble Ranch property (39YA93), the Grandview Pavement/Yellowstone Trail (45YA916) and the Union Pacific Depot (45GH67). Ethnographic research and consultation with the Yakama Nation did not reveal any properties of traditional cultural importance within the project APE.

Pfaff (2002) presents guidelines regarding assessment of the eligibility of property types found on the Yakima Project as individual properties. This undertaking will have an adverse effect on the following historic irrigation resources--the Matheson lateral along the 1910 route, the Rocky Ford power plant property and Bonnieview power plant property-- due to the infilling of the open ditches and removal of structures that are within these properties. The Cornell Farmstead/Morgan Ranch historic property and Union Pacific rail line will suffer no adverse effect; the Matheson lateral is a non-contributing element to the Morgan Ranch property and the Union Pacific rail line is ineligible to the National Register. The City of Grandview well house will suffer no effect because SVID will not be altering standing structures not owned by Reclamation or managed by SVID. Based on the Morgan Lake site's dimensions, the site should not suffer any effect by this undertaking.

The adverse effect posed by this project will be resolved by mitigating negative effects to irrigation structures, monitoring in the vicinity of the Morgan Lake site, and implementing protocols for inadvertent discoveries of cultural resources or human remains.

During the Phase 2A of the SVID piping, mitigation of effects to second-tier irrigation resources was accomplished by meeting Washington State Level II documentation requirements. Those resources are of the same type as the ones discussed above (i.e., laterals off the Sunnyside Canal with a mix of historic and non-historic weirs, headgates, turnouts, etc.). Thus a similar mitigation of negative effects to the Matheson lateral along the 1910 route and the Rocky Ford and Bonnieview power plants will be the completion of Level II documentation. One of the drops in the Ryder lateral will also have Level II documentation. The quantity of this structure type within the APE suggests it was probably in popular use ca. 1940, and documentation of one example will record additional information on the historic development of the Sunnyside Irrigation System.

This undertaking will have no effect on the Morgan Lake site. However, the site boundaries are not well defined. Therefore an archaeological monitor will be present when ground-disturbing work occurs along 235 m of the Rocky Ford lateral starting where the lateral curves southeast after crossing Dwinell Road (UTM 10T 730494 E 5125419 N) and continuing to the south.

While no prehistoric cultural material was observed during the survey, it is possible such materials could be exposed during ground-disturbing activities. Potential prehistoric cultural material could include concentrations of fire-modified rock and charcoal, stained/ashy sediments, calcined bone, shell, lithic artifacts such as flaked and groundstone tools or manufacturing debris. If any possible cultural material is encountered during the project, work must be suspended at that location and the USBR Archaeologist and DAHP notified.

In the event of an inadvertent discovery of human remains, all work in the vicinity of the find will be halted and the authorized SVID official, County Coroner, local law enforcement, USBR Archaeologist, and DAHP must be notified immediately. The authorized SVID official will determine if State or Federal regulations apply. Revised Code of Washington (RCW) 27.44; 68.50; 68.60 apply on non-federal lands. Federal regulations including the National Historic Preservation Act (NHPA), Archaeological Resources Protection Act (ARPA), and Native American Graves Protection and Repatriation Act (NAGPRA) apply on federal lands. A protocol that must be followed if such a discovery occurs will be provided for distribution to field crews.

These findings are being reviewed with the Yakama Nation and the Washington State Historic Preservation Officer for a final determination.

### 4.5 Wetlands

Most of the wetlands in the project area are a result of on-farm irrigation ponds. Even with piping the lateral canals, these ponds may still continue operating, therefore many of these wetlands may not be affected. The native soils the wetlands are found in are not naturally conducive to wetland formation. Wetlands, by definition, have a hydric soil; the soils in the wetlands within the project area range from mesic to xeric moisture regimes.

Reclamation’s BCP implementation may result in the loss of irrigation induced wetlands, however Reclamation’s ongoing land restoration and enhancement efforts will offset any potential loss. Currently, Reclamation has identified approximately 445 acres of existing wetland habitat that can be used as mitigation for the conservation programs in the Yakima Basin (Reclamation 2009b).

