



**HABITAT FARMING ENTERPRISE PROGRAM
CONCEPTUAL RIPARIAN AND AQUATIC
HABITAT RESTORATION PLAN
ENTIAT RIVER WATERSHED, WASHINGTON**

JUNE 26, 2007

**FOR
IRIS
C/O CHELAN COUNTY CONSERVATION
DISTRICT**

**Habitat Farming Enterprise Program
Conceptual Riparian and Aquatic Habitat
Restoration Plan
SANRAY ORCHARDS
File No. 15850-002-02**

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Prepared for:

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**HABITAT FARMING ENTERPRISE PROGRAM
CONCEPTUAL RIPARIAN AND AQUATIC HABITAT RESTORATION PLAN
SANRAY ORCHARDS
ENTIAT RIVER VALLEY
CHELAN COUNTY, WASHINGTON
FOR
INITIATIVE FOR RURAL INNOVATION AND STEWARDSHIP (IRIS)
C/O CHELAN COUNTY CONSERVATION DISTRICT**

INTRODUCTION

Riparian areas provide a vital resource to fish, wildlife and humans in Washington State. This highly productive, diverse habitat occurs adjacent to rivers, streams, seeps and springs and provides continuity between terrestrial and aquatic ecosystems (Cedarholm et al. 2000). Riparian areas contribute to the quantity and quality of aquatic habitat utilized by seventy-seven species of fish that inhabit freshwater. Some of these contributions include: shade, cover, nutrients for the food-base, streambank stabilization, large woody debris influences on fluvial geomorphic processes, filtration of upland sediment and pollution, and moderation of flooding and erosion during high flow (Spence et al. 1996). Riparian areas are also used by approximately 85 % of Washington State's terrestrial vertebrate species (Knutson and Naef 1997). This habitat provides areas for cavity-nesting birds and mammals as well as insectivores, cover and resting habitat for amphibians, reptiles, and small mammals. A robust riparian habitat has well developed vegetation, usually with multiple canopy layers, each providing a unique habitat, niche, or microclimate (Beschta et al. 1987). The protection and enhancement of riparian areas along streams in Chelan County, Washington, and other counties in the Upper Columbia Region has been identified as a key element of the restoration of healthy terrestrial ecosystems, and an action necessary for the recovery of Upper Columbia salmonid species (spring Chinook, steelhead and bull trout) listed under the Endangered Species Act.

While the benefits of restoring and managing riparian fish and wildlife habitat are recognized by the public, the costs associated with riparian restoration and management are typically borne by the landowners themselves unless incentive programs are available. Many incentive programs have been developed to promote voluntary habitat protection, restoration, and management of riparian areas; however, growers report that they are either not well-suited to tree fruit growers in Washington, or the programs do not deal with the costs that would be borne by them, which can be categorized as: 1) the opportunity cost of foregone fruit production, 2) the direct costs of restoring farmlands to habitat, and, 3) the costs of maintaining riparian habitat into the future for conservation benefits (personal communication Messrs. Sandidge, Small and Small., Entiat valley orchardists, 2007).

The desire to integrate fish and wildlife habitat restoration and protection goals with economic strategies that would support sustainable, agricultural land use lifestyles motivated tree fruit farmer members of the Entiat Watershed Planning Unit, a local watershed organization that has been involved in collaborative natural resource management and planning for over 13 years, to approach the Institute for Rural Innovation and Stewardship (IRIS, now Initiative for Rural Innovation and Stewardship) and request assistance with the development of a conceptual program that would provide farmers appropriate economic return for growing and maintaining riparian habitat as an alternative to traditional crops. The IRIS supported the concept and has championed the development of a pilot program under the title of the "Habitat Farming Enterprise Program (HFEP)". IRIS has established partnerships with the Chelan County Conservation District (CCCD), The Nature Conservancy, Washington Rivers Conservancy, Washington Biodiversity Council, Chelan County and the Chelan-Douglas Land Trust to develop the HFEP. IRIS

completed a needs assessment for a HFEP pilot effort in 2005 and recommended that funding be allocated to two priority actions: (1) development of a habitat-based Conceptual Riparian and Habitat Restoration Plan for a selected pilot project site in the Entiat River watershed, and (2) development of an economics-based business model for calculation of potential remuneration rates for participants in the HFEP.

The Chelan County Conservation District partnered with IRIS Committee entities including The Nature Conservancy and the Washington Rivers Conservancy to fund the development of a Conceptual Riparian and Habitat Restoration Plan using a pilot project site in the Entiat River watershed. The CCCD, on behalf of the EWPU and the IRIS Committee, requested that GeoEngineers assist with the development of the Conceptual Riparian and Habitat Restoration Plan for the demonstration project site. GeoEngineers was asked to work with the owners and operators of SANRAY ORCHARDS, other valley orchardists, the CCCD and the US Forest Service to develop a brief report and conceptual plan illustration that will be used to further develop the Habitat Farming Enterprise Program (HFEP).

The objective of this Draft Report and schematics is to answer the questions: “What might on-farm implementation of the HFEP look like?” and “What are the issues faced by tree fruit growers that should be considered as part of pilot HFEP development?” This document describes the approach and findings of GeoEngineers in developing a Conceptual Riparian and Habitat Restoration Plan for the demonstration project site located at SANRAY ORCHARDS in the Entiat River watershed, Chelan County, Washington (Figure 1).

APPROACH

The following approach was developed collaboratively by the CCCD, the EWPU, IRIS/HFEP project partners and GeoEngineers based on existing information and experience with similar projects. GeoEngineers was asked to produce a brief report and conceptual restoration plan schematics for the pilot project site. This draft report describes the site, proposed restoration actions, expected results and benefits to terrestrial and aquatic species, and challenges to implementing an HFEP project at the site. Alternative conceptual restoration plan schematics are provided to assist project partners in developing a shared vision of the on-farm riparian and habitat restoration component of the Habitat Farming Enterprise Program (HFEP).

The following approach to the development of a Conceptual Restoration Plan for the site was used:

1. Compile and summarize existing information regarding riparian and aquatic habitat in and adjacent the pilot project site;
2. Discuss land management issues at the site and potential solutions with Sarah Walker (EWPU Coordinator and CCCD staff), Ray Sandidge (EWPU founding member and owner SANRAY ORCHARDS), Jon Small (EWPU founding member and SANRAY ORCHARDS lessee) and Jim Small (EWPU founding member and orchardist);
3. Develop alternative terrestrial and aquatic habitat restoration treatments for the site, including the development of estimates of potential water quantity benefits to instream flows;
4. Prepare a brief, draft report and schematics depicting the current condition and conceptual restoration plans for the site; and,
5. Develop a poster including pre and post-restoration schematics of the pilot project site (SANRAY ORCHARDS) in the Entiat River watershed, Chelan County, Washington.

PROJECT SITE

SANRAY ORCHARDS is located in the Entiat River watershed, Water Resource Inventory Area (WRIA) 46, which flows into the Columbia River at approximately River Mile (RM) 483.7 near the City of Entiat, Washington (Figure 1). The WRIA is approximately 305,640 acres in area (CCCD 2004), and is bounded on the northeast by the Chelan Mountains and the Lake Chelan watershed (WRIA 47); to the southwest are the Entiat Mountains and the Wenatchee River watershed (WRIA 45). SANRAY ORCHARDS is located on the right bank (looking downstream) of the river between RM 5.1 near the Hanan-Detwiler (H-D) irrigation diversion intake downstream to approximately RM 4.4 where the Dinkelman Canyon Road bridge crosses the Entiat River (Figure 2). Most of the 20-plus acres of orchard and riparian lands are located on elevated, remnant floodplain and outwash from Dissmore and Dinkelman Canyons. Some of the orchard lands are on active floodplain, such as those just downstream from the H-D irrigation diversion.

SANRAY ORCHARDS is centrally located in a reach of the Entiat River where riparian and aquatic habitat restoration projects are being implemented. Beginning in 2001 a variety of instream, riparian, off-channel habitat, and irrigation efficiency projects have been developed and implemented between RM 3.2 and 7.0 (CCCD 2004, CCCD 2006). Owner/managers Ray Sandidge and Jon Small granted permission to install instream habitat demonstration projects in 2001 (Figure 3) and continue to work cooperatively with the CCCD, EWPU, IRIS and other project partners to implement habitat enhancement programs involving SANRAY ORCHARDS property. Current proposed projects include installation of additional instream habitat structures adjacent SANRAY ORCHARDS and the proposed consolidation of the Knapp-Wham (K-W) and H-D irrigation diversions, which would lead to decommissioning of the H-D diversion located at SANRAY ORCHARDS (see Appendix C). The project site is located immediately upstream from the “Bridge-to-Bridge (B2B) reach” (RM 3.2-4.4), presently considered the highest priority instream and off-channel habitat restoration area in the watershed.

EXISTING CONDITION

A description of existing condition is necessary to provide a baseline against which a “rehabilitated” future condition may be compared. The following text provides a brief chronology of significant factors contributing to the existing condition, followed by brief characterizations of current land use and management, riparian and aquatic habitat, water resources, and the regulatory environment.

The Entiat River watershed, like many in the Pacific Northwest, has been transformed by human use. In the late 1800s and early 1900s settlers in the Entiat River valley began to change land type and river processes through land and forest management, logging, fire suppression, irrigation and the construction of lumber mills, splash dams and log pools. Mill pools and dams were among the first major manmade instream structures (see CCCD 2004, page 3-5). These structures significantly altered fluvial geomorphic processes. Photographs from the era of mill operations and log drives illustrate the dramatic changes made to the movement of water, sediment, and large woody debris through the Entiat River system. Changes in the delivery and routing of water, sediment and large woody debris in the Entiat River brought changes in riparian and habitat forming processes, resulting in riparian and aquatic habitat simplification.

Agricultural development (orchards) began in the valley in the late 1800’s and logging and lumber production was prevalent throughout the early 1900’s until about 1940. Soil and farmland protection dikes and levees were installed throughout the lower Entiat River during this intensive logging and land development period. Soon thereafter, the valley experienced the flood of record in 1948. An estimated 11,000 cubic-feet per second (cfs) flowed down the Entiat River through a channel whose peak annual discharge ranged between 2,000 and 5,000 cfs. The 1948 flood caused extensive damage, changing

channel conditions and prompting the construction of additional dikes and levees throughout the lower 10 miles of the river. These actions, intended to mitigate flood effects, reduced dynamic interactions between water, sediment, and large woody debris in the river, resulting in further aquatic and riparian habitat simplification.

In spite of these and other aquatic and terrestrial influences, such as reoccurring wildfire, the Entiat River watershed presents a unique opportunity to restore and enhance riparian and aquatic habitat. With the majority of watershed uplands and stream headwaters in public ownership, public land management policies protecting and restoring watershed processes have already improved conditions such that hydrologic and sediment transport regimes are more balanced and there is greater recruitment of large woody debris. These elements have been critical to re-establishing more stable fluvial geomorphic processes resulting in the natural creation and maintenance of more complex and productive aquatic and riparian habitat.

