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HOOD RIVER PRODUCTION PROGRAM HOOD RIVER FISH HABITAT PROTECTION, RESTORATION AND MONITORING PLAN

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HOOD RIVER PRODUCTION PROGRAM

Hood River Fish Habitat Protection, Restoration, and Monitoring Plan

Prepared by:

Holly Coccoli[1]

And

Michael Lambert

The Confederated Tribes of the Warm Springs Reservation of Oregon
P.O. Box C
Warm Springs, OR 97761

Confederated Tribes of the Warm Springs Reservation of Oregon
Oregon Department of Fish and Wildlife
Hood River Watershed Group
USDA Forest Service

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[1] *Hood River Watershed Group, 2990 Experiment Station Drive, Hood River OR 97031*

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EXECUTIVE SUMMARY

Effective habitat protection and rehabilitation are essential to the long-term recovery of anadromous fish populations in the Hood River subbasin. This Habitat Protection, Restoration, and Monitoring Plan was prepared to advance the goals of the Hood River Production Program (HRRP) which include restoring self-sustaining runs of spring chinook salmon and winter and summer steelhead. The HRPP is a fish supplementation and monitoring and evaluation program initiated in 1991 and funded by the Bonneville Power Administration (BPA) as part of the Northwest Power Planning Council Fish and Wildlife Program. The HRPP is a joint effort of the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) and Oregon Department of Fish and Wildlife (ODFW).

Using recent watershed assessment and federal watershed analysis reports, this Plan reviews the historic and current condition of riparian, instream and upland habitats; natural watershed processes; anadromous and resident fish populations; identifies limiting factors, and indicates those subbasin areas that need protection or are likely to respond to restoration. Primary habitat restoration needs were identified as (1) improved fish screening and upstream adult passage at water diversions; (2) improved spawning gravel availability, instream habitat structure and diversity; and (3) improved water quality and riparian conditions.

While several early action projects have been initiated in the Hood River subbasin since the mid 1990s, this Plan outlines additional projects and strategies needed to protect existing high quality habitat, correct known fish survival problems, and improve the habitat capacity for natural production to meet HRPP goals.

1. INTRODUCTION

Native populations of spring chinook and coho salmon in the Hood River have become extinct while fall chinook salmon, summer and winter steelhead, sea-run cutthroat, Pacific lamprey, and bull trout have declined to very low numbers. Extinct and depressed fish runs are symptoms of not a single deleterious land use or management practice, but instead are the result of multiple and cumulative impacts to the watershed ecosystem over time. Over the last 150 years, land and resource use practices on public and private lands have resulted in extensive loss of spawning and rearing habitat for anadromous salmonids and resident trout. Dams, agricultural and forest management practices, channelization, road construction, water withdrawals, fisheries management, migration barriers, and other factors have all contributed to a reduction in species diversity and abundance. Only by improving land management practices and restoring stream systems to a desired habitat condition is it possible to restore healthy, self-sustaining salmonid populations.

Salmonids have thrived in the Columbia Basin for thousands of years. Salmon and steelhead are valued as prime recreational and commercial fish and are an essential part of the heritage and environmental quality of the Pacific Northwest. Salmon and steelhead continue to be the foundation of Native American culture for the CTWSRO and other Tribes. The 1855 Treaty with the Tribes of Middle Oregon specifically reserved to CTWSRO the right to fish at all their usual and accustomed fishing areas throughout the Columbia Basin, along with a sufficient quantity and quality of aquatic habitat to maintain harvestable fish runs. In addition, the treaty reserved tribal access to certain lands for hunting, gathering traditional foods and medicinal herbs, and religious purposes. Upon signing the treaty, the United States government promised to protect these rights which have been consistently reaffirmed by the federal courts.

As the co-managers of fisheries resources the CTWSRO and ODFW, in collaboration with the Hood River Watershed Group (HRWG) and U.S. Forest Service (USFS), have identified a number of constraints that limit the production of anadromous fish in the Hood River subbasin. Resolving these concerns will require close cooperation with private landowners and state, local, and federal agencies with jurisdiction over activities within the subbasin.

1.1 Hood River Production Program Background

Measure 703(f)(5) of the Northwest Power Planning Council (NPPC) 1987 Fish and Wildlife Program recommended that BPA investigate the feasibility of artificial production facilities for chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*O. mykiss*) in the Hood, Umatilla, Walla Walla, Grande Ronde, and Imnaha rivers. These facilities, known as the Northeast Oregon Hatchery Project (NEOH), were to be used to supplement natural production in these rivers.

Measure 703(f)(5) of the Program further stated that prior to design of the facilities, a Master Plan would be developed by the tribes and fish agencies for review and approval by the NPPC. In 1991, the NPPC agreed to separate the Hood River portion of the NEOH and link it with the Pelton Ladder Project. This occurred because the Pelton Ladder Master Plan had identified the Hood River subbasin as a destination for spring chinook salmon smolts produced by the Pelton Ladder Project (Smith 1991) and the Hood River Production Master Plan identified a need for spring chinook salmon production (O'Toole and ODFW 1991).

In 1992, the NPPC accepted the Hood River Production Master Plan and recommended adoption of a phased approach consisting of evaluation studies, project implementation, and follow-up monitoring and re-evaluation. Comprehensive data collection began in the Hood River subbasin in late 1991, including information on the life history and production of anadromous salmonid stocks returning to the subbasin (Olsen et al. 1994). Information collected for the HRPP was used to prepare an Environmental Impact Statement (EIS) evaluating project impacts on the human environment.

The HRPP is funded by the BPA and jointly implemented by the CTWSRO and the ODFW. The primary goals of the HRPP are (1) to re-establish naturally sustaining spring chinook salmon using Deschutes River stock, (2) rebuild naturally sustaining runs of native summer and winter steelhead, (3) maintain the genetic characteristics of the populations, (4) restore degraded fish habitat, and (5) contribute to tribal and non-tribal fisheries, ocean fisheries, and the NPPC interim goal of doubling salmon runs.

In Section 7 of the 1994 Columbia River Basin Fish and Wildlife Program, the NPPC reiterated its determination that artificial production and habitat actions should be fully coordinated (NPPC 1994). In 1996, an EIS was completed for the HRPP cooperatively by BPA, CTWSRO, and ODFW (DOE and BPA 1996). The EIS recommended re-establishing or rebuilding self-sustaining populations of anadromous salmonids in the Hood River subbasin through a combination of supplementation, habitat improvements, and a monitoring and evaluation program. BPA issued a record of decision on October 10, 1996 to proceed with the recommended alternative.