## 4.6 Wildlife

All of the piping would be installed on the existing canal banks or within the canal prism. Some soil from the banks of the canals will be used as fill for the pipe, which may remove some vegetation used by some wildlife as habitat or forage, but will be re-vegetated after construction. As such, piping of the three lateral canals would not affect wildlife or wildlife habitat.

## 4.7 Indian Trust Assets

There would be no impacts to ITAs associated with the on-site activities of this proposed action. Regardless, it is the general policy of Reclamation to perform its activities and programs in such a way as to protect ITAs and avoid adverse effects whenever possible (Reclamation, 2000). Therefore, Reclamation will comply with procedures contained in Departmental Manual Part 512.2, guidelines, which protect ITAs.

## 4.8 Environmental Justice

Water is a limited resource, and in many years, demand is much higher than supply. This condition has prevailed in the area for several years. Under the No Action Alternative, this circumstance will continue into the future. Under Alternative 2, impacts to social well-being are positive compared to the no-action alternative, in that the improvement in water supply during water short times will likely lessen the potential conflict between competing water users, including minority populations and low-income populations residing in the project area.

## 4.9 Sacred Sites

To date, no sacred sites have been identified in the project area. Therefore, none of the alternatives would impact known sacred sites. However, if a tribe identifies a sacred site within the area affected by the preferred alternative, Reclamation will promote accommodation of access and protect the physical integrity of the site.

## 4.10 Public Safety

The existing Rocky Ford, Ryder, and Matheson lateral canals are located within and adjacent to rural and urban residential areas, including populated areas within Benton County and in the City of Grandview. These existing open canals vary in size from small to very large, and normally transport relatively large volumes of water during the irrigation season. Many of these canals are accessible to the public, and some may pose a potential safety hazard to people and animals entering the water in these facilities. The proposed ELIPS-RRM project would involve enclosing approximately 51 miles of these open canals with buried pipe, which would result in elimination of these possible public safety conditions.

### 4.10.1 Transportation

Under Alternative 2, the proposed RRM project, there are approximately 60 sites on existing canals and at new locations where pipelines would cross or intersect existing transportation facilities within the project action area. These sites include major and arterial roads used by motorized vehicles within urban areas in and near the City of Grandview. Potentially affected road sites are also located in rural areas of Benton County, including approximately 5 pipeline locations that may affect the SR-241 highway. New pipelines would intersect at 2 locations the existing tracks and ROW of the BNSF railway within and near the City of Grandview (personal communication, Don Schramm, 2009b). Pipelines would also be placed within or would intersect with the ROW for the abandoned Union Pacific railway tracks within mostly rural areas of Benton County (RH2, 2009b). There may be short-term impacts to existing automobile traffic due to possible road closures and detours at intersecting locations where very large pipes will be installed (personal communication, Don Schramm, 2010). During pipeline construction activities, there may also be localized short-term impacts to existing vehicle traffic due to additional heavy vehicle use for pipeline materials hauling.

Any possible negative effects to existing transportation facilities and local vehicle use within the project area due to the implementation of Alternative 2 would be mitigated as much as possible by the following measures (personal communication, Don Schramm, 2009b, 2010). SVID will utilize an existing master crossing agreement with Benton County, the City of Grandview, and the BNSF railway company. During construction activities for most road/pipe crossing locations, at least one road lane would be kept open for vehicle use if possible. If any road closures or detours are required for pipe installations, SVID would request a variance to the existing master crossing agreement with the applicable local government entity. Road crossing designs and signing plans will be prepared by SVID prior to specific construction activities. Best Management Practices (BMPs) will be used by SVID contractors for road crossing construction, vehicle traffic control, road signing, and other activities that may have short duration effects on existing transportation resources during project implementation.

### 4.10.2 Air Quality

Implementation of the proposed RRM piping project would involve construction activities, use of heavy equipment and vehicles, and other related actions that may temporarily affect existing air quality conditions in the project area during construction. These potential short-term effects could result from increased airborne dust due to construction activities and from increased engine emissions due to heavy vehicle and construction equipment operations. Air quality impacts from vehicle emissions associated with constructing the proposed facility would vary from day to day depending on the timing and intensity of construction, but these impacts are expected to be minimal and of short-term duration.