Also unique to the Entiat River watershed is an award-winning, benchmark-setting collaborative natural resource management and stewardship ethic championed by major landowners in the watershed. For over a decade, private landowners have been working cooperatively with public land managers and other natural resource agencies through the Entiat River Watershed Planning Unit (EWPU). Private landowners have advocated for the responsible management and stewardship of natural resources, minimizing the human influence on natural resources, habitat, and protected species (CCCD 2004).

LAND USE AND MANAGEMENT

The majority of the land area in the Entiat River WRIA is owned by the public and managed by state and federal agencies including over 90% of the land area managed by the U.S. Forest Service (USFS) Wenatchee National Forest (WNF), the U.S. Bureau of Land Management (BLM), the US Fish and Wildlife Service, the Washington Department of Natural Resources (WDNR) and the Washington Department of Fish and Wildlife (WDFW). The largest land manager is the U.S. Forest Service with approximately 253,255 acres, or 83% of the watershed comprised of federal forest lands. Wilderness, old growth reserves, wildlife and riparian reserves comprise 63 % of federal land areas managed as reserve. Additional federal forest lands are designated as “unusable” due to features like steep topography. Approximately 9% of the watershed area is in private ownership, with irrigated agriculture making up less than 1% of the total land use in the watershed, mostly concentrated in the valley bottom between River Mile (RM) 0 and 11.7.

Like many orchards in the Entiat valley and Chelan County, SANRAY ORCHARDS is a family-owned, commercial agricultural operation. The total area of lands managed is approximately 22 acres. Approximately 5 acres are not available for orchard or other agriculture production because the space is existing riparian area or used for roads, outbuildings, equipment storage, and residential purposes. For over 30 years the remaining 17 acres have been used for commercial pear and apple orchard, and (other) agricultural production purposes. SANRAY ORCHARDS is irrigated with water from the Knapp-Wham (K-W) and Hanan-Detwiler (H-D) ditches, which divert water from the Entiat River at approximately RM 5.85 and 5.1, respectively. The ditches have been in existence since the early 1900’s and operate under Water Right Claims.

Land management at SANRAY ORCHARDS involves operation and maintenance tasks common to any orchard. The orchard area is irrigated both to maintain the trees and the grass cover crop. The grass must be mowed, trees pruned, and invasive plants (e.g. weeds) removed. In riparian areas, orchardists must also take action to control encroachment on orchards from riparian species such as cottonwood and alder. Both herbicides and pesticides are used to maintain the orchards. Entiat River orchardists, including

SANRAY ORCHARDS, apply best management practices (BMPs) recommended by the Environmental Protection Agency (EPA), Natural Resource Conservation Service (NRCS) and CCCD to minimize the potential effects of land management on native plants and animals and protect water quality at the site. SANRAY ORCHARDS uses “soft” herbicide and pesticide management techniques, advanced soil moisture analyses and drip irrigation to apply irrigation water directly to the crop.

SANRAY ORCHARDS must address three significant operation and maintenance challenges as a result of having riparian land. The HFEP cannot exacerbate, and should minimize or eliminate the effects of these challenges to encourage orchard owners and managers to participate in the program.

Frost Control

Most orchards in the Entiat River are located in the valley bottoms. Frost is a common problem for orchardists as it can cause significant loss of buds and fruit, sometime leading to poor economic returns. Accumulation of frost can be especially problematic in areas of low topographic relief adjacent to mature riparian vegetation where frost pockets naturally form (Sandidge 2007, personal communication). Orchardists use a variety of methods to reduce frost damage. For example, Entiat valley orchardists actively manage air flow by shortening the height of riparian vegetation in short segments coincident with natural low points in the land along the stream and orienting orchard plots and rows to allow the free flow of air off the orchard, thereby minimizing frost damage and crop loss.

Spray Drift

Orchardists are required, by law, to obtain licenses and apply herbicides and pesticides consistent with label instructions to minimize risks to humans and domestic animals, as well as native plant species and animals, inhabiting areas adjacent treated lands. SANRAY ORCHARDS, located adjacent the Entiat River, and other agricultural operators in the Columbia Basin were recently challenged to manage spray drift to protect threatened and endangered species. In January 2004, Federal District Court Judge John Coughenour issued an injunction that put in place no-spray zones of 100 yards for aerial applications and 20 yards for ground applications of more than 30 of 54 pesticides considered by the court (Federal Register 2004). These restrictions were imposed because the EPA, US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) had failed to consult with one another regarding the potential impacts of chemicals licensed by the EPA on ESA listed threatened and endangered salmonid species in the Columbia River basin. The USFWS, NOAA fisheries and the EPA subsequently established a framework consultation process to review existing and new pesticide certifications. No-spray buffers remain in effect for each pesticide until EPA consultations with NMFS and the USFWS are complete and the EPA issues a determination that a pesticide will have “no effect” on threatened and endangered species (see WSDA 2007).

Beaver Depredation

Management of lands adjacent to riparian areas involves challenges posed by native wild animal species. Orchardists along the Entiat River are particularly troubled by beaver (Castor canadensis). Beaver, through the construction of dams, disrupt irrigation water flows by changing the direction and rate of flow in side channels of the Entiat River and open irrigation ditches and bypass canals. Of most concern to orchardists, however, is the direct depredation of fruit trees and pollinator species (non-fruit bearing trees used to pollinate fruit-bearing trees) by beaver. Managers of SANRAY ORCHARDS have observed beaver traveling over 100 feet upslope, outside the existing riparian corridor, moving under and through exclusion fencing, and traveling past riparian species and fruit-bearing trees to fell apple pollinator species. This can become a significant orchard management issue because few pollinator species are planted in order to maximize the number of fruit-bearing trees. If beaver remove the few pollinator trees

planted, fruit-bearing trees may not be pollinated or bear fruit. SANRAY ORCHARDS spends significant time and financial resources, every year, trying to minimize beaver damage and preventing conflicts consistent with WDFW recommendation (WDFW 2007). SANRAY ORCHARDS spends additional resources every year repairing damage done, when recommended treatments are ineffective. Orchardists in the Entiat River valley have sought but have not received support from wildlife management agencies addressing beaver problems in the valley. WDFW certifies local trappers for the removal of beaver; however, the ongoing cost of this service, if utilized, is borne solely by the private land owner/manager.

RIPARIAN AND AQUATIC HABITAT

Riparian and aquatic habitat resources in the Entiat River watershed have been assessed using a variety of quantitative, semi-quantitative, and qualitative methods. The CCCD (2004) compiled the findings of various monitoring programs (e.g. Archibald 2004, 2003; Hamstreet 2007, 2006, 2005; Hamstreet and Carie 2004, 2003); riparian assessments (Erickson 2003, Lillquist and Erickson 2002, CCCD 1998); and salmonid habitat assessments (e.g. Mobrand Biometrics, Inc. 2003; Entrix, Inc. 2003; Andoneagui 1999; Caldwell et al. 1995). The Entiat WRIA 46 Management Plan (Management Plan, CCCD 2004) and Detailed Implementation Plan (DIP, CCCD 2006) summarized these reports and outlined an ambitious watershed restoration program including actions to protect and enhance riparian and aquatic habitat in the watershed. Larger geographic-scale salmonid and habitat recovery programs like the Proposed Upper Columbia Salmon Recovery Plan (UCSRP, UCSRB 2006) have adopted restoration recommendations in the Management Plan and DIP. The following summarizes findings of these assessments, reports, and plans.

Riparian Habitat

Three assessments have been used to characterize current riparian condition, change from historic to current status, and to develop riparian habitat protection and restoration recommendations for the Entiat River watershed. These assessments were completed by the Natural Resource Conservation Service (NRCS) Stream Team (CCCD 1998), the USFS-Wenatchee National Forest (1996) and Central Washington University (Erickson 2003, Lillquist and Erickson 2002). The report by the USFS characterized riparian vegetation from the headwaters of the Entiat River watershed to Entiat Falls near RM 34. The USFS assessment area is outside the vicinity of this project, and descriptions have been left out of this report. The following summarizes the findings of the NRCS and CWU efforts.

In 1995 the NRCS Stream Team completed a comprehensive stream survey of the lower 20 miles of the Entiat River, characterizing riparian ecology, stream geomorphology, fish ecology, aquatic habitat, and geologic features (CCCD 1998). As part of the survey the NRCS conducted a riparian inventory to determine the dominant overstory species, percent canopy, and dominant age class of the vegetation following the procedures of Bauer and Burton (1993). Age-class categories were defined following Hankin and Reeves (1988) and dominant plant community complex was described following the approaches of Winward and Paggett (1987) and Burton (1991). Information in Table 1 summarizes NRCS surveys results within the lower 11 miles of the Entiat River, including the project site in reach 2 (source CCCD 1998). The NRCS found a very low percent riparian canopy cover. In 2006 the United States Bureau of Reclamation conducted similar stream surveys of the lower 6 miles of the Entiat River. Results have not been published, but presentations made by the USBR illustrate the same problems observed by the NRCS persist in the lower Entiat River.

Table 1. Riparian vegetation, canopy cover, age class, plant community, and geomorphic stream-type by reach in the Entiat River watershed (source CCCD 1998).

Reach No.	Reach Length (miles)	Reach Description	Canopy Cover (%)	Dominant Age Class ^a	Dominant Plant Community	Dominant Stream Class ^b
1	2.3	End of slack water to Firestation bridge	0-10	Small tree (8"-20.9" dbh)	cottonwood/ red osier dogwood	C3, F3, B3c
2	3.0	Firestation bridge to Old Hatchery bridge	0-10	Small tree	cottonwood/ dogwood/ erect willow	C3, B3c, F3
3	2.7	Old Hatchery bridge to Johnson/Steven's bridge	0-10	Large tree (21"-31" dbh)	cottonwood/willow	F3, C3, B3c
4	3.0	Johnson/Steven's bridge to bridge near Mud Creek	0-10	Small tree	cottonwood/alder	F3, B3c, C3

^a (Hankin and Reeves 1988), ^b(Rosgen 1994)

As part of the Entiat WRIA planning effort, the CCCD contracted with CWU to conduct land use and riparian surveys for the Entiat River watershed between RM 0 and RM 25.7 using Geographic Information System (GIS), and ground-truthed by the CWU with visual observation. The riparian assessment completed by CWU included identification of the presence/absence of riparian vegetation, community type (e.g. riparian forest, riparian forest burned, riparian meadow, riparian meadow burned), and relative height of vegetation (e.g. 1-25 ft., 25-70 ft., 71-100 ft.) (Lillquist and Erickson 2002). In addition an analysis of change from historic to current extent of riparian vegetation in the lower 10 miles of the Entiat River, Justin Erickson (2003) evaluated the implications of landuse and riparian habitat change on salmon recovery.