Currently, the HRPP is working to rebuild native winter and summer steelhead populations and to reestablish spring chinook salmon in the Hood River. The Powerdale Trapping Facility operated by the ODFW and the Parkdale Fish Facility operated by CTWSRO, provide support for HRPP monitoring and supplementation activities within the subbasin. These facilities were completed in 1996 and 1998 respectively.

The HRPP seeks to integrate hatchery supplementation and natural production to increase stock abundance, productivity, and use of available subbasin habitat. The chances for HRPP success and long term recovery of salmonid populations ultimately depend on the effectiveness of habitat improvement and protection actions. It is anticipated that the hatchery component of

the program will be phased out over time subject to future evaluations. The combination approach of supplementation and habitat improvement is intended to facilitate a shift toward optimum habitat utilization and reduce reliance on traditional hatchery production in the Columbia River Basin (DOE and BPA 1996). Toward this end, a number of "early action" habitat projects including riparian restoration, passage improvements, and watershed assessment preparation - have been implemented by CTWSRO with BPA funding since 1996. Additionally, the USFS, Oregon Department of Environmental Quality (ODEQ), ODFW, and irrigation districts have completed projects such as fish passage remediation, water quality monitoring, and instream large wood placement.

1.2 Purpose and Objectives

To meet HRPP goals, including self-sustaining steelhead and spring chinook salmon populations, it is essential that (1) high quality spawning and rearing habitat is protected, restored or enhanced in the Hood River subbasin, and (2) problems affecting natural fish production are eliminated or minimized. The natural productivity of the existing salmonid habitat has been altered by historic and ongoing forest practices, irrigation withdrawals, hydro generation, agricultural practices, and transportation systems. Although alleviating problems and enhancing habitat will improve the subbasin's natural production capacity consistent with NPPC objectives, it is critical that the HRPP reinforce efforts to protect existing high quality aquatic habitats and actively cooperate with other agencies, land managers, and landowners to promote improved land and water management practices.

The Habitat Protection, Restoration and Monitoring Plan follows the watershed characterization and habitat needs described in the Hood River Watershed Assessment (HRWG 1999) and in federal watershed analyses prepared for the East, Middle and West Forks of the Hood River (USFS 1996a, USFS 1996b). Plan implementation will rely strongly on cooperation, partnerships and cost sharing between private landowners, federal, state and local government, and other organizations. Activities in this Plan will require close coordination between the ODFW, CTWSRO, and other project cooperators to ensure successful and cost-effective project completion and to meet the desired biological objectives. This Plan is a working document to be adjusted based on new information, funding availability, actual costs, project feasibility, cooperation between agencies and private landowners, and prioritization among projects.

The purpose of the Habitat Protection, Restoration and Monitoring Plan is to:

1. Identify strategies and actions to protect existing productive habitat;
2. Propose projects and strategies to restore and improve degraded habitat or water quality, and indicate their relative priority.

1.3 Relationship to Other Plans

In addition to being part of the BPA-funded Hood River Production Program described earlier, the Habitat Protection, Restoration and Monitoring Plan addresses habitat conditions and needs identified in the *Hood River Watershed Assessment* (HRWG 1999). The assessment methodology generally followed the Oregon Watershed Assessment Manual (Watershed Professionals Network 1998) which emphasizes geomorphic structure in determining habitat potential and planning stream restoration activities. Key findings of the assessment are summarized in Chapter 4. The *Watershed Assessment* was a project of the HRWG, a forum of state, tribal and federal agencies, stakeholders, and citizens. The HRWG is one of many locally formed watershed councils integral to the *Oregon Plan for Salmon and Watersheds.* The *Oregon Plan* seeks to foster coordination among state agencies and local cooperative action to help address Endangered Species Act and Clean Water Act concerns. Implementation of the Habitat Protection, Restoration and Monitoring Plan will assist meeting *Oregon Plan* objectives in the Hood River subbasin.

Implementation of the present Plan will strongly compliment watershed and fish habitat protection and restoration investments on federal lands. Fifty one percent of the subbasin lies within the Mt. Hood National Forest. The *Mt. Hood National Forest Land and Resource Management Plan* (USDA Forest Service 1990) established a system of land allocation and management guidelines for these lands. The *1994 Northwest Forest Plan* provided supplemental protection for late successional forest and riparian areas. Its Aquatic Conservation Strategy (ACS) components - riparian reserves, key watersheds, watershed analysis, and watershed restoration - are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems on federal lands. All USFS activities in the subbasin are intended to meet or be consistent with ACS objectives. Watershed analyses for the East, Middle and West Forks of the Hood River were completed in 1996 and contributed to the preparation of the *Hood River Watershed Assessment.*

Based on the Watershed Assessment, a locally-developed *Hood River Watershed Action Plan* will be prepared by the HRWG in the year 2000 with funding support from the Oregon Watershed Enhancement Board and CTWSRO. The projects described in this Habitat Protection, Restoration and Monitoring Plan were prepared by CTWSRO and ODFW in collaboration with the USFS and HRWG, and will be identified as anadromous fish priorities for incorporation into the local *Watershed Action Plan.* The *Watershed Action Plan* will be broader in scope and address additional measures such as environmental education, land use planning, on-farm and residential water use efficiency, pesticide use practices, water quality monitoring. A technical advisory committee for the *Watershed Action Plan* development will include CTWSRO, ODFW, USFS, ODEQ, and local government representatives.

The present Plan encourages measures that address land use management practices. The Hood River County Comprehensive Land Use Plan adopted in 1984 governs land use on non-

federal land. Hood River County is required to complete periodic reviews to fulfill state-mandated goals, including natural resource and fish habitat protection, but is lagging behind schedule.

The present Plan would implement habitat protection and improvement needs and objectives identified earlier in the *Hood River Subbasin Salmon and Steelhead Production Plan* (ODFW and CTWSRO1990), namely to provide optimum habitat for all anadromous salmonid freshwater life stages and to improve passage for upstream and downstream migrant salmonids. Projects in this Plan implement several of the strategies outlined in the *Hood River Subbasin Salmon and Steelhead Production Plan.* The *Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon* (Columbia River Inter-Tribal Fish Commission 1995) presented institutional and technical recommendations for the Columbia Basin and a Hood subbasin plan calling for fish screen improvements, continued habitat projects, supplementation, monitoring and evaluation; enforcement of water quality standards; and instream flow restoration.