Potential short-term negative effects to existing air quality within the project area due to the implementation of Alternative 2 would be mitigated as much as possible by the following measures (personal communication, Don Schramm, 2009b). Most construction activities will occur during winter months when soil moisture is naturally high which will minimize airborne dust creation. For construction work that occurs during summer periods, standard BMPs and other dust abatement measures such as wet suppression and soil stabilization for construction sites and ditch fill materials will be implemented by SVID and/or contractors using residual water from lateral canals, drains, and other water sources. Temporary wind fencing around active construction areas may also be used if necessary to reduce any localized dust emissions (Yakima River Basin Water Storage Feasibility Study Final PR/EIS, Reclamation 2008). Areas along existing canal banks which have soil and vegetation disturbance due to pipeline construction will be re-vegetated after project implementation. No long-term impacts to air quality are anticipated from implementation of the proposed project.

### 4.10.3 Noise

Existing noise sources in the proposed project area include the project construction area as well as nearby agricultural, commercial, industrial, recreational, and residential areas. Existing noise levels are attributable to motor vehicles, industrial and commercial operations, railroad transportation, and agricultural operations (Yakima River Basin Water Storage Feasibility Study Final PR/EIS, Reclamation 2008). Implementation of the RRM piping project would involve short-term construction activities, use of heavy equipment and vehicles, and other related actions that may temporarily impact existing noise conditions in the project area.

Implementation of the proposed project would be in compliance with all local, state, and federal noise ordinances and regulations, therefore no specific mitigations would be necessary. Standard BMPs will be used by SVID contractors to minimize any short-term ambient noise impacts during road crossing construction and other transportation related activities.

## 4.11 Cumulative Impacts

Cumulative impacts are those effects on the environment resulting from the incremental consequences of a proposed action alternative when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these actions.

The YRBWEP PEIS (Reclamation, 1999) addresses cumulative impacts for the portion of impacts attributable to the program actions. For this action, the impacts are also cumulative to the other elements of the YRBWEP that may be implemented. Since these impacts are considered in the PEIS, they do not need to be addressed separately in this document. No additional cumulative impacts have been identified.

Washington State Department of Archaeology and Historic Preservation

National Oceanic and Atmospheric Administration - National Marine Fisheries Service

Sunnyside Valley Irrigation District

Yakima River Basin Water Enhancement Project

Washington Water Trust

RH2 Engineering Inc., Environmental Group

Yakama Nation

**Appendix A – List Of Preparers**

Richard Pastor, Natural Resource Specialist, Bureau of Reclamation, Columbia- Cascades Area Office, Yakima, WA.

Wendell S. Willey, Fish Biologist, Bureau of Reclamation, Columbia-Cascades Area Office.

Warren Hurley, Archeologist, Bureau of Reclamation, Columbia-Cascades Area Office.

John Evans, Environmental Protection Specialist, Bureau of Reclamation, Columbia-Cascades Area Office.

David Kaumheimer, Environmental Program Manager, Bureau of Reclamation, Columbia-Cascades Area Office.

Don Schramm, Assistant District Manager, Sunnyside Valley Irrigation District, Sunnyside, WA.

## Appendix B – Bibliography

Appel, Marcella. 2008. Temperature Profile of the Lower Yakima River Prosser, WA to Richland WA. Benton Conservation District. Draft Presentation.

Barbour, M., B. Paulik, F. Drysdale, and S. Lindstrom. 1991. California vegetation: diversity and change. Fremontia. 19(1):3-12.

Barnhart, R.A. 1986. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Steelhead. U.S. Fish and Wildlife Service Biological Report 82 11.60.

Busack, C., C. Knudsen, A. Marshall, S. Phelps and D. Seiler. 1991. Yakima Hatchery Experimental Design. Annual Progress Report DOE/BP-00102, Bonneville Power Administration, Div. Of Fish and Wildlife, Portland, Oregon. 226 pp.