Results of the above identified riparian assessments were compiled and verified by the Entiat WRIA Planning Unit (CCCD 2004). The information was use to characterize riparian condition and make recommendations for the protection and/or enhancement of riparian vegetation. Results suggest that the reach of the Entiat River that includes SANRAY ORCHARDS is the highest priority reach for riparian protection and restoration due, in part, to the significant changes in the amount of riparian vegetation between 1945 and 1998 (Erickson 2003).

In addition to the Watershed Plan (CCCD 2004) numerous other documents have identified riparian restoration as a priority for maintaining overall watershed health as well as contributing to the recovery of ESA listed salmon species in the Upper Columbia Region (e.g. UCSRB 2006; NPCC 2004; Mobrاند Biometrics, Inc. 2003; Andonaegui 1999). In addition, a stream network temperature analysis of the Entiat River watershed demonstrated that projects that would reduce width-depth ratio in the lower 10 miles of the Entiat River, together with riparian planting projects throughout the Entiat River watershed would do the most to mitigate excessive water temperatures in the watershed (Hendrick and Monahan 2003).

GeoEngineers, the CCCD and EWPU recently completed a riparian protection and restoration prioritization project for the Entiat River between river miles (RM) 0 and 34 (GeoEngineers 2007). Results identified riparian areas along SANRAY ORCHARDS as the highest priority for protection of riparian shade and habitat function along the 34 mile length of Entiat River evaluated in the study. Results also indicated riparian areas along SANRAY ORCHARDS as a high priority for restoration of riparian vegetation, in those few areas where such vegetation was not found.

Clearly the protection and restoration of riparian vegetation has been identified as a priority in the Entiat River watershed. Further, the protection of riparian vegetation at SANRAY ORCHARDS, in particular, is a priority within the watershed. Landowners in the Entiat River watershed, including those managing SANRAY ORCHARDS, are interested in developing and implementing programs that protect and restore riparian vegetation, provided that they are able to continue to operate their family-farms and enjoy the use of their land without pressure from development and regulations. Programs like the HFEP must be developed immediately and made available to land managers like those at SANRAY ORCHARDS while the interest and opportunity is high.

Aquatic Habitat

Many species of anadromous and non-anadromous fish inhabit the Entiat River watershed. Table 2 identifies the fish species known or expected to inhabit the Entiat River or tributaries. Spring and late-run Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) are the most prevalent anadromous salmonids in the watershed. Upper Columbia Spring Chinook are listed under the Endangered Species Act as endangered, while steelhead and bull trout are listed as threatened, making these species of special management interest and concern within the Entiat River Watershed and larger Upper Columbia region. Several populations of economically and culturally important anadromous species also use the Entiat River. Coho salmon (*Oncorhynchus kisutch*) were once common, but are now considered extirpated (Nehlsen et al 1991). Sockeye salmon (*Oncorhynchus nerka*) were introduced to the Entiat River watershed many years ago, but were thought not to have established self-sustaining populations (Mullan et al. 1992). Sockeye, and Coho strays resulting from YN reintroduction efforts in the Wenatchee and Methow watersheds, have been observed spawning in the lower Entiat River in recent years (Hamstreet 2007, 2006, 2005; Hamstreet and Carie 2004, 2003).

Humans have made a number of modifications to aquatic habitat in the Entiat River watershed, with the most significant changes made in the lower 10 miles of the watershed. Timber harvest, log drives, mill operations, grazing, agriculture, road construction, channel modifications (e.g. simplifying and widening), construction of dikes and levees, residential development and recreation have all had varying levels of effect on aquatic habitat (CCCD 2004, CCCD 1998). Changes to hydrologic, hydraulic, and fluvial geomorphic functions and processes have resulted in simplification of aquatic habitat.

Comparisons of 1930's U.S. Bureau of Fisheries (USBOF) aquatic habitat surveys with more recent surveys indicate a significant loss of primary pools in the lower Entiat River watershed, approximately 85% since the 1930's (USBOF 1936, CCCD 1998 and 2004, USFS-WNF 1996). The Washington Conservation Commission (WCC) noted that a lack of overwinter juvenile rearing habitat may be the most significant factor limiting salmonid production in the watershed (Andonaegui 1999). The Ecosystem Diagnosis and Treatment (EDT) analysis of the Entiat River Watershed noted significant loss of habitat complexity among other attributes (Mobrاند Biometrics, Inc. 2003), and the recent Proposed Upper Columbia Salmon Recovery Plan identified the lack of habitat complexity and off-channel habitat/floodplain connectivity in the lower Entiat River watershed as primary factors limiting the recovery of ESA listed species (UCSRB 2006).

Table 2. Summary of known and expected* species in the Entiat River watershed, and federal and state protected species status (CCCD 2004).

Common Name	Scientific Name	Federal Status	State Status
Upper Columbia River late-run (summer) Chinook salmon	<i>Oncorhynchus tshawytscha</i>	--	--
Upper Columbia River spring Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Endangered March 16, 1999	Candidate
Upper Columbia River summer steelhead	<i>Oncorhynchus mykiss</i>	Down-listed to threatened January 5, 2006	Candidate
Sockeye salmon	<i>Oncorhynchus nerka</i>	--	--
Coho salmon	<i>Oncorhynchus kisutch</i>	--	--
Columbia River bull trout	<i>Salvelinus confluentus</i>	Threatened June 12, 1998	Candidate
Westslope cutthroat trout	<i>Oncorhynchus clarki lewisi</i>	--	--
Redband trout	<i>Oncorhynchus mykiss gardineri</i>	--	--
Eastern brook trout	<i>Salvelinus fontinalis</i>	--	--
Mountain whitefish	<i>Prosopium williamsoni</i>	--	--
Pacific Lamprey	<i>Lamptera tridentate</i>		
River Lamprey	<i>Lamptera ayresi</i>	--	--
Western Brook Lamprey	<i>Lamptera richardsoni</i>	--	--
Chiselmouth	<i>Acrocheilus alutaceus</i>	--	--
Peamouth	<i>Mylocheilus caurinus</i>	--	--
Northern pikeminnow	<i>Ptychocheilus oregonensis</i>	--	--
Longnose dace*	<i>Rhinichthys cataractae</i>	--	--
Dace sp.	<i>Rhinichthys spp.</i>	--	--
Redside Shiner	<i>Rhizodonius balteatus</i>	--	--
Bridgelip sucker	<i>Catostomus columbianus</i>	--	--
Largescale sucker	<i>Catostomus macrocheilus</i>	--	--
Sucker sp.	<i>Catostomus spp.</i>	--	--
Mottled sculpin*	<i>Cottus bairdi</i>	--	--
Torrent sculpin	<i>Cottus rhotheus</i>	--	--
Sculpin sp.	<i>Cottus spp.</i>	--	--

Notes: * Indicates the expected presence based on Mullan et al. 1992 and other USFWS reports.

The Management Plan (CCCD 2004) and other reports have proposed ways to address the loss of habitat complexity, the paucity of pools, and problems with overwinter rearing habitat limitations. Among the proposed treatments are engineered instream rock and wood structures and the connection of the mainstem Entiat River with remnant or constructed flood plain and side channel habitat. The mainstem Entiat River adjacent SANRAY ORCHARDS, like much of the lower Entiat River, has a combination of C3, B3c, and F3 channel types (Table 1), based on the Rosgen stream channel classification system (Rosgen 1994). The F3 channel type, in particular, is thought to reflect a channelized condition, resulting from

flood control efforts implemented prior to and following the flood of 1948. An F3 channel type has a very high width-to-depth ratio and is typically representative of a riffle or run habitat type.

SANRAY ORCHARDS has a number of unique aquatic habitat features resulting from both natural processes, and human influences. This site has existing side channel, backwater, and braided channel habitat. Some of these aquatic habitat features are associated with islands formed by outwash from Dissmore Canyon following the Crum Canyon fire in 1976 (Personal communication with Sandidge 2007). Off-channel and pool habitat were also created through the construction of the H-D irrigation diversion and bypass channel (Figure 3), and by the construction of a rock weir as part of the 2001 EWPU demonstration project (Figure 4).

Additional instream habitat improvement projects have been proposed at this site. The USBR has been working collaboratively with SANRAY ORCHARDS, the EWPU, the CCCD, and others to develop a multi-phase habitat complexity and instream flow enhancement project for the site. Initial habitat enhancement proposals include installation of a rock-vortex cross vane and large woody debris (LWD) downstream from the cross vane, decommissioning of the H-D diversion in preparation for consolidation with the K-W system. Subsequent phases may include installation of rootwads and retention of a large portion or all of the H-D diversion bypass channel after consolidation; the extent of actions that may be feasible has yet to be determined.

Landowners in the Entiat River watershed, including those managing SANRAY ORCHARDS, are already working cooperatively with federal agency, state agency, local government, non-governmental organizations and others to protect and restore aquatic habitat in the Entiat River watershed. Orchardists in the Entiat River valley and elsewhere in north-central Washington appreciate the opportunity to expand on ongoing habitat protection and restoration efforts, but are also interested in protecting their lifestyle and livelihood. Aquatic habitat protection and restoration efforts could be better integrated with riparian and upland management through programs like the HFEP, significantly enhancing ongoing aquatic habitat effort. Such programs like the HFEP, however, must be developed immediately and made available to land managers like those at SANRAY ORCHARDS before aquatic habitat protection and restoration efforts are completed.

Existing Riparian and Aquatic Habitat Function

The USFS-Entiat Ranger District recently completed a Biological Assessment (BA) of the lower Entiat River. The BA was prepared to analyze and evaluate the potential effects of three proposed restoration projects in the Lower Entiat River, including one at SANRAY ORCHARDS. Table 3 is a summary of the baseline condition of aquatic habitat and other environmental conditions in the lower Entiat River. These conditions describe the lower Entiat River, but are also generally true for the project site specifically.

The baseline condition of riparian and aquatic habitat at the SANRAY ORCHARDS is mixed. As with other areas of the lower river the project site has excessive water temperatures, a paucity of large woody debris, few primary pools, poor floodplain connectivity, a poor drainage network, and improperly functioning riparian areas. Portions of the site, however, have intact riparian vegetation with mature canopy. Aquatic habitat adjacent SANRAY ORCHARDS also benefit from intense groundwater upwelling, estimate to be over 30 cfs per mile between Dissmore and Dinkelman Canyons (CCCD 2003). Upwelling at this level helps to maintain instream flows during low flow periods, moderates water temperature, and may moderate dissolved oxygen and silt levels, perhaps explaining the recently discovered heavy use of this area by spawning steelhead (*O. mykiss*) (see Hamstreet 2007, 2006, 2005; Hamstreet and Carie 2004, 2003).