Several projects included in this Plan address water quality improvements and support ongoing water quality planning. To comply with Clean Water Act requirements for non-point source pollution, the ODEQ has begun a *Total Maximum Daily Load* evaluation process for the Hood River subbasin that is expected to focus on stream temperature. Completion is anticipated during the year 2000. With oversight and funding from the Oregon Department of Agriculture, the Hood River Soil and Water Conservation District is developing a *Hood River Agricultural Water Quality Management Area Plan* to address agricultural water quality problems as required by Oregon State Senate Bill 1010. A local advisory committee of agricultural landowners was convened in 1999 and includes CTWSRO participation. The Agricultural Water Quality Management Plan will be finalized in the fall 2000 and subject to approval by ODEQ and EPA.

Farmers Irrigation District (FID) has completed a *Water Conservation Plan* which outlines district objectives for system efficiency, water use and supply, and instream flow and habitat restoration (FID 1995). Several projects in the Water Conservation Plan would assist meeting those objectives.

A *Bull Trout Conservation Plan* is being prepared by the interagency Hood Basin Bull Trout Working Group, and a *Bull Trout Recovery Plan* is being developed by the U.S. Fish and Wildlife Service as required by the 1998 Endangered Species Act listing for bull trout. Similarly, several projects in the Bull Trout Recovery Plan will improve habitat conditions for salmonid species including bull trout.

Additionally, the habitat protection and improvement measures proposed in this document compliment fisheries enforcement efforts by state and tribal authorities. Oregon State Police (OSP) enforces fishing regulations in the Hood River subbasin with special attention to ESA-listed salmonids. OSP fisheries enforcement activities in the Hood River subbasin follow annual work plans such as the *Laurance Lake Bull Trout Action Plan* (e.g., Oregon State Police 1999) and the *Hood River Adult and Juvenile Steelhead and Bull Trout Plan* (e.g., Oregon State Police 1999). The Columbia River Inter-Tribal Fisheries Enforcement agency monitors fisheries in the Columbia

River and enforces closures around the mouth of the Hood River.

2. DESCRIPTION OF HOOD RIVER SUBBASIN

2.1 General Features

The Hood River is a tributary of the Columbia River, joining it on the south side of the Columbia River Gorge 22 miles upstream of Bonneville Dam. The Hood River subbasin is bounded on the west by the Cascade mountain range, on the east by Mosier Creek, on the south by the Sandy and White River drainages and on the north by the Columbia River. The subbasin covers 339 square miles, or approximately 217,337 acres. For watershed analysis and assessment purposes, the Hood River subbasin was divided into four U.S.G.S. Hydrologic Unit Code (HUC) 5th field watersheds and fifty 6th field subwatersheds (Figure 1).

Subbasin elevations range from 11,245 feet to 74 feet above sea level. Pleistocene glaciation produced most of the topographic features that form the Hood River valley landscape, while Mt. Hood glacial meltwater and Holocene-era floods produced terraces of fluvial clay, silt, sand, gravel and boulders (PacifiCorp 1998). Basin rock formations are primarily volcanic, with the Columbia River basalt the most widespread. Bedrock channel formations of basalt and basaltic andesite occur in the West Fork and its tributaries.

The Hood River stream network consists of three main forks - the West, Middle, and East Forks – which converge into the mainstem Hood River near RM 12.0. Major tributaries to the West Fork include Greenpoint, Lake Branch, Elk, and McGee creeks. Tony, Coe Branch, Eliot Branch, and Clear Branch creeks are major tributaries to the Middle Fork Hood River. Evans Creek and Dog River are major tributaries to the East Fork Hood River, and Neal Creek is a major tributary to the mainstem Hood River. These tributaries are especially important because they support anadromous fish. The subbasin contains approximately 400 miles of perennial stream channel of which an estimated 108 miles is accessible to anadromous fish. Figure 2 shows the location of major streams, HRPP facilities and key subbasin features.

Five tributaries are fed by glacial sources that drain approximately one third of the total glacial ice on Mt. Hood (USFS 1996b). These are Newton and Clark Creeks in the East Fork watershed, Coe and Eliot Branches in the Middle Fork, and Ladd Creek in the West Fork watershed. During high flows, these tributaries transport large amounts of bedload and sediment. Glacial melt increases water turbidity in the form of suspended silt and glacial flour during summer and early fall. Glacial sediment is more prevalent in the Middle and East Forks of the Hood River and in the mainstem Hood River, while glacial sediment in the West Fork Hood River is contributed only by one small tributary, Ladd Creek. Natural disturbances which commonly contribute significant amounts of sediment to stream channels include landslides and dam break floods that originate on glacial