Buchanan D.V., M.L. Hanson, and R.M. Hooton, 1997. Status of Oregon's bull trout. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon. 24 pp.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of the West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA Tech. Memo. NMFS-NWFSC-27, 261 pp.

Bryant, F.G., and Z.E Parkhurst. 1950. Survey of the Columbia River and its tributaries-4. Area III, Washington streams from the Klickitat and Snake Rivers to Grand Coulee Dam on the Columbia and its tributaries above Grand Coulee Dam. U.S. Fish Wild. Serv. Spec. Sci. Rep. Fish. 37, 108 p.

Campton, D. E., and J. M. Johnston. 1985. Electrophoretic evidence for a genetic admixture of native and nonnative rainbow trout in the Yakima River, Washington. Trans. Am. Fish. Soc. 114: 782-793.

Chapman, D.W. 1986. Salmon and steelhead abundance in the Columbia River in the Nineteenth Century. Transactions of the American Fisheries Society. 115:662-670.

Craig, S.E., 1997. Habitat conditions affecting bull trout (Salvelinus confluentus) spawning areas within the Yakima River Basin, Washington. M. S. Thesis, Central Washington University, Ellensburg, Washington. 74 pp.

Cramer, S.O., D.B. Lester, P.A. Monk, and K.L. Witty. 2003. A review of Abundance Trends, Hatchery and Wild Fish Interactions, and Habitat Features of the Middle Columbia Steelhead ESU. Prepared for Mid Columbia Stakeholders. S.P. Cramer & Associates, Sandy, Oregon.

Cuffney, T.F., M.R. Meador, S.D. Porter, and M.E. Gurtz. 1997. Distribution of fish, benthic invertebrate, and algal communities in relation to physical and chemical conditions, Yakima River Basin, Washington, 1990. U.S. Geological Survey, Raleigh, North Carolina. Water Resources-Investigations Report 96-4280. 94 pp.

Dahl, T.E. 1990. Wetland losses in the United States 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service, Washington D.C.

Davidson, F. A. 1953. Historical notes on development of Yakima River Basin. Manuscript report, 21 p. (Available from West Coast Sockeye Salmon Administrative Record, Environmental and Technical Services Division, Natl. Mar. Fish. Serv., 525 N. E. Oregon Street, Portland, OR 97232).

Fast, D., J. Hubble, M. Kohn and B. Watson, 1991. Yakima River spring Chinook enhancement study. Final Report. Bonneville Power Administration, Portland, OR. DE-A179-83BP39461.

Fast, David E., Joel D. Hubble, Bruce D. Watson. 1986. Yakima Indian Nation, Yakima River Spring Chinook Enhancement Study, Annual Report FY 1986, Report to Bonneville Power Administration, Contract No. 1983BI39461, Project No. 198201400, 211 electronic pages (BPA Report DOE/BP-39461-3)

Federal Register, Vol. 64, No. 57, March 25, 1999, Rules and Regulations. pp 145 17-14528.

Forest Ecosystem Management Assessment Team (FEMAT). 1993. Forest Ecosystem Management: an ecological, economic, and social assessment. Report published by the U.S. Department of Agriculture and five other federal agencies, July 1993.

Fraley, J.J. and B.B. Shepard, 1989. Life history, ecology and population status of migratory bull trout (Salvelinus confluentus) in the Flathead Lake and River system, Montana. Northwest Science 63(4): 133–143.

Fulton, L. A. 1970. Spawning areas and abundance of steelhead trout and coho, sockeye and chum salmon in the Columbia River Basin–past and present. U.S. Fish and Wildlife Service. Special Scientific Report – Fisheries Number 618. Washington, D.C. 37 pp.

Goetz, F.A., 1994. Distribution and juvenile ecology of bull trout (Salvelinus confluentus) in the Cascade Mountains. Master of Science, Oregon State University, Corvallis, Oregon. 173 pp.

Hockersmith, E., J. Vella, and L. Stuehrenberg. 1995. Yakima River radio-telemetry study: steelhead, 1989-1993. Annual report submitted to Bonneville Power Administration, Portland, Oregon. DOE/BP-00276-3.