Existing side-channel and backwater habitats in the H-D bypass channel are valuable to aquatic species. Snorkel surveys of the bypass channel completed during the daytime and nighttime in August of 2005 revealed concentrated use of fish habitat use in the H-D bypass channel. Over 1000 fish were observed during the daytime, approximately 50% of which were juvenile Chinook salmon (*O. tshawytscha*) and approximately 50% of which were identified as juvenile rainbow trout (*O. mykiss*). The proposed consolidation of the K-W and H-D irrigation diversions may, however, result in the elimination of a portion of the H-D bypass channel (USFS-WNF 2007). The EWPU and partners have been working with landowners and irrigation ditch managers to improve instream flows in the mainstem Entiat River through the consolidation of the K-W and H-D ditches, consistent with recommendation in the Management Plan (CCCD 2004). The specific actions associated with final KW-HD system consolidation and H-D ditch and bypass channel decommissioning have not yet been finalized or proposed for permitting or construction; however, the USFS-Entiat Ranger District included a description of the ditch consolidation project in the lower Entiat River BA (USFS-WNF 2007).

Table 3. Matrix of environmental baseline conditions in the lower Entiat River watershed (modified from USFS-WNF 2007).

Diagnostic/Pathway Indicators	Baseline Environmental Conditions
Water Quality	
Water Temperature	Not Properly Functioning
Sediment/Turbidity	At Risk
Chemical Contamination/Nutrients	Properly Functioning
Habitat Access	
Physical Barriers	Properly Functioning
Habitat Elements	
Substrate Embeddedness	Properly Functioning
Large Woody Debris	Not Properly Functioning
Pool Frequency	Not Properly Functioning
Pool Quality	At Risk
Off-channel Habitat	At Risk
Refugia	At Risk
Channel Conditions and Dynamics	
Width/Depth Ratio	At Risk
Streambank Condition	At Risk
Floodplain Connectivity	Not Properly Functioning
Flow/Hydrology	
Change in Peak/Base Flows	Properly Functioning
Increase in Drainage Network	Not Properly Functioning
Watershed Conditions	
Road Density and Location	Not Properly Functioning
Disturbance History	At Risk
Riparian Conservation Areas	Not Properly Functioning

Immediate Need for the HFEP to Help Address Habitat Needs

The above summarizes reports and studies that have clearly identified the value and need for protection and restoration of riparian areas throughout the Entiat River. Taking such action will significantly contribute to efforts to mitigate water temperature exceedences, address the recovery of threatened and endangered species, protect and restore floodplain and proper stream-channel function, and riparian and terrestrial habitat goals. With the identification of riparian lands along SANRAY ORCHARDS as the highest priority for protection of riparian vegetation (GeoEngineers 2007), with SANRAY ORCHARDS manager interest in implementing riparian protection and enhancement tools that also meet orchard land-management objectives, and with ongoing aquatic habitat restoration adjacent SANRAY ORCHARDS and elsewhere in the Entiat River valley, now is the time to fully develop and implement the HFEP.

REGULATORY ENVIRONMENT

The regulatory environment is one of two pressures felt by landowners and land managers in the Entiat River watershed. Ray Sandidge, Jon Small, and Jim Small described the combined pressure from regulatory agencies to change land management practices for the benefit of terrestrial and aquatic species, and pressure from developers to convert orchard lands to residences as opposing forces squeezing the family farmer (personal communication 2007). In addition, existing Chelan County Comprehensive Plan zoning requirements for properties designated as Commercial Orchard state that parcels of no less than 10 acres in size may be created, thereby eliminating the ability of growers to parcel out or sell a small portion of their holdings in order to keep the remainder of their operation viable. Messrs. Sandidge, Small, and Small (personal communication 2007) suggested that tree fruit production may remain a viable lifestyle were they and other growers able to enroll a few acres of lands through a land leasing program like the HFEP and in return receive a small, predictable sum of money on an annual basis that could be used to support the remainder of their operation and help mitigate against adverse trends in agricultural economic markets over time. Absent such a program, development and regulatory pressures may squeeze this lifestyle out of existence and further compromise natural systems since the likely result will be increased development.

Local Regulations

Messrs. Sandidge, Small, and Small (personal communication 2007) expressed concern about the current limitations to land use imposed by local regulations. They also mentioned opportunities and challenges working within or changing local regulations to enable a program like the HFEP. The following summarizes some of the issues and opportunities addressed.

Chelan County Code

The Chelan County Code is comprised of sixteen sections (Chelan County 2007). Management of SANRAY ORCHARDS is most directly effected by a number of sections, including:

- Title 6 Taxes – The existing county code taxes orchardists by acreage area in orchard production. Local taxes would need to account for changes in orchard area if converted to other uses such as riparian and/or aquatic habitat. Messrs. Sandidge, Small and Small (personal communication 2007) acknowledged that the Chelan County Public Benefit Rating System (PBRs) may prove an opportunity to credit orchardists for conversion of orchard to open-space/public beneficial uses such as riparian and aquatic habitat. Innovative applications of the PBRs and other taxation laws are needed to avoid penalizing landowners for converting commercial orchard to open space-riparian and aquatic habitat area. Rather, tax incentives should be applied for those areas where conversion of orchard to habitat is determined to be the highest and best use.

- Title 11.78: Fish and Wildlife Habitat Conservation Areas Overlay District (FWOD) – The subsection pertaining to riparian buffers may impose limitation on actions intended to enhance riparian and aquatic habitat under the HFEP. Other sub-sections of this section of the code may or may not present an opportunity for application of the HFEP in the Entiat.
- Title 11 and 12: Agricultural Zoning – Agricultural lands of long-term significance have been designated in the Chelan County Comprehensive Plan. Although intended to long-term economic sustainability of orchard lands, zoning may serve to limit the ability to implement programs like the HFEP.

State Regulations

The State of Washington has both laws and rules that regulate actions in the state. Laws are developed by the Legislature, signed by the Governor, and promulgated under the Revised Code of Washington (RCW). Rules are developed by agents of the state (e.g. Department of Ecology), and are promulgated under the Washington Administrative Code (WAC). A wide variety of laws and rule have been developed that may affect operation of SANRAY ORCHARDS.

Ray Sandidge (landowner SANRAY ORCHARDS), Jon Small (leasee) and Jim Small (orchard land owner/manager) expressed concern about the likelihood of implementing a Habitat Farming Enterprise Program in the Entiat River watershed, given the effects of the following state laws and regulations:

Water Resources

Management of water resources in the state of Washington are governed by several state laws including:

- The Surface Water Code (Chapter 90.03 Revised Code of Washington, RCW)
- The Claims Registration Act (Chapter 90.14 RCW)
- The Minimum Flows and Levels Act (Chapter 90.22 RCW)
- The Ground Water Code (Chapter 90.44 RCW)
- The Water Resources Act of 1971 (Chapter 90.54 RCW), and
- The Watershed Planning Act (Chapter 90.82 RCW).

In September 2005 the Department of Ecology adopted Chapter 173-546 Washington Administrative Code (WAC), Water Resources Management Program -Entiat River Basin Water Resource Inventory Area (WRIA) 46 (Ecology 2005). The program was developed and proposed by the Entiat WRIA Planning Unit under the authority of the Watershed Planning Act (Chapter 90.82 RCW). The program created rules for the management of instream and out-of-stream water resources based on assessment findings and plan recommendations (see CCCD 2004). The instream flows and associated maximum water allocation were established to maintain ecosystem objectives including protection of wildlife, fish, water quality, scenic, aesthetic and other environmental values (Chapter 173-546 WAC).

Streamflow in the Entiat River adjacent SANRAY ORCHARDS is regulated based in measurements made at the Entiat near Entiat (Keystone Gauge, RM 1.4), with instream flows ranging from a low of 185 cubic feet per second (cfs, August through mid-March) to a high of 898 cfs in early to mid-June. The EWPU and partners identified a variety opportunities to enhance instream flows associated aquatic habitat in the

Entiat River watershed through projects including: conservation, transfer, water banking, and use of the trust water program.

State law or WRIA-specific rules outlined above may impose limitations on actions intended to benefit riparian and aquatic habitat and species if such action may require changes in irrigation rights at SANRAY ORCHARDS. Any reductions in irrigation amounts at the site may be subject to relinquishment, abandonment, or change authorization requirements under Washington State water laws and rules. Use of programs such as the state Trust Water program would have to occur in conjunction with any reductions in quantity of water use that resulted from HFEP actions in order to prevent water rights relinquishment.

Water Quality

Management of water quality in the state of Washington is governed by the Water Pollution Control Act (Chapter 90.48 RCW). The purpose of this law is to ". . . maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment . . . the propagation and protection of wildlife, birds, game, fish and other aquatic life, and the industrial development of the state."

Crop conversion and actions to enhance riparian and aquatic habitat under the HFEP may help meet standards and achieve objectives represented by water quality laws. Enhancement of riparian habitat is one of two actions identified in the Management Plan (CCCD 2004) as most likely to mitigate water temperature exceedences in the watershed. Water temperature is one of a number of water quality parameters addressed under this state law. In 2004 the State of Washington Department of Ecology (WDOE) identified the lower Entiat River as exceeding state water quality standards, but assigned the Clean Water Act listing to Water Quality Assessment Category 4(b). This categorization identifies the water body as impaired by the pollutant, but not requiring a Total Maximum Daily Load Allocation (TMDL) because there is an existing pollution control project. The Management Plan and DIP were cited as the existing pollution control plans. The U.S. Environmental Protection Agency (EPA) also formally supported implementation of the Management Plan and DIP in lieu of more traditional regulatory approaches used to address water temperature exceedences (EPA 2005). In order to maintain Ecology and EPA support, however, the EWPU must continue to develop and implement priority riparian projects to address water temperature exceedences. Implementation of riparian protection and restoration action on SanRay Orchards as part of the HFEP would support these ongoing riparian protection and restoration efforts.

Similarly, the potential instream flow benefits discussed in the Water Resources section, above, could help moderate late-season stream temperatures and minimize the number of excursions beyond state water quality standards.

Federal Regulations

Land use management and business operations can be effected by a wide variety of federal regulations. Federal laws like the U.S. Endangered Species Act (ESA) and Clean Water Act (CWA) can have direct effects on SANRAY ORCHARDS and efforts to improve riparian and aquatic habitat.

Ray Sandidge (landowner SANRAY ORCHARDS), Jon Small and Jim Small (land managers) expressed concern about the likelihood of implementing a Habitat Farming Enterprise Program in the Entiat River watershed, given the effects of the following federal laws and regulations:

National Environmental Policy Act of 1969

NEPA is an environmental protection law and process similar to SEPA. NEPA requires all federal agencies to "utilize a systematic, interdisciplinary approach that will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making, which may have an impact on man's environment." NEPA is triggered whenever a project received federal funding or when an action requires federal permits, licenses, or approval. NEPA compliance has been incorporated into or integrated with other federal acts including the Clean Water Act (CWA), Coastal Zone Management Act (CZMA), the Pollution Prevention Act (PPA), and the Endangered Species Act (ESA). NEPA requires that a detailed statement of the potential environmental impact of major federal actions that significantly affect the environment be included in every recommendation or report on proposals for legislation.