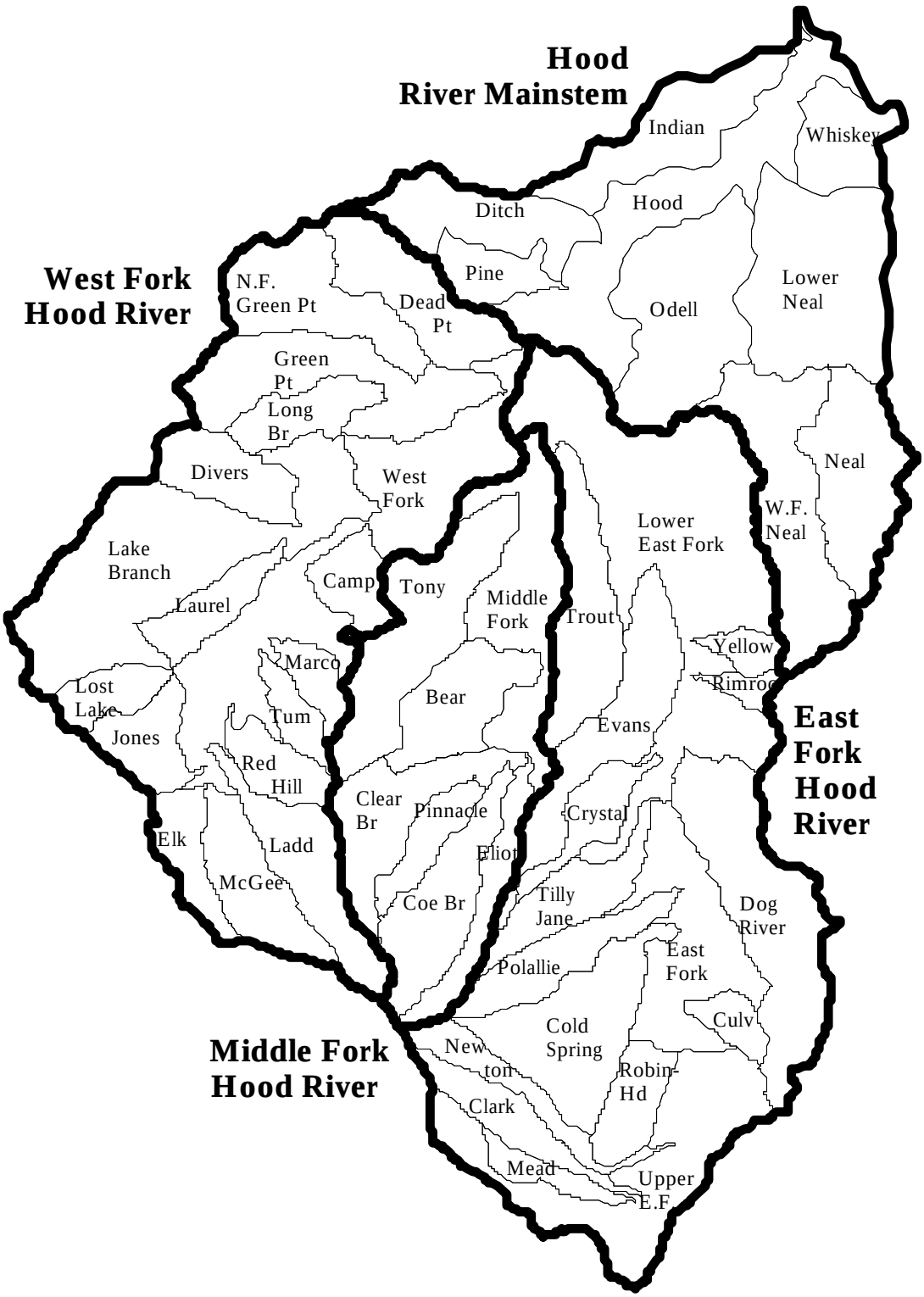


Figure 1. U.S.G.S. fifth-field Hydrologic Unit Code watersheds and sixth-field subwatersheds delineated for the Hood River subbasin.

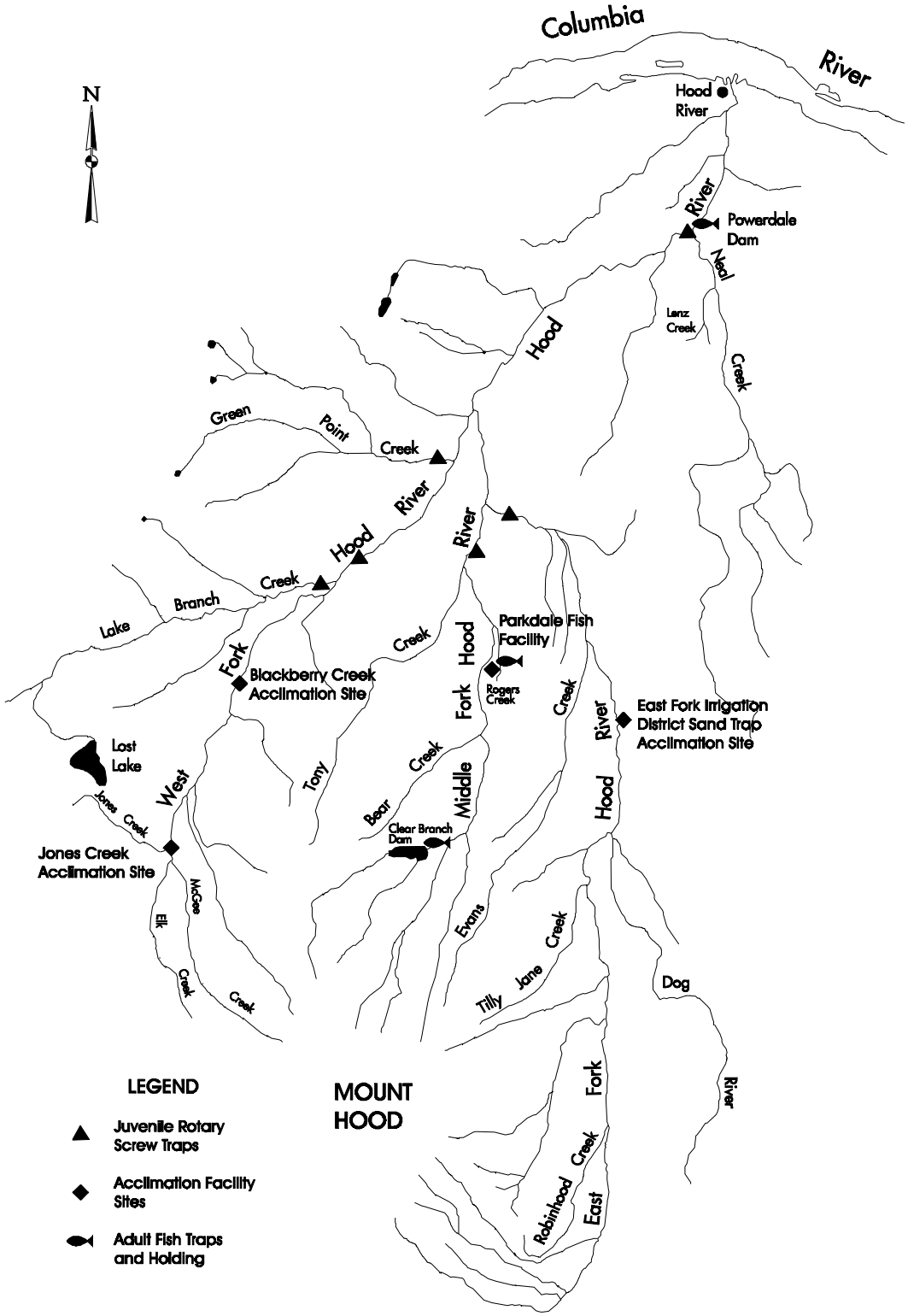


Figure 2. Diagram of major tributaries within the Hood River subbasin showing locations of Hood River Production Program facilities.

moraines and steep slopes of Mt. Hood.

Most stream channels in the subbasin are moderate to high gradient and confined by terraces or narrow v-shaped valleys with limited floodplain area. Notably, much of the mainstem Hood River, the East Fork and portions of the West Fork consist of low gradient reaches under 2.5 percent or less. Channel morphology is characterized predominantly by single thread channels with low sinuosity. Coarse boulder-rubble substrates are predominant. Eleven channel habitat types were identified in the Hood River subbasin using the Oregon Watershed Assessment channel habitat classification scheme (Watershed Professionals Network 1999). These are listed below in order of prevalence and their distribution is shown in Table 1.