Jensen, D.B., M. Torn, and J. Harte. 1990. In our own hands: a strategy for conserving biological diversity in California. California Policy Seminar Research Report. University of California, Berkley.

Joy, J. and B. Patterson. 1997. A suspended sediment and DDT total maximum daily load evaluation report for the Yakima River. Washington Department of Ecology, Publication No. 97-321. Olympia, Washington.

Knowles, C.J. and Robert G. Gumtow, 1996. Saving the Bull Trout. The Thoreau Institute, Oak Grove, Oregon, 21 pp.

Kreeger, K.E., and W.J. McNeil. 1993. Summary and estimation of the historic run sizes of anadromous salmonids in the Columbia and Yakima Rivers. Prepared for the Yakima River Basin Coalition, Yakima, Washington.

Lichatowich, J.A. and L.E. Mobrand. 1995. Analysis of Chinook salmon in the Columbia River from an ecosystem perspective. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon. 102 pp.

Lichatowich, J.A. and L.E. Mobrand, L. Lestelle and T. Vogel. 1995. An Approach to the diagnosis and treatment of depleted Pacific salmon populations in Pacific Northwest watersheds. Fisheries 20: 10-18.

Lilga, M.C. 1998. Effects of flow variation on stream temperatures in the lower Yakima River. Masters Thesis, Washington State University, Pulman, Washington. 91 pp.

MacDonald, K., S. Noble, and J. Haskins, 1996. An assessment of the status of aquatic resources within subbasins on the Wenatchee National Forest, U.S. Forest Service.

McPhail, J. D. and C. B. Murray, 1979. The early life-history and ecology of Dolly Varden (Salvelinus malma) in the upper Arrow Lakes. Department of Zoology and Institute of Animal Resources, University of British Columbia, Vancouver, British Columbia, Canada.

McIntosh, B.A., S.E. Clark, and J.R. Sedell. 1990. Summary report for Bureau of Fisheries stream habitat surveys: Yakima River basin. Prepared for US Department of Energy, Bonneville Power Administration, Portland, OR. No. 89-104, 297 pp.

Monk, P. 2001. Results of fish surveys in the Roza-Sunnyside Board of Joint Control irrigation drain network. Contract report to Sunnyside Valley Irrigation District, Sunnyside, Washington. 49 pp.

Morace, J.L., G.J. Fuhrer, J.F. Rinella, S.W. McKinzie, and others. 1999. Surface water quality assessment of the Yakima River Basin, Washington: Overview of significant findings, 1987-1991. U.S. Geological Survey, Water Resources Investigations Report 98-4113, 119 pp.

National Marine Fisheries Service (NMFS). 1996. Factors for decline: a supplement to the notice of determination for West Coast steelhead under the Endangered Species Act. National Marine Fisheries Service, Protected Resources Branch, Portland, Oregon.

National Marine Fisheries Service (NMFS). 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. NOAA Tech. Memo NMFS-NWFSC-35. 443 pp.

National Marine Fisheries Service (NMFS). 2004. Critical Habitat Analytical Review Team (CHART) Report. Department of Commerce, National Oceanographic and Atmospheric Administration.

National Research Council Committee on Protection and Management of Pacific Northwest Anadromous Salmonids (NRCC). 1996. Upstream: Salmon and Society in the Pacific Northwest. National Academy Press, Washington, DC, 452 pp.

Northwest Power Planning Council (NPPC). 2001. Yakima Subbasin Summary. Laura Berg, editor. Portland, OR. 376 pp.

Northwest Power Planning Council (NPPC). 1986. Council staff compilation of information on salmon and steelhead losses in the Columbia River Basin, Technical Appendix D of the 1987 Columbia River basin fish and wildlife program. Northwest Power Planning Council, Portland, OR.

Pearsons, T. N., G. A. McMichael, S. W. Martin, E. L. Bartrand, J. A. Long and S. A. Leider. 1996. Yakima species interactions studies. Annual Report FY 1994. Bonneville Power Administration DOE/BP-99852-3.

Pfaff, Christine E. 2002. Harvests of Plenty, A History of the Yakima Irrigation Project, Washington. Bureau of Reclamation Technical Service Center, Denver, Colorado.