Endangered Species Act of 1973

The Endangered Species Act (ESA) of 1973 is administered by the Department of the Interior (USFWS 2007). The ESA applies to the management of fish, wildlife and plant species that are at risk of extinction. The purpose of the Act is to protect, conserve and enhance ecosystems upon which threatened and endangered (T&E) species depend, and to develop and implement plans to recover the habitat and populations to such levels as to prevent extinction. All federal departments and agencies must seek to conserve T&E species and utilize their authorities to further the purposes of the ESA. Federal agencies are also required to cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species. The ESA also applies to the actions of any person subject to the jurisdiction of the United States. It prohibits the harm or "take" of species listed as threatened or endangered under the Act.

Significant consideration is given to the ESA when any type of activity within the Entiat River WRIA. Three of four anadromous salmonid stocks utilizing the Entiat River watershed are protected under the ESA. Two federal agencies, NOAA Fisheries and the U.S. Fish and Wildlife Service, are responsible for management of species listed in the Entiat River watershed. These protected anadromous fish stocks are:

- Upper Columbia River spring Chinook salmon (*O. tshawytscha*) were listed as Endangered on March 16, 1999;
- Upper Columbia River steelhead (*O. mykiss*), down-listed to threatened on January 5, 2006; and
- Upper Columbia River bull trout (*S. confluentus*), listed as Threatened on June 12, 1998.

Critical habitat for Upper Columbia River Spring Chinook salmon and upper Columbia River Steelhead was designated on September 2, 2005 (Federal Register 2004) for the Entiat River. Critical habitat has been neither proposed nor designated for bull trout within Upper Columbia River Basin – Unit 21, which includes the Entiat River. The Entiat River provides Essential Fish Habitat for Coho and Chinook salmon (USFS-WNF 2007). The lower river contains a steelhead minor spawning area and the entire river is designated a major spawning area for spring Chinook (UCSRB 2006).

The USFWS is also responsible for management of other protected species. The USFWS maintains a list of protected species in the Entiat River watershed. The only other species found in the vicinity of SANRAY ORCHARDS is the bald eagle (*Haliaeetus leucocephalus*). Other species of plant and animal in the Entiat River watershed are protected under the ESA, but do not occur in the immediate vicinity of the project.

Any activities, including riparian and aquatic habitat restoration will need to comply with the ESA and related federal laws. In areas like the Entiat River watershed where species are protected as “endangered” under the ESA, there are fewer options available to comply with the law. In the Entiat River watershed, compliance is obtained either through permitting of specific actions or through development and approval of a habitat conservation plan (HCP). HCP’s are typically reserved for actions that are programmatic in nature.

Clean Water Act

The Federal Water Pollution Control Act of 1972, amended in 1977, is generally referred to as the Clean Water Act. The Clean Water Act defines the process and standards to regulate discharge of pollutants into U.S. waters. The U.S. Environmental Protection Agency (EPA) has responsibility for implementing the law. The EPA has delegated responsibility to Ecology to administer the CWA in Washington State, including the Entiat River watershed, including monitoring surface waters for compliance with standards, maintaining a list of impaired streams, and developing and implementing pollution cleanup plans.

Immediate Need for the HFEP to Help Address Regulatory Issues

The above summarizes regulatory programs and processes intended to protect natural resource and improve the quality of life. For over 13 years, orchardists and landowners in the Entiat River watershed have committed personal time and resources to addressing natural resource management issues (see CCCD 2004, 2006). Rather than being rewarded for their efforts, these citizens have found themselves constrained by more regulations, and placed at financial and regulatory risk (personal communication Sandidge, owner/manager SANRAY ORCHARDS, 2007). A program like the HFEP needs to be fully developed and implemented immediately to take full advantage of the good will and interest orchardists and other landowners have shown in addressing regulatory issues, before problems grow any complex or divisive. Actions envisioned under the HFEP are expected to simultaneously address multiple local, state, and federal regulatory issues. Programs like the HFEP that address multiple resource issues should, therefore, be fully developed, funded and provided the necessary human resource support as a priority over other programs that address fewer regulatory or natural resource issues.

CONCEPTUAL FUTURE CONDITION

A comparison of existing and potential future conditions is necessary to provide HFEP proponents and future participants with a means to evaluate the benefits and risks of existing land uses against the benefits and risks of potential future land uses under programs like the HFEP. The IRIS completed a feasibility assessment, evaluating the feasibility of implementing a program like the HFEP (Mullinix et al. 2005). The feasibility study concluded that a program like the HFEP could be effective, but partners agreed that an on-the-ground example of an HFEP project would be needed to more fully evaluate technical, regulatory, and economic aspects of the HFEP. This Conceptual Restoration Plan for SANRAY ORCHARDS provides a more detailed description of technical aspects of the HFEP, identified potential regulatory challenges, and suggests attributes of the HFEP for which an economic analysis should be completed. Regulatory and economic analyses are outside the scope of this report, and are being address separately. Once such work is completed, landowners can then determine if there are sufficient economic incentives that will facilitate the transition of land use for current condition to the conceptual future condition.

The Conceptual Restoration Plan for SANRAY ORCHARDS was developed as the result of decades of knowledge and experience with natural resources of the Entiat River watershed, and the experience of project partners with similar projects in the Entiat River watershed and elsewhere in the Upper Columbia River basin. Staff from GeoEngineers, Inc., the CCCD and the USFS met with the owner and managers

of SANRAY ORCHARDS. Observations were made at the site, discussed among participants, evaluated against technical information available for the watershed and HFEP project objectives, and a range of alternative conceptual site plans were developed. This section of the report identifies conceptual future conditions (Figure 5, 6, 7), identifies the potential benefits to riparian and aquatic habitat of each alternative, and identifies regulatory and economic challenges to implementation of the HFEP at the site.

ALTERNATIVE 1 – EXTENSIVE HABITAT ENHANCEMENT

The extensive riparian and aquatic habitat enhancement project envisioned in Alternative 1 is intended to expand upon the existing riparian and aquatic habitat at the project site by converting land located in the floodplain, downstream from the H-D irrigation diversion entirely from orchard irrigation to riparian and aquatic habitat (Figure 5). The goal of this alternative is to provide the maximum amount of aquatic habitat area, floodplain connectivity, mitigation of water temperature exceedences through the protection and restoration of a mature riparian community, maximum habitat area for riparian species (e.g. amphibians, mammals, birds), minimal beaver depredation, minimal risk of spray drift, and a site plan that allows for the continued use of SANRAY ORCHARDS as a commercial agricultural operation while providing an attractive riparian project for funding by the proposed HFEP.

This alternative would include the removal of two areas of existing orchards and cover crop equaling approximately 1.6 acres. The areas envisioned for conversion include:

- Approximately 1.3 acres of pear orchard located on the river side of the H-D irrigation diversion and bypass channel.
- Approximately 0.3 acres of apple orchard located on the landward side of the H-D bypass channel, just upstream from the confluence of the bypass channel and the mainstem Entiat River.

This alternative would also include installation of approximately 3200 feet of welded-wire mesh beaver exclusion fencing.

Please see Figure 5 and Table 4 for additional information about proposed riparian and aquatic habitat restoration actions under this alternative.

Proposed Actions at 1.3 acre Pear Orchard

Under Alternative 1, the HFEP would support the development of four habitat features within the 1.3 acre pear orchard area of SANRAY ORCHARDS. Aquatic habitat in the existing bypass channel would be enhanced through expansion of pool habitat area at the existing pool adjacent the irrigation screen, a new high-flow side channel and pool would be constructed midway through the existing pear orchard, a side channel and pool would be constructed at the southern end of the pear orchard, and the remainder of the orchard would be replaced with a riparian tree-scrub complex.

If the K-W/H-D irrigation consolidation is completed, and the H-D diversion and screen were abandoned, expansion of the existing pool habitat would utilize space previously occupied by these features. At the time pool expansion was completed, LWD and rootwads would be added to the margins of the pool and areas adjacent the pool would be aggressively planted with riparian vegetation.

Under this alternative, a high-flow side channel would be created connecting the mainstem Entiat River to a pool constructed in the central part of the existing orchard area, just southeast from the existing pool habitat. The constructed pool would be connected to the existing bypass channel by a channel of approximately the same width, depth, and grade as the existing channel, serving to continuously

backwater this area at all flows. A high-flow channel would also be constructed starting at the confluence of the existing bypass channel and the constructed backwater slough. The high-flow side channel would be a meander braid constructed parallel to the existing bypass channel, returning to the existing bypass channel just upstream from the service bridge over the bypass channel, used to access the 1.3 acre pear orchard.

A side channel would also be constructed between the mainstem Entiat River and the bypass channel at a point just northeast from the service bridge accessing the 1.3 acre pear orchard. This side-channel would empty into a pool, which would then be connected to the existing bypass channel. The side channel, pool, and channel connecting to the bypass would all be constructed at an elevation that would provide a continuous flow of water from the mainstem Entiat River into the pool and bypass channel.

Pear orchard, access roads, and pear-bin storage areas would be replaced with a combination of native trees and shrubs throughout the 1.3 acre area. This would create a buffer width of over 150 feet between the Entiat River and the remaining apple orchard, and over 60 feet between the bypass channel and the upslope apple orchard.

Proposed Actions at 0.3 Acre Apple Orchard

A backwater slough would be constructed off the lower bypass channel just upstream from the confluence of the bypass channel and the mainstem Entiat River. The backwater slough would be constructed at an elevation that would provide a continuous flow of water from the bypass channel into the slough.

The remainder of the apple orchard would be removed and planted with a combination of native riparian trees and shrubs providing a buffer width of over 100 ft from the Entiat River and over 60 ft. between the irrigation bypass channel and remaining apple orchard (see Figure 5).

POTENTIAL BENEFITS

Land Use and Management

Existing pear and apple orchard proposed for conversion to riparian and aquatic habitat would need to be fully compensated by the HFEP. Both the pear and apple orchard envisioned for conversion are presently producing commercially marketable product. Were the HFEP not to occur, the apple orchard located on the 0.3 acre area would need to be replaced with another marketable product within the next decade. The pear orchard located on the 1.3 acre area, however, was only recently planted, is entering its first year of quality production, and would be expected to produce commercially marketable product for the next 50 years. Were the pear orchard removed as part of the HFEP, compensation would need to be commensurate with lost revenue for this type of crop for up to 50 years of production.

An additional consideration in estimating a HFEP compensation package is the fact that the 1.3 acres pear orchard in the floodplain is being managed as a “block” with a 9 acre area upslope on SANRAY ORCHARDS. When the two land areas are in production, pear is anticipated to produce sufficient revenue to make up for operating costs and, over time, generate a profit. Owners and operators of SANRAY ORCHARDS claim that they would be challenged to turn a profit if the 1.3 acre area of pear were removed from production in the near term, and the 10+ acre pear “block” were reduced in size. The owners and operators of SANRAY ORCHARDS claim that, in keeping with the farm revenue plan, it would be necessary to provide additional compensation to SANRAY ORCHARDS if the 1.3 acres were removed in the near-term.