- MV Moderately steep, narrow valley
- SV Steep headwater
- VH Very steep headwater
- MM Low-to-moderate gradient, moderate terrace/hillslope confinement
- MC Moderate gradient constrained
- AF Alluvial fan/elongated glacial outwash
- MH Moderate gradient headwater
- FP3 Floodplain small stream
- LC Low gradient constrained
- FP2 Floodplain medium/large stream
- BC Bedrock canyon

Table 1. Distribution of channel habitat types among perennial streams in the Hood River by 5th Field watersheds (U.S.G.S. Hydrologic Unit Code).

5th Field Watershed	**Channel Habitat Types** (total stream miles)										
	FP2	**FP3**	**AF**	**MM**	**LC**	**MC**	**MV**	**BC**	**SV**	**VH**	**MH**
Mainstem Hood River	1.2	4.4	0	12.4	4.3	5.6	22.1	0	15.9	1.8	5.1
West Fork Hood River	0	0	2.4	10.8	0	8.0	26.6	1.1	39.6	15.7	1.9
Middle Fork Hood River	0	0	5.0	7.4	0	5.4	16.1	0	6.7	14.4	0
East Fork Hood River	0	2.3	16.1	28.4	0.8	17.5	27.6	0	22.5	28.3	5.0
Total miles	1.2	6.7	23.5	59.1	5.0	36.6	92.4	1.1	84.8	60.2	12.0
Percent of Subbasin	<1	2%	6%	15%	1%	10%	24%	<1	22%	16%	3%

Most stream channels in the subbasin, or 77 percent of the total stream length, are confined by hill slopes or terraces and have limited floodplain area. Forty one percent consists of channels

classified as a sediment source, 36 percent as sediment transport, and 23 percent as sediment deposition zones. Lower gradient (<3.5 percent) and unconfined to moderately confined channels contain important depositional areas for wood and sediment and have the greatest potential for complex habitat development and fish production. Channel types where these characteristics predominate are MM and FP2/FP3 channels. While MM channels are probably the primary spawning and rearing habitat in the subbasin, significant pockets of spawning and rearing habitat occur locally within other channel habitat type designations.

2.2 Climate and Hydrology

The subbasin is located in the transition zone between weather dominated by wet marine airflow to the west and the dry continental climate of eastern Oregon. About two-thirds of the Hood River Watershed is within the Cascades ecoregion and has a moist temperate climate (Pater, D. E. et al. 1998). The northeast portion is in the Eastern Cascades Slopes and Foothills ecoregion and has a dry continental climate. Mean annual precipitation ranges from 130 inches on the upper west boundary in the Cascade Range to less than 30 inches in the lower east valley.

Typical of many Cascade mountain streams, the hydrology of the subbasin is characterized by highly variable streamflow and rapid storm runoff. Short, steep channels with limited floodplain storage contribute to a "flashy" peak flow pattern. The Hood River mean annual flow is 1,079 cfs, recorded at the USGS Gage No. 1412000 at Tucker Bridge (RM 6.1). The record flood is reported as 33,200 cfs and occurred December 22, 1964. Mean monthly flow ranges from a low of 342 cfs in September to a high of 1,605 cfs in January (period of record 1966 to 1997). Snowmelt generally begins during April. The minimum 7-day average low flow of the Hood River at Tucker Bridge was 155 cfs and occurred in September 1994 (period of record 1966 to 1997). Many tributaries have very low summer flows, while tributaries with glacial sources maintain higher flows.

Natural disturbances that occur in the subbasin include floods, fires, debris flows, landslides, and insect epidemics. Evidence suggests that most natural disturbance processes in the West Fork watershed are primarily climate driven (USFS 1996a; USFS 1996b). Mass wasting or landslides are common to semi-common events and are a major force in shaping riparian and aquatic habitat conditions. Periodically, natural dams created by terminal moraines at receding glaciers on Mt. Hood break and cause debris flows triggered by intense rainstorms. Ladd, Coe, Pollalie, Eliot, Clark, and Newton creeks have a history of these events. Stand-replacing fires were historically large scale but rare events. Below 4,000 feet, fire return is driven by seasonal drought combined with prolonged drought. Rain-on-snow floods are common disturbance events. The USFS has observed the rain-on-snow zone to extend up to 6,500 feet elevation in the East Fork Hood River drainage.

2.3 Land Use, Economic, and Cultural Setting

Land use is governed by the 1984 County Comprehensive Land Use Plan, which established urban growth boundaries for the City of Hood River and the towns of Parkdale, Odell, and Mt. Hood. The County experienced an annual growth rate of 2.04% between 1990 and 1995 (CGEDA 1998). County population is projected to increase by 3,000 to 4,000 people every five years, reaching an estimated 36,483 by the year 2040. Approximately 65 percent of the watershed is publicly-owned, with 51 percent in federal ownership. Of the private land, a large percentage is zoned as either Exclusive Farm Use (one third) or Forest Land (one half). The remaining 17 percent of land is in mixed-use private ownership. The County is neither urban nor rural, but somewhere in between with small urban centers in Odell, Parkdale, and the City of Hood River. The population is dispersed, with 67 percent of County residents living outside of urban growth boundaries. Zoning under the current Comprehensive Land Use Plan will allow an estimated 4,200 new lots and parcels that will accommodate about 10,000 additional people outside of City limits (USFS 1996a). Conversion of forest and pasture to single-family residential development is rapidly increasing in rural lands outside of the urban growth areas.

The economy of the Hood River subbasin centers on agriculture (primarily pear and apple orchards), recreation and tourism, and forestry. Approximately 15,000 acres of orchard and 2,000 acres of pasture are irrigated. The majority of agricultural operations consist of small acreage farms. Among the 305 farms with sales of ten thousand dollars or more annually, the average farm size is 73 acres (Seavert 1994). Of these, the majority are 49 acres or smaller.

Outdoor recreation and tourism has expanded into the second biggest economy in the watershed. Recreational use on public and private forestlands is increasing as the population grows in Portland and in the Columbia River Gorge area. The Mt. Hood National Forest, Mt. Hood Meadows Ski Resort and the Columbia River Gorge National Scenic Area draws visitors, while the City of Hood River is an international windsurfing destination. Whitewater kayaking, angling, hiking, general tourism, camping, snow sports and mountain biking are increasing watershed uses. Recreational fishing is a popular activity within the Hood River subbasin. Most recreational fishing occurs in the lower four miles of the Hood River below Powerdale Dam. Targeted species include summer and winter steelhead, spring chinook salmon, and resident trout. A strong link between tourism and land development in the Hood River valley is noted by historians and continues today (USFS 1996b).