Phelps, S.R., B.M. Baker and C.A. Busack. 2000. Genetic relationships and stock structure of Yakima River basin and Klickitat River basin steelhead populations. Washington Department of Fish and Wildlife Genetics Unit unpublished report. Olympia, Washington. 56 pp.

Ratliff, D.E. and P.J. Howell, 1992. The Status of Bull Trout Populations in Oregon. P.J. Howell and D.V. Buchanon (Editors). Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis. pp.10–17.

Reynolds, F.L., T.J. Mills, Rbenthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California. 129 pp.

RH2. 2009a. Wetland Delineation Report, Phase II Enclosed Lateral Improvement Projects. Bothell, Washington.

RH2. 2009b. Matheson, Rocky Ford, and Ryder Pipeline Location Maps, Phase II Enclosed Lateral Improvement Projects. Bothell, Washington.

Rieman, B.E., D.C. Lee, and R.F. Thurow, 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River Basins. North American Journal of Fisheries Management 17:1,111–1,125.

Rieman, B.E., and McIntyre, 1993. Demographic and habitat requirements for conservation of bull trout. U.S. Forest Service Intermountain Research Station, General Technical Report INT-302.

Romey, B., and S.P. Cramer. 2001. Aquatic habitat survey of irrigation drainage networks, lower Yakima River Basin. Prepared for the Roza-Sunnyside Board of Joint Control and U.S. Bureau of Reclamation. Prepared by S.P. Cramer and Associates, Sandy, Oregon. 76 pp.

Schreck, C.B., K.W. Li, R.D. Hort., and C.S. Sharpe. 1986. Stock Identification of Columbia River Chinook Salmon and Steelhead Trout. Division of Fish and Wildlife, Bonneville Power Administration, Project 83-45 1, Final Report, Portland , Oregon.

Shapovalov, L. and A.C. Taft. 1954. The life histories of the steelhead rainbow trout (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch) with special reference to Waddell Creek, California, and recommendations regarding their management. California Department of Fish and Game Bulletin 98.

Thurow, R., 1987. Completion Report: Evaluation of the South Fork Salmon River Steelhead Trout Fishery Restoration Program Performed for the U.S. Department of Interior, Fish and Wildlife Service Lower Snake River Fish and Wildlife Compensation Plan, Contract No. 14-16-0001-86505 for the Period March 1, 1984 to Feb. 28, 1986.

Tiner, R.W. 1991. The concept of a hydrophyte for wetland identification. Bioscience 41:236-247.

UMA Consultants Incorporated (UMA). 2000. Roza-Sunnyside Board of Joint Control Water Conservation Program Tier One Feasibility Study. Report Prepared by UMA Consultants Inc., in association with MSO Technologies, and Keller Bliesner Engineering. March, 2000.

U.S. Bureau of Reclamation (BOR). 2009. Briefing Paper for Commissioner Robert W. Johnson. Pacific Northwest Region, Columbia-Cascades Area Office, Yakima, Washington.

U.S. Bureau of Reclamation (BOR). 2009a. Biological Assessment of Potential Effects to Middle Columbia River Summer Steelhead from Implementation of the Sunnyside Division Phase 2 Water Conservation Plan. Pacific Northwest Region, Columbia-Cascades Area Office, Yakima, Washington. July, 2009.

U.S. Bureau of Reclamation (BOR). 2009b. Sunnyside Division Phase 2A Conservation Project Environmental Assessment. Pacific Northwest Region, Columbia-Cascades Area Office, Yakima, Washington. September, 2009.

U.S. Bureau of Reclamation (BOR). 2008. Yakima River Basin Water Storage Feasibility Study Final PR/EIS, Reclamation. Pacific Northwest Region, Upper Columbia Area Office, Yakima, Washington. December, 2008.

U.S. Bureau of Reclamation (BOR). 2002. Draft Interim Comprehensive Operating Plan (IOP) for the Yakima Project, Washington. Pacific Northwest Region, Upper Columbia Area Office, Yakima, Washington. 420 pp.