The design of the aquatic and riparian enhancement efforts at SANRAY ORCHARDS is intended to reduce the amount of time, effort, and expense needed to manage riparian lands. This alternative proposes to install approximately 3200 linear feet of welded wire mesh beaver exclusion fencing. This alternative will also significantly reduce the need for active management of riparian vegetation to maximize air flow for frost control purposes, and would place significant distance between orchard lands and open water, minimizing the risk of spray drift issues. Thus, the three main land management issues identified by landowners (i.e. frost control, spray drift, beaver depredation) would be addressed by this alternative.

Riparian and Aquatic Habitat

Alternative 1 describes the most robust and aggressive riparian and aquatic habitat enhancement option available at the site. This alternative would protect existing quality riparian and aquatic habitat, while enhancing habitat attributes identified as limiting in the lower Entiat River.

This proposal would significantly increase aquatic habitat. The number of pools at the site would increase from one to four, a 300% increase. The amount of side channel habitat would increase from an estimated existing bypass channel length of 2820 feet by an additional 1320 feet for a total of 4140 linear feet of side-channel habitat. Assuming an average channel width of 10 feet, this would be a change in total area from 28200 square feet (0.65 acres) to 41400 square feet (0.95 acres) of side channel habitat. This would be an increase of approximately 47% in this habitat type over the existing condition. The mainstem Entiat River and portions of the upper bypass channel are currently used for spawning purposes by steelhead and other anadromous salmonids. The created side channel and off-channel pool habitat would serve as valuable salmonid fry dispersal and rearing areas for fish emerging from concentrations of redds located upstream. Aquatic habitat enhancements at the site would add value to the existing quality pool and side-channel habitat in the bypass channel.

The existing riparian and open space area occupies approximately 1.71 acres between the pear and apple blocks being considered for the HFEP under Alternative 1. With the removal of 1.3 acres of pear and 0.26 acres of apple orchard at SANRAY ORCHARDS, additional area would be available for restoration as riparian area. Assuming the entire pear and apple orchard areas removed are replaced with riparian vegetation, this would provide an additional potential riparian area of 1.56 acres. Based on aquatic habitat areas estimates above, we can assume that aquatic habitat would occupy 0.3 acres of the site. Thus a total of 1.26 acres of riparian area would be created at the pear and apple orchard areas. An additional area adjacent the pear and apple orchard blocks are anticipated to also be planted in riparian vegetation, amounting to approximately 1.5 acres of additional riparian vegetation. Thus, in total, Alternative 1 would provide 3.06 acres of new riparian vegetation, in addition to the approximate 1.71 acres at the site. This amounts to an increase in riparian habitat area of about 180%.

The expansion of riparian area at the site would significantly increase riparian habitat both at the site and in the lower Entiat River. The combination of existing ponderosa pine with broadleaf tree (e.g. cottonwood) and shrub (e.g. elderberry) riparian plantings and expansion of low velocity aquatic habitat at the site would support birds of prey (e.g. Osprey, Pandion haliaetus) insectivorous birds (e.g. Flammulated owl, Otus flammeolus), cavity nesting ducks (e.g. wood duck, Aix sponsa), woodpeckers (e.g. Black-backed woodpecker, Picoides arcticus), shallow-water foraging species (e.g. Great Blue Heron, Ardea herodias), shorebirds (e.g. spotted sandpiper, Actitis macularia) and songbirds (e.g. western tanager, Piranga ludoviciana). A number of small mammals are considered to be obligate inhabitants of stream-side riparian areas (e.g. water shrew, Sorex palustris). Other species like bats (big brown bat, Eptesicus fuscus), carnivores (bobcat, Lynx rufus), and ungulates (e.g. mule deer, Odocoileus hemionus) will utilize riparian areas for feeding, hiding, and resting purposes.

Water Resources

Potential island riparian and aquatic habitat enhancement project would require elimination of 1.6 acres of orchard. This would amount to an instantaneous quantity of approximately 0.032 cfs (14 gallons per minute, gpm) and approximately 6.5 acre-feet per year (ac-ft/yr). Water not used to irrigate this orchard are would first be applied to riparian vegetation planted at the site. Any water not needed for riparian vegetation could be placed in trust under the Washington State Water Resource Management Act (Chapter 90.42 RCW), and used to maintain instream flows in the Entiat River and associated side-channel habitat.

Expanded riparian area may benefit water quality in a number of ways. First, water temperature exceedences are expected to be mitigated through the restoration of riparian vegetation, through shading of the stream and adjacent channel. The fact that groundwater recharges this reach is especially important as the cool water influx will continue to help meet long-term water temperature mitigation objectives and provides thermal refugia for aquatic species. Second, development of buffer zones in excess of 100 feet are expected to reduce runoff rates and minimize the erosive effects of high water or flooding, thus minimizing erosion and sediment contributions to the stream (Fischer et al 2000). Third, wide buffer areas also serve to retain nutrients. Any nutrients from upslope agricultural or residential areas will be better assimilated by the enhanced buffer areas.

ALTERNATIVE 2 – MODERATE HABITAT ENHANCEMENT

The moderate riparian and aquatic habitat enhancement project envisioned in Alternative 2 is intended to expand upon the existing riparian and aquatic habitat at the project site by converting land located in the floodplain, downstream from the H-D irrigation diversion entirely from orchard irrigation to riparian and aquatic habitat (Figure 6). The goal of this alternative is to provide the same riparian shade benefits and comparable riparian species habitat benefits as was provided in Alternative 1. Aquatic habitat area and floodplain connectivity benefits are not anticipated to be as great as under Alternative 1, but are balanced against the desire of the landowner to restore orchard in the HFEP fails to continue funding of riparian areas established under the HFEP. Additional goals of this alternative, as with Alternative 1, are to minimize beaver depredation, minimize risk of spray drift, and provide a site plan that allows for the continued use of SANRAY ORCHARDS as a commercial agricultural operation while providing an attractive riparian project for funding by the proposed HFEP.

This alternative would include the removal of two areas of existing orchards and cover crop equaling approximately 1.6 acres. The areas envisioned for conversion include:

- Approximately 1.3 acres of pear orchard located on the river side of the H-D irrigation diversion and bypass channel.
- Approximately 0.3 acres of apple orchard located on the landward side of the H-D bypass channel, just upstream from the confluence of the bypass channel and the mainstem Entiat River.

This alternative would also include installation of approximately 3200 feet of welded-wire mesh beaver exclusion fencing.

Please see Figure 6 and Table 4 for additional information about proposed riparian and aquatic habitat restoration actions under this alternative.

Proposed Actions at 1.3 Acre Pear Orchard

Under Alternative 2, the HFEP would support the development of three habitat features within the 1.3 acre pear orchard area at SANRAY ORCHARDS. Aquatic habitat in the existing bypass channel would be enhanced through expansion of pool habitat area at the existing pool adjacent the irrigation screen, a side channel and pool would be constructed at the southern end of the pear orchard, and the remainder of the orchard would be replaced with a riparian tree-scrub complex.

If the K-W/H-D irrigation consolidation is completed, and the H-D diversion and screen were abandoned, expansion of the existing pool habitat would utilize space previously occupied by these features. At the time pool expansion was completed, LWD and rootwads would be added to the margins of the pool and areas adjacent the pool would be aggressively planted with riparian vegetation.

Under this alternative, a side channel would be constructed between the mainstem Entiat River and the bypass channel at a point just northeast from the service bridge used to access the 1.3 acre pear orchard. This side-channel would empty into a pool, which would then be connected to the existing bypass channel. The side channel, pool, and channel connecting to the bypass would all be constructed at an elevation that would provide a continuous flow of water from the mainstem Entiat River into the pool and bypass channel.

The entire pear orchard, access roads, and pear-bin storage areas would be replaced with a combination of native trees and shrubs. As with alternative 1, this would create a buffer width of over 150 feet between the Entiat River and the remaining apple orchard, and over 60 feet between the bypass channel and the upslope apple orchard.

Proposed Actions at 0.3 acre Apple Orchard

A backwater slough would be constructed off the lower bypass channel just upstream from the confluence of the bypass channel and the mainstem Entiat River. The backwater slough would be constructed at an elevation that would provide a continuous flow of water from the bypass channel into the slough.

The remainder of the apple orchard would be removed and planted with a combination of native riparian trees and shrubs. As with Alternative 1, this would provide a buffer width of over 100 ft between the Entiat River and upslope apple orchards, and over 60 ft. between the irrigation bypass channel and remaining apple orchard (see Figure 6).

POTENTIAL BENEFITS

Land use and Management

Existing pear and apple orchard proposed for conversion to riparian and aquatic habitat would need to be fully compensated by the HFEP. Both the pear and apple orchard envisioned for conversion are presently producing commercially marketable product. Were the HFEP not to occur, the apple orchard located on the 0.3 acre area would need to be replaced with another marketable product within the next decade. The pear orchard located on the 1.3 acre area, however, was only recently planted, is entering its first year of quality production, and would be expected to produce commercially marketable product for the next 50 years. Were the pear orchard removed as part of the HFEP, compensation would need to be commensurate with lost revenue for this type of crop for up to 50 years of production.

An additional consideration in estimating a HFEP compensation package is the fact that the 1.3 acres pear orchard in the floodplain is being managed as a “block” with a 9 acre area upslope on SANRAY

ORCHARDS. When the two land areas are in production, pear is anticipated to produce sufficient revenue to make up for operating costs and, over time, generate a profit. Owners and operators of SANRAY ORCHARDS claim that they would be challenged to turn a profit if the 1.3 acre area of pear were removed from production in the near term, and the 10+ acre pear “block” were reduced in size. The owners and operators of SANRAY ORCHARDS claim that, in keeping with the farm revenue plan, it would be necessary to provide additional compensation to SANRAY ORCHARDS if the 1.3 acres were removed in the near-term.

The design of the aquatic and riparian enhancement efforts at SANRAY ORCHARDS is intended to reduce the amount of time, effort, and expense needed to manage riparian lands. This alternative proposes to install approximately 3200 linear feet of welded wire mesh beaver exclusion fencing. This alternative will also significantly reduce the need for active management of riparian vegetation to maximize air flow for frost control purposes, and would place significant distance between orchard lands and open water, minimizing the risk of spray drift issues. Thus, the three main land management issues identified by landowners (i.e. frost control, spray drift, beaver depredation) would be addressed by this alternative.

Riparian and Aquatic Habitat

Alternative 2 would provide the same amount of riparian area as Alternative 1, but would provide a more modest increase in aquatic habitat and floodplain connectivity at the site. The number of pools would increase from one to three, a 200% increase. The amount of side channel habitat would increase from an estimated existing bypass channel length of 2820 feet by an additional 405 feet for a total of 3225 linear feet of side-channel habitat. Assuming an average channel width of 10 feet, this would be a change in total area from 28200 square feet (0.65 acres) to 32250 square feet (0.74 acres) of side channel habitat. This would be an increase of approximately 14% in this habitat type over the existing condition. The mainstem Entiat River and portions of the upper bypass channel are currently used for spawning purposes by steelhead and other anadromous salmonids. The created side channel and off-channel pool habitat would serve as valuable fry dispersal and rearing areas for fish emerging from concentrations of redds located upstream. Aquatic habitat enhancements at the site would add value to the existing quality pool and side-channel habitat in the bypass channel.