Forestry continues to be an important economic activity, with two lumber mills currently in operation. Hood River County owns approximately 30,000 acres dedicated as industrial forest or 15 percent of the subbasin. Timber sales from County land contributes about one third of revenues for public services. Longview Fibre Company owns 22,000 acres of industrial forestland in the Neal Creek and West Fork Hood River drainage areas, and along Tony Creek.

The entire Hood River subbasin is located within the boundary of lands ceded to the United

States by the seven bands of Wasco- and Sahaptin- speaking Indians whose representatives were signatories to the Treaty with the Tribes of Middle Oregon of June 25, 1855. 12 Stat. 963. The CTWSRO is the legal successor in interest to the Indian signatories to the treaty (ODFW and CTWRSO 1990). Article I of the treaty describes the 10-million acre area of eastern Oregon ceded by the Tribes to the United States and sets out the boundaries of the Warm Springs Indian Reservation (Figure 3). Article I also contains "the express right of taking fish in the streams running through and bordering said reservation and at all other usual and accustomed stations, in common with citizens of the United States." While the Hood River is not a stream bordering or running through the Warm Springs Indian Reservation to which the Tribes reserved an exclusive fishing right, it is a stream that has traditionally been fished by tribal members and their forefathers. Thus, the Tribe's treaty rights attach at all usual and accustomed fishing places throughout the Hood River subbasin. Tribal rights include a harvest allocation right to take up to half the harvestable number of each salmon and steelhead run passing the Tribe's usual and accustomed fishing places, as well as a right to sufficient habitat quality and quantity to maintain harvestable run sizes. The CTWSRO and its members own several hundred acres of trust allotments located near the City of Hood River. These lands are managed by the Bureau of Indian Affairs and are not subject to state or local land-use regulations.

The HRWG serves as a local forum for public education and agency coordination in watershed health and fish recovery efforts, and generates volunteer involvement in habitat improvement work. Formed in 1993 under the sponsorship of the HRSWCD, it is formally recognized as the subbasin watershed council by the Hood River County Board of Commissioners. The HRWG states its mission as *"to sustain and improve the Hood River Watershed through education, cooperation and stewardship"* and makes decisions by consensus at open meetings held each month. Active participants include orchardists, irrigation districts, industry, sport fishers, forestry, environmental groups, water/sewer districts, small business, local government, state and tribal agencies, the USFS, Natural Resources Conservation Service, and the interested public. CTWSRO and ODFW representatives serve on the HRWG Technical Advisory Committee and provide regular status reports on HRPP activities and anadromous fish populations at HRWG meetings. The HRWG completed a Watershed Assessment in 1999 with funding from the Governor's Watershed Enhancement Board, For the Sake of the Salmon Foundation, and from CTWSRO.

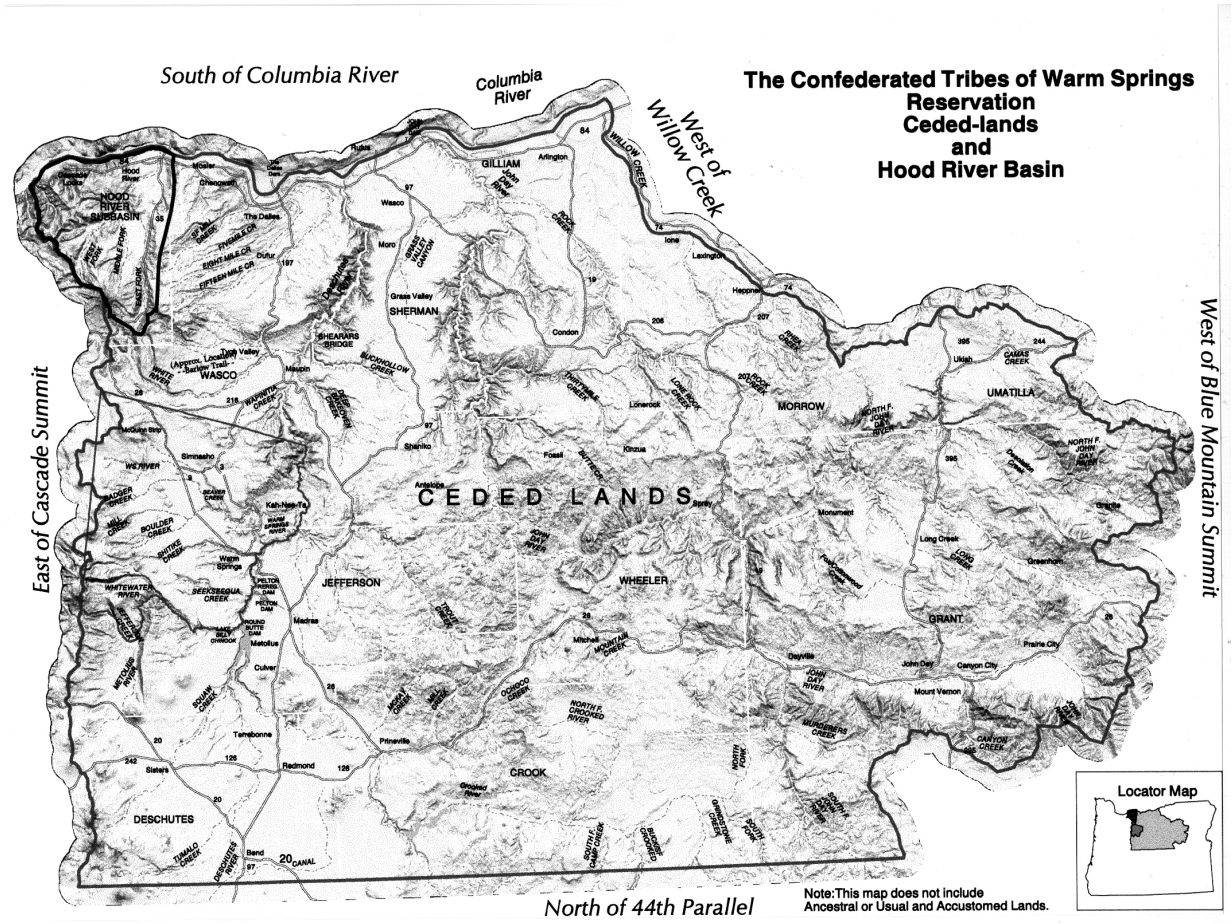


Figure 3. Diagram showing the location of the Confederated Tribes of the Warm Springs Reservation, Ceded-lands, and Hood River subbasin within the Ceded-lands.