U.S. Bureau of Reclamation (BOR). 2000. Biological Assessment: Yakima project operations and maintenance- Supplemental to the December, 1999 Biological assessment on the Federal Columbia river power system. Pacific Northwest Region, Upper Columbia Area Office, Yakima, Washington. 236 pp.

U.S. Bureau of Reclamation (BOR), 1999. Final Programmatic Environmental Impact Statement. Yakima River Basin Water Enhancement Project, Washington. Pacific Northwest Region, Upper Columbia Area Office, Yakima, Washington. 199 pp.

U.S. Bureau of Reclamation (BOR). 1998. Draft Basin Conservation Plan for the Yakima River Basin Water Conservation Program.

U.S. Department of the Interior (DOI). 1995. Departmental Manual Part 512, Chapter 2.

U.S. Department of the Interior (DOI). 2000. Departmental Manual Part 303, Chapter 2.7 A.

Vaccaro, J.J. 1986. Simulation of streamflow temperatures in the Yakima River basin, Washington, April-October 1981. U.S. Geological Survey Water Resources Investigations Report 85-4232, Tacoma, Washington.

Washington Department of Fish and Wildlife (WDFW), 1998. Salmonid Stock Inventory. Appendix: Bull Trout and Dolly Varden. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fisheries and Washington Department of Wildlife (WDF). 1993. Washington State Salmon and Steelhead Stock Inventory. Appendix Three; Columbia River Stocks. Washington Department of Fisheries, Olympia, Washington.

Wise, Daniel R., Zuroske, Maire., Carpenter, Kurt D., Kiesling, Richard L. 2009. Assessment of Eutrophication in the Lower Yakima River Basin, Washington, 2004–07. U. S. Geological Survey. Reston, Virginia.

Wissmar, R.C. and S.D. Craig, 1998. Factors affecting bull trout spawning activity and habitat selection in an altered headwater stream. Unpublished manuscript.

Yakama Nation (YN), Washington Department of Fisheries, and Washington Department of Wildlife. 1990. Salmon and Steelhead Production Plan – Columbia Basin System Plan, Yakima River Subbasin.

Yakima Klickitat Fisheries Program, 2003b. Yakima River adult salmon returns 1983 – present. Online at: Online at http://www.ykfp.org

Zuroske, Marie. 2009. Water Quality Conditions in Irrigation Waterways within the Roza and Sunnyside Valley Irrigation Districts, Lower Yakima Valley, Washington, 1997-2008. Prepared for the Roza-Sunnyside Board of Joint Control.

**Personal Communications**

Johnston, M., Personal Communication. 2002. Conversation with Mark Johnston, Yakama Nation Fisheries, August 2002. Subject: Bull trout observed passing through the spring Chinook broodstock collection facility at Roza Diversion Dam.

Monk, P., Personal Communication. 2003. Conversation with Pat Monk, Roza-Sunnyside Board of Joint Control Fish Biologist, October-November 2003. Subject: Fish habitat conditions in Sulphur and Spring/Snipes Creek Wasteways.

Pearsons, T., Personal Communication. 2002. Ongoing conversations between T. Pearsons, Washington State Department of Fish and Wildlife Fish Biologist and Walter Larrick, Fish Biologist, Bureau of Reclamation.

Schramm, D. Personal Communication. 2009a. Conversation with Don Schramm, Manager, Sunnyside Valley Irrigation District and Scott Willey, Fish Biologist, Bureau of Reclamation.

Schramm, D. Personal Communication. 2009b. Conversation with Don Schramm, Manager, Sunnyside Valley Irrigation District and Jerry Jacoby, Conservation Specialist, Bureau of Reclamation. December 8 and December 15, 2009.

Schramm, D. Personal Communication. 2010. Conversation with Don Schramm, Manager, Sunnyside Valley Irrigation District and Richard Pastor, Natural Resource Specialist/Fish Biologist, Bureau of Reclamation. February 4, 2010.

Jerry Jacoby, Personal Communication. 2009. Conversation with Jerry Jacoby, Conservation Specialist, Bureau of Reclamation and Scott Willey, Fish Biologist, Bureau of Reclamation. December 10, 2009.