The existing riparian and open space area occupies approximately 1.71 acres between the pear and apple blocks being considered for the HFEP under Alternative 2. With the removal of 1.3 acres of pear and 0.26 acres of apple orchard at SANRAY ORCHARDS, additional area would be available for restoration as riparian area. Assuming the entire pear and apple orchard areas removed are replaced with riparian vegetation, this would provide an additional potential riparian area of 1.56 acres. Based on aquatic habitat areas estimates above, we can assume that aquatic habitat would occupy 0.3 acres of the site. Thus a total of 1.26 acres of riparian area would be created at the pear and apple orchard areas. An additional area adjacent the pear and apple orchard blocks are anticipated to also be planted in riparian vegetation, amounting to approximately 1.5 acres of additional riparian vegetation. Thus, in total, Alternative 2 would provide 3.06 acres of new riparian vegetation, in addition to the approximate 1.71 acres at the site. This amounts to an increase in riparian habitat area of about 180%.

The same riparian habitat benefits would be realized by the same species under Alternative 2 as were described for Alternative 1. The riparian area restored under Alternative 2 is the same as that restored under Alternative 1. The only difference between the two is that Alternative 1 provides a higher degree of aquatic habitat enhancement and floodplain connectivity than Alternative 2, potentially resulting in a difference in riparian habitat quality between the two alternatives.

Water Resources

Potential water quantity and water quality benefits under Alternative 2 would be the same as those described for Alternative 1.

ALTERNATIVE 3 – LIMITED HABITAT ENHANCEMENT

The limited riparian and aquatic habitat enhancement project envisioned in Alternative 3 is intended to reflect a scenario where implementation of the K-W/H-D consolidation leads to the loss of some existing riparian and aquatic habitat at the project site. Alternative 3 describes actions that could be taken at the site to convert apple orchard located in the floodplain, downstream from the H-D irrigation diversion to riparian and aquatic habitat (Figure 7). The goal of this alternative is to protect and mitigate the potential loss of riparian habitat, aquatic habitat, and floodplain connectivity at SANRAY ORCHARDS if Phase 3 of the K-D/H-D project designed by the USBR is implemented (see USFS-WNF 2007 and Appendix A). Phase 3 of the K-W/H-D project could result in the loss of the H-D bypass channel, currently providing over 2800 linear feet of off-channel habitat in the lower Entiat River. This alternative proposes to connect the Entiat River to the lower bypass channel, increase pool habitat area, and provide some riparian habitat enhancements. Riparian and aquatic habitat benefits under this alternative are balanced against a desire by the landowner to maintain a profitable orchard operation at SANRAY ORCHARDS, recognizing that the 1.3 acre pear orchard located between the bypass channel and Entiat River was only recently established, and is expected to produce commercially marketable fruit for the next 50 year. As with Alternative 1 and 2, this alternative is also designed to minimize beaver depredation, minimize risk of spray drift, and provide a site plan that would be an attractive riparian project for funding by the proposed HFEP.

This alternative would include the removal of one area of existing orchards and cover crop equaling approximately 0.3 acres, described as follows:

- Approximately 0.3 acres of apple orchard located on the landward side of the H-D bypass channel, just upstream from the confluence of the bypass channel and the mainstem Entiat River.

This alternative would also include limited aquatic habitat and riparian restoration work in the area of the 1.3 acres of pear orchard as described in alternatives 1 and 2. Riparian and aquatic habitat work would be completed in a manner to avoid removal of pear orchard at the site. This alternative would also include installation of approximately 1700 feet of welded-wire mesh beaver exclusion fencing.

Please see Figure 7 and Table 4 for additional information about proposed riparian and aquatic habitat restoration actions under this alternative.

Proposed Actions at 1.3 acre Pear Orchard

Under Alternative 3, the HFEP would work together with habitat complexity and instream flow enhancements developed by the USBR. This alternative assumes that the K-W/H-D consolidation would be completed, that the H-D irrigation canal would be reclaimed, that the bypass channel adjacent the pear orchard would be abandoned, and that water diverted by the cross-vane would be returned to the Entiat River through bifurcation works (see Appendix A).

Under this alternative, a side channel would be constructed between the mainstem Entiat River and the bypass channel at a point just northeast from the service bridge used to access the 1.3 acre pear orchard. This side-channel would empty into a pool, which would then be connected to the existing bypass channel. The side channel, pool, and channel connecting to the bypass would all be constructed at an elevation that would provide a continuous flow of water from the mainstem Entiat River into the pool and

to the lower bypass channel. It is assumed that with the completion of the K-W/H-D consolidation and reclamation of H-D infrastructure, which the bypass channel adjacent the pear orchard would no longer convey water and would not be connected to the newly constructed side channel and pool.

Proposed Actions at 0.3 acre Apple Orchard

A backwater slough would be constructed off the lower bypass channel just upstream from the confluence of the bypass channel and the mainstem Entiat River. The backwater slough would be constructed at an elevation that would provide a continuous flow of water from the bypass channel into the slough.

The remainder of the apple orchard would be removed and planted with a combination of native riparian trees and shrubs. As with Alternatives 1 and 2, implementation of this alternative would provide a buffer width of over 100 ft between the Entiat River and upslope apple orchards, and over 60 ft. between the irrigation bypass channel and remaining apple orchard (see Figure 7).

POTENTIAL BENEFITS

Land use and Management

Existing apple orchard proposed for conversion to riparian and aquatic habitat would need to be fully compensated by the HFEP. The apple orchard envisioned for conversion is presently producing commercially marketable product. Were the HFEP not to occur, the apple orchard located on the 0.3 acre area would need to be replaced with another marketable product within the next decade.

The design of the aquatic and riparian enhancement efforts at SANRAY ORCHARDS is intended to reduce the amount of time, effort, and expense needed to manage riparian lands. This alternative proposes to install approximately 1700 linear feet of welded wire mesh beaver exclusion fencing. It would not directly address the need for active management of riparian vegetation to maximize air flow for frost control purposes in the pear orchard but would do so at the apple orchard site. Spray drift buffers concerns at the pear orchard site would not be addressed because the 1.3 acre pear orchard would be left unchanged. It would, however, improve address buffer distances at the 0.3 acre apple orchard site. Thus, of the three main lands management issues identified by landowners (i.e. frost control, spray drift, beaver depredation) beaver control would be addressed well, but frost control and spray drift issues would largely remain unchanged.

Riparian and Aquatic Habitat

Alternative 3 describes a rather modest treatment of riparian and aquatic habitat enhancement at the site based on the assumption that implementation of the K-W/H-D consolidation project would result in loss of aquatic habitat adjacent the pear orchard through the abandonment of the H-D irrigation and bypass system. This alternative provides recommendations for actions that would maximize use of remaining riparian and aquatic habitat areas, and proposes enhancements of side-channel and pool habitat features at the site.

Alternative 3 would create a moderate amount of new aquatic habitat, but with reductions caused by Phase 3 of the K-W/H-D project, would realize a net loss of aquatic habitat. The number of pools would increase from one to three, a 200% increase. If Phase 3 of the K-W/H-D project were implemented without implementation of this alternative, approximately 2720 linear feet (approximately 0.62 acres) of aquatic habitat would be lost. If Alternative 3 were implemented, the amount of side channel habitat would change from an existing bypass channel length of 2820 feet (approximately 0.65 acres) down to approximately 2125 linear feet (approximately 0.49 acres) of side-channel habitat. This would be a loss

of approximately 24% of this habitat type over the existing condition. The mainstem Entiat River and portions of the upper bypass channel are currently used for spawning purposes by steelhead and other anadromous salmonids. The maintained and created side channel and off-channel pool habitat would serve as valuable fry dispersal and rearing areas for fish emerging from concentrations of redds located upstream. Aquatic habitat enhancements at the site would add value to the existing quality pool and side-channel habitat in the bypass channel.

The existing riparian and open space area occupies approximately 1.71 acres between the pear and apple blocks being considered for the HFEP under Alternative 3. With the removal of 0.26 acres of apple orchard at SANRAY ORCHARDS, additional area would be available for restoration as riparian area. Assuming the entire apple orchard areas removed are replaced with riparian vegetation, this would provide an additional potential riparian area of 0.26 acres. Based on aquatic habitat areas estimates above, we can assume that aquatic habitat would occupy 0.09 acres of the site. Thus a total of 0.17 acres of riparian area would be created at the apple orchard site. An additional area adjacent the pear and apple orchard blocks are anticipated to also be planted in riparian vegetation, amounting to approximately 1.5 acres of additional riparian vegetation. Thus, in total, Alternative 3 would provide 1.66 acres of new riparian vegetation, in addition to the approximate 1.71 acres at the site, an increase of almost 100%.

The quantity and quality of riparian area and habitat created under Alternative 3 would not be as great as Alternatives 1 or 2. It would, however, significantly increase riparian area, benefiting riparian species, and providing important shade and other water quality benefits. Riparian species identified in Alternatives 1 and 2 as benefiting from the proposed riparian area enhancements would also benefit from enhancements proposed in Alternative 3.

Water Resources

Potential island riparian and aquatic habitat enhancement project would require elimination of 0.26 acres of apple orchard. This would amount to an instantaneous quantity of approximately 0.005 cfs (2 gallons per minute, gpm) and approximately 1 acre-foot per year (ac-ft/yr). Water not used to irrigate this orchard are would first be applied to riparian vegetation planted at the site. Any water not needed for riparian vegetation could be placed in trust under the Washington State Water Resource Management Act (Chapter 90.42), and used to maintain instream flows in the Entiat River and associated side-channel habitat.

This alternative assumes that the K-W/H-D irrigation ditch consolidation would be fully implemented. The design work for the consolidation estimated that between 2 and 6 cfs would be returned to the Entiat River as a result of the irrigation ditch consolidation. The lower Entiat River often has a base flow of around 100 cfs during the low flow period. Part of the low flow period occurs during the later summer or early fall, when irrigation water is often at its highest use. The return of between 2 and 6 cfs to the Entiat River would be a significant benefit to aquatic habitat.

Expanded riparian area may benefit water quality in a number of ways. First, water temperature exceedences are expected to be mitigated through the restoration of riparian vegetation, through shading of the stream and adjacent channel. Second, development of wide buffer zones is expected to reduce runoff rates and minimize the erosive effects of high water or flooding, thus minimizing erosion and sediment contributions to the stream. Third, wide buffer areas also serve to retain nutrients. Any nutrients from upslope agricultural or residential areas will be better assimilated by the enhanced buffer areas.