3. ANADROMOUS AND RESIDENT FISH

3.1 Introduction

Many manmade and natural occurrences have contributed to the extinction or decline of fish stocks in the Hood River subbasin over time. Extensive use of fish wheels and horse seines in the Columbia River and tributaries were reported as a large factor in basin wide declines in the early 1900s (USFS 1996a; USFS 1996b). Contributing factors occurring within the subbasin from 1915 to the 1950s included the use of streams and splash dams for log transport, passage barriers, water withdrawals for irrigation and hydropower, and unscreened diversions (USFS 1996a; USFS 1996b). Three major dams have adversely impacted anadromous fish in the Hood River: Hines Dam on the East Fork (RM1.2), Clear Branch Dam (RM 1.0) on a Middle Fork tributary, and Powerdale Dam on the mainstem Hood River (RM 4.5). Hines Dam was built in 1907 and was a barrier for 41 years (USFS 1996b) before it was breached in 1966. Clear Branch Dam was built in 1969 and is a complete barrier to upstream migration. Prior to dam construction, coho salmon and winter steelhead spawned in a segment of Clear Branch that is currently inundated by Laurance Lake. Powerdale Dam, constructed in 1923, continuously diverted up to 500 cfs from a 3-mile bypass reach without any minimum instream flow requirement until 1965. Major water diversions, including the 127 cfs East Fork Irrigation District (EFID) diversion, was operated without fish screens for decades. These activities, combined with overfishing, intensive timber harvest, road construction, culvert barriers, stream cleanout, beaver trapping, and natural events such as drought and catastrophic debris flows have all contributed to the decline and/or extinction of fish runs in the Hood River system.

3.2 Historic Species Abundance and Distribution

Little information about historic fish populations is available for the pre-1900 period. Pioneer accounts report indigenous trout in Lost Lake, Lake Branch and the West Fork Hood River. Exploration parties in 1878 and 1880 noted that Lost Lake was “alive with trout” at dusk. In less than one hour, a man caught enough 8-12 inch trout from a single pool in Lake Branch to feed 7 people two meals apiece (USFS 1996a; USFS 1996b). On October 20, 1899, the Glacier newspaper reported settler Chris Dethman’s catch, likely of coho salmon - “so far has amounted to 112 fine salmon trout” at the mouth of Neal Creek (Krussow 1989). Pat Moore, valley resident, recalls his grandfather saying that steelhead in Neal Creek were so numerous in his childhood, circa 1915, that “ you could stand there and pitchfork them out”. Mr. Moore also recalled a large run of searun cutthroat went up Shelley Creek, a Neal Creek tributary. Longtime residents Jerry Routson and David Winans recall large numbers of salmon or steelhead migrating

up into the West Fork over Punchbowl Falls even before 1957 fish ladder construction. Both noted that the scene "resembled Celilo Falls except on a small scale" and attracted crowds of tourists on warm weekends (HRWG 1999).

Anadromous fish distribution in the subbasin was more extensive under historical conditions. Anadromous fish reported to occur in the East Fork historically were steelhead, coho, searun cutthroat and Pacific lamprey. Steelhead are documented upstream as far as Cold Springs Creek in the East Fork Hood River and could have migrated much further (USFS 1996b). Coho and steelhead were likely found in the Middle Fork upstream to Clear Branch above Pinnacle Creek. Predominant anadromous species in the West Fork were likely steelhead, searun cutthroat, spring chinook and Pacific lamprey (USFS 1996a), while fall chinook likely used the mainstem and lower East Fork Hood River. Pacific lamprey were formerly noted as common throughout the subbasin in the early 1960s (Oregon State Game Commission 1963). However, Pacific lamprey have not recently been observed above Powerdale Dam.

3.3 Current Distribution and Population Status of Anadromous Fish

Anadromous species presently found in the Hood River subbasin include spring and fall chinook salmon *(Oncorynchus tshawytscha)*, summer and winter steelhead (*O. mykiss iridius)*, coho salmon *(O.kisutch)*, sea-run cutthroat *(O.clarki)*, and Pacific lamprey *(Lamptera tridenta)*. Table 2 shows the general distribution and status of these anadromous stocks. Both indigenous and hatchery populations of summer and winter steelhead occur in the Hood River. Indigenous Hood River spring chinook salmon have been extinct since the early 1970s (ODFW and CTWSRO 1990). The coho and fall chinook salmon populations in the Hood River are currently at very low numbers and believed to be progeny of strays (Olsen et al. 1996). Steelhead in the Hood River were listed as threatened under the Endangered Species Act in 1998.

Indigenous resident fish species include bull trout, rainbow, and cutthroat trout. Bull trout were listed as a threatened species under the ESA in 1998. Introduced resident species include brook trout, brown trout, brown bullhead, and smallmouth bass.

HRPP hatchery releases include Deschutes River stock spring chinook salmon and Hood River stock winter and summer steelhead. Skamania summer steelhead are also released into the subbasin below Powerdale Dam for fishery purposes but are not allowed to migrate into upstream habitat. The current hatchery program in the Hood River subbasin was implemented in 1992. A full description of this program and a history of subbasin hatchery releases are provided in O'Toole and ODFW (1991), Olsen et al. (1994), Olsen et al. (1998) and Lambert et al. (December 1999).

Table 2. Primary distribution and status of anadromous fish populations in the Hood River subbasin.

Species	Spawning, Holding and Rearing Areas	Status of Wild Population
Spring chinook salmon	Elk Creek McGee Creek West Fork Hood River Mainstem Hood River	Native stock extinct; current natural production limited
Summer steelhead	West Fork Hood River and tributaries Lake Branch (lower) Mainstem Hood River Lower East Fork Hood River	Threatened Species - listed by NMFS March 1998
Winter steelhead	East Fork and tributaries Neal Creek Green Point Creek Middle Fork and tributaries Mainstem Hood River	Threatened Species - listed by NMFS March 1998
Fall chinook salmon	Mainstem Hood River East Fork Hood River	Native stock presumed extinct; current natural production limited
Coho salmon	East Fork and tributaries Middle Fork and tributaries Mainstem Hood River and small tributaries Neal Creek and tributaries	Native stock presumed extinct; current natural production limited
Sea-run cutthroat trout	East Fork and tributaries Middle Fork and tributaries Mainstem Hood River Neal Creek and tributaries	Severely depressed[a]
Pacific lamprey	Recently documented only below Powerdale Dam, other distribution uncertain	Significant decline from historic levels. Recent observations limited to mainstem Hood River below Powerdale Dam

[a] *Severely depressed = less than 100 spawners.*

Spring Chinook Salmon

The Oregon State Game Commission operated an adult trap at Powerdale Dam (RM 4.5) from 1963-1971 (ODFW and CTWSRO 1990). Trapping records support the conclusion that the Hood River indigenous population was extirpated. Between 1965 and 1971, only four spring chinook salmon passed through the Powerdale Dam fishway (Table 3). In 1986, ODFW officially declared Hood River spring chinook salmon extinct. The causes of extinction most likely included overfishing, poorly screened and unscreened diversions, a catastrophic debris flow in Ladd Creek and massive flooding which occurred during the 1960's, and severe summer

streamflow depletions below the Powerdale hydroelectric diversion. From 1923 to 1965, no minimum instream flow was maintained in the Hood River below this diversion. In August 1941, streamflows as low as 3 cfs occurred within the 3-mile bypass reach below the diversion dam (State Water Resources Board 1965). In 1965, a minimum flow requirement of 45 cfs was established and was increased to 100 cfs in 1983.