Table 4. Summary of metrics for alternative conceptual restoration plans. All metrics as estimates provided for comparison purposes.

	Orchard Area (acres)	Open Space and Structures (acres)	Mature Riparian Area (acres)	Number of Pools	Aquatic Habitat Area (acres)	Typical Buffer Width (ft)	New Beaver Fencing (ft)
Existing Condition	17	3.29	1.71	1	0.65	20-100	0
Phase 3 K-W/H-D	17	3.29	1.71	0	0.02	20-100	0
Alternative 1	15.4	1.84	4.76	3	0.95	60-150	3200
Alternative 2	15.4	1.84	4.76	2	0.74	60-150	3200
Alternative 3	16.7	2.14	3.16	2	0.49	20-100	1700

POTENTIAL RISKS AND LIMITATIONS

Previous sections of this report identified land management, economic, and regulatory considerations. The following is a bulleted list of potential issues specific to this site and the alternatives described. Ways to address or mitigate these issues are provided where possible. Potential issues were considered in a general sense, and apply across the alternatives described above. The following should not be construed as an exhaustive list of considerations. More detailed designs will need to be developed for the site, changes may occur in land management plans, or changes may occur in the regulatory environment prior to implementation of a HFEP for this site. Therefore the following considerations were developed based on conversations GeoEngineers has had with Messrs. Sandidge, Small and Small (personal communication 2007), the USFS, and the CCCD, and based on experience GeoEngineers has had with similar projects.

LAND MANAGEMENT

- Orchard lands adjacent to the constructed backwater slough habitat at the apple orchard site will be relatively close to open water. Use of Best Management Practices (BMPs) regarding spray drift will at this site will be especially important,
- None of the alternatives discussed recommend either lethal or non-lethal removal of beaver. Each of the alternatives assume that fencing with address beaver depredation issues. Fencing is not proposed for lands owned by Betty Tyler. If it is determined that fencing should also be installed along this property, permission must be obtained from the owner, and an roughly 250 feet of additional fencing should be added to the budget,
- Lethal and non-lethal beaver removal may be alternatives selected by the landowner or land manager independent of the HFEP. Beaver removal is not considered in any of the alternatives presented because they are a native and obligate riparian species. Proper riparian function may depend on the continued presence of beaver at the site,
- If the H-D diversion is abandoned, and the irrigation canal is reclaimed as irrigable acreage, irrigation water will be needed to serve these lands. Any changes to irrigation water use should consider the potential need for irrigation water for reclaimed acreage,

- If the H-D diversion is abandoned and a portion of the bypass channel is reclaimed as irrigable acreage, irrigation water will be needed to serve these lands. Any changes to irrigation water use should consider the potential need for irrigation water for reclaimed acreage,
- Riparian vegetation will need to be maintained for the first 3 to 5 years after plantings have been completed,
- Construction of side-channel and pool habitat where pear orchard is currently located may create challenges if the HFEP is discontinued and the landowner or manager elects to restore orchard or other agricultural crops to the site.

ECONOMICS

HFEP partners are attempting to devise a program that sustains the economic viability of orchard lands, while improving riparian, floodplain, and aquatic habitat conditions. This project describes potential riparian and aquatic habitat enhancement actions at SANRAY ORCHARDS. It does not, however, provide an economic analysis. Rather, the IRIS is working with Chelan County and economists to devise incentive programs that would enable implementation of riparian and aquatic habitat enhancement programs, such as those described in this project.

During the May 11, 2007 site visit, discussions of potential habitat enhancement actions at SANRAY ORCHARDS often led to concerns being expressed about the economic viability of the orchard, timing or sequencing of actions, and alternative means to compensate landowners for costs and opportunities lost if the HFEP were implemented. GeoEngineers, the CCCD, and the USFS made note of economic concerns, but were not asked by IRIS to address these concerns. This report provides a list of economic concerns to assist Chelan County and economists as they develop alternative HFEP incentive programs.

Concerns included:

- Costs to physically remove and properly dispose of any pear or apple orchard removed under this alternative,
- Costs to design, permit, and construct the riparian and aquatic habitat area,
- Costs to maintain riparian and aquatic habitat at the site once the HFEP is implemented,
- Costs of installing welded-wire beaver exclusion fencing,
- Costs to maintain beaver exclusion fencing,
- Costs of beaver management and repairs prior to implementation of this alternative,
- Costs of beaver management and repair subsequent implementation of the HFEP,
- Costs of riparian vegetation management prior to implementing this alternative,
- Previous costs of applying BMPs to manage spray drift,
- Costs to apply BMPs to manage spray drift if this alternative is implemented,
- Opportunities lost with premature removal of pear orchard,
- Costs of separating the 1.3 acre pear orchard from the 9 acre pear management “block”,
- Opportunities lost with removal of 0.3 acres of apple orchard,
- Opportunities to use land for alternative purposes (e.g. residential development),

- Local taxes/credits with the removal of pear and apple orchard, and replacement with riparian and aquatic habitat, and
- Federal tax considerations with removal of pear and apple orchard.

REGULATIONS

Once a conceptual restoration alternative has been selected, a more detailed design will be developed. More detailed permitting and regulatory requirements can be developed at that time. There are several regulatory and permitting considerations for this site, even with a conceptual level of development, such as the following:

- Local, state and federal permits will be needed for construction activities within the ordinary high water make, and within shoreline jurisdictional areas.
- If the HFEP were implemented at a site, and Chelan County updated its zoning or critical habitat designations, lands currently used for orchard may be designated as open space or critical areas (e.g. riparian habitat). To avoid this problem, Chelan County may need to create a separate landuse designations for any lands enrolled in a program like the HFEP. There may be an opportunity to address this issue, if the County considers using the public benefit rating system to change designation of any lands enrolled in a program like the HFEP. As an alternative, Chelan County could handle HFEP proposals as a conditional use.
- Water resource management may prove a regulatory challenge for any irrigated lands converted to riparian and aquatic habitat. Failure to use water for a period greater than 5 years may result in relinquishment of rights. To avoid relinquishment, water might be applied to riparian vegetation, or used on “reclaimed” lands, as described earlier in this document. Another option would be to place water no longer used for irrigation purposes into the Washington State trust water program. This would require that a preliminary determination of the validity and extent of irrigation water use at the site. This would also require a determination of the Annual Consumptive Quantity (ACQ) of all H-D irrigation under the claim. Under an ACQ analysis, all lands served water by the H-D ditch would need to be evaluated for use. The ACQ would determine an estimate of the total quantity of water beneficially used and the total acreage served. These facts would be included in any determinations made about a proposed trust water right.
- If orchard lands are converted to riparian and aquatic habitat, there may be federal, state and local constraints on efforts to convert these areas back to orchard land if the HFEP is discontinued. For example, construction of new aquatic habitat under this alternative may be used by endangered salmon (*O. tshawytscha*) or threatened steelhead (*O. mykiss*). If the HFEP is discontinued and the orchardist begins to restore lands to orchard, areas converted to aquatic habitat very likely would be protected under the Endangered Species Act. For the HFEP to work, orchardist would need assurances that there would not be risk of a “take” violation under the ESA if orchard lands were restored. To avoid such a quandary, the landowners may seek a Habitat Conservation Plan, Incidental Take Permit, or Section 10b “experimental” permit for implementation of the HFEP. Alternatively, the HFEP would need to provide a program and level of compensation suitable for the continual use of this space for riparian and aquatic habitat purposes.

CONCLUSIONS AND RECOMMENDATIONS

This report describes the demonstration project site, alternative potential riparian and aquatic habitat restoration actions, expected results and benefits to terrestrial and aquatic species, and challenges to implementing a HFEP project at SANRAY ORCHARDS. Alternative conceptual restoration plans are

provided to assist project partners in developing a shared vision of the on-farm riparian and habitat restoration component of the Habitat Farming Enterprise Program (HFEP). The landowner and land managers are interested, but have not committed to implementing any of the alternatives at this time. Rather, the landowner and land managers supported the development of alternatives described in this report to assist HFEP partners develop a vision for how the HFEP might be implemented in a manner that would support protection and restoration of riparian and aquatic habitat while sustaining family farming in north-central Washington. This conceptual restoration should be used by IRIS and HFEP partners to immediately address regulatory and economic issues to enable expeditious implementation of the HFEP demonstration project at SANRAY ORCHARDS and other orchards in north-central Washington.

SANRAY ORCHARDS is adjacent to the “Bridge-to-Bridge” Reach, an area of the Entiat River watershed prioritized for protection and restoration of aquatic resources (CCCD 2004). The orchard is also adjacent a section of the Entiat River that has existing floodplain, side channel habitat, mature riparian vegetation, relatively complex instream habitat and substantial groundwater upwelling providing base flow and thermal refugia during the heat of the year. Riparian areas within and adjacent SANRAY ORCHARDS were recently identified as the highest priority area for protection of riparian vegetation (GeoEngineers 2007). Further, this reach is a priority aquatic habitat restoration area (see CCCD 2004, 2206; UCSRB 2006) of the Entiat River as it is used heavily by spawning and rearing life stages of endangered steelhead (*O. mykiss*), and other aquatic species. Therefore, there is immediate need for development and implementation of a program like the HFEP to assist landowners with ongoing upland, riparian, and aquatic habitat protection and restoration efforts at this high priority site.

Three alternatives were developed to offer a range of options for consideration by landowners, land managers, the CCCD, the USFS, IRIS, Chelan County and other HFEP project partners. All three options offer significant riparian and aquatic habitat protection and enhancement benefits. HFEP project partners have agreed to use Alternative 1 (Extensive Habitat Enhancement) to illustrate the potential benefits of the HFEP and to solicit support for further analysis of regulatory, economic, and programmatic aspects of the program (see Appendix B). Regulatory and economic aspects of the HFEP were beyond the scope of this Conceptual Restoration Plan. This report, however, identifies a number of regulatory and economic issues which must be immediately addressed to enable implementation of the HFEP at the demonstration project site. GeoEngineers recommends that IRIS and HFEP partners immediately proceed with economic analyses and resolution of regulatory concerns. We also recommend that a forum be convened with prospective HFEP participants (orchardists and other riparian land owners) located throughout north-central Washington. The forum should be used to evaluate the applicability of actions proposed at the SANRAY ORCHARDS demonstration project site to other orchard and riparian land areas.

GeoEngineers appreciates the opportunity to provide technical assistance on this project. We are interested in further assisting with this effort and can provide further technical support as needed, facilitating resolution of economic and regulatory matters, and facilitating the landowner forum. There is a clear need to the immediate implementation of a program like the HFEP on sites like SANRAY ORCHARDS, and a willingness to participate as soon as regulatory, economic, and HFEP programmatic issues are resolved.

LIMITATIONS

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

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FIGURES





APPENDIX A
U.S. BUREAU OF RECLAMATION DESIGN DRAWINGS





APPENDIX B
HABITAT FARMING ENTERPRISE PROGRAM POSTERS