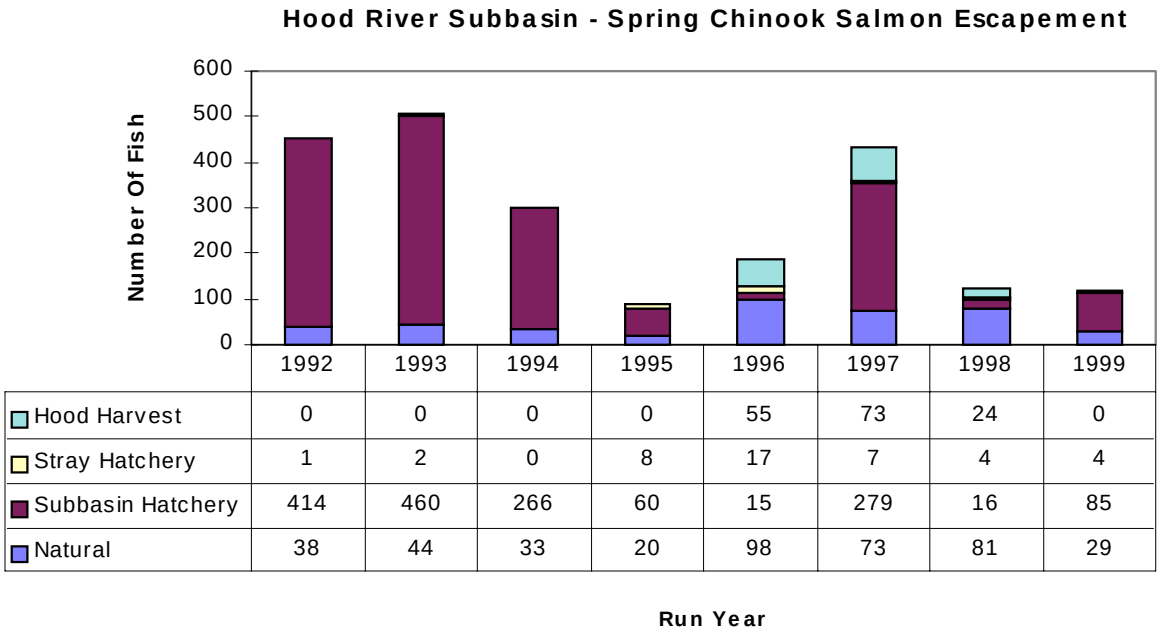
Table 3. Escapement of adult spring chinook salmon past Powerdale Dam, 1963-1971.

Year	Escapement
1963	22
1964	15
1965	0
1966	0
1967	1
1968	0
1969	1
1970	2
1971	0

ODFW stocked the Hood River subbasin with Carson broodstock between 1985-1992. As part of the HRPP, managers began using Deschutes River broodstock for the Hood River smolt supplementation program in 1993. The switch from Carson to Deschutes stock was to assist in building a self-sustaining population since Deschutes stock was considered better suited to the Hood River. The long term HRPP objective is to release 250,000 hatchery reared spring chinook smolts, however, as a phased in approach, 125,000 are released annually until 2002 when supplementation will be re-evaluated (DOE and BPA 1996). Starting in 1996, CTWSRO began acclimating and volitionally releasing 125,000 spring chinook salmon smolts into the West Fork Hood River using portable raceways. In 1999, a portion of these smolts were acclimated in the Middle Fork Hood River and volitionally released. Prior to the first acclimation release in 1996, all hatchery smolts were directly released from an ODFW liberation truck into the West Fork Hood River.

Spring chinook salmon returns to the Hood River subbasin are currently low (Figure 4). In 1999, the escapement of spring chinook salmon in the subbasin was 118, of these, 29 were naturally produced. By comparison, the HRPP spawner escapement goal for spring chinook salmon in the Hood River is 400 adults. Scale analysis indicates naturally produced spring chinook salmon return primarily as four year old adults (Olsen et al., December 1998). Spring chinook salmon adults enter Powerdale Dam trap beginning early in May and complete trap entry by late September to early October. Spawning ground surveys have shown peak spawning to

occur between late August and mid-September (Lambert et al. December 1998).



	1992	1993	1994	1995	1996	1997	1998	1999
Hood Harvest	0	0	0	0	55	73	24	0
Stray Hatchery	1	2	0	8	17	7	4	4
Subbasin Hatchery	414	460	266	60	15	279	16	85
Natural	38	44	33	20	98	73	81	29

Figure 4. Adult spring chinook salmon escapement to the Powerdale Dam trap on the Hood River (RM 4.0), 1992-1999. Mini-jack counts are not included.

Summer Steelhead

Punch card data collected during sport harvest by ODFW from 1977 to 1994 indicates that the Hood River supported healthy runs of summer steelhead in past years (Table 4). However, recent escapement data shows the native summer steelhead population has stabilized (Figure 5). During the 1998-99 run year 132 unmarked summer steelhead returned to the Powerdale Dam fish trap, up from 79 in the 1997-98 run year. By comparison, the HRPP spawner escapement goal for naturally produced summer steelhead is 1,200 adults.

Table 4. Sport harvest of summer steelhead in the Hood River subbasin, 1977-1995.[a]

Run Year	Sport Catch
1977-78	1770
1978-79	3064
1979-80	1105
1980-81	2499
1981-82	2854
1982-83	2749
1983-84	2406
1984-85	3626
1985-86	3745
1986-87	3307
1987-88	3135
1988-89	4455
1989-90	3226
1990-91	3015
1991-92	1576
1992-93	1111
1993-94	1107

[a] Estimates are from punch-card returns adjusted for non-response bias. Catch includes wild and hatchery summer steelhead.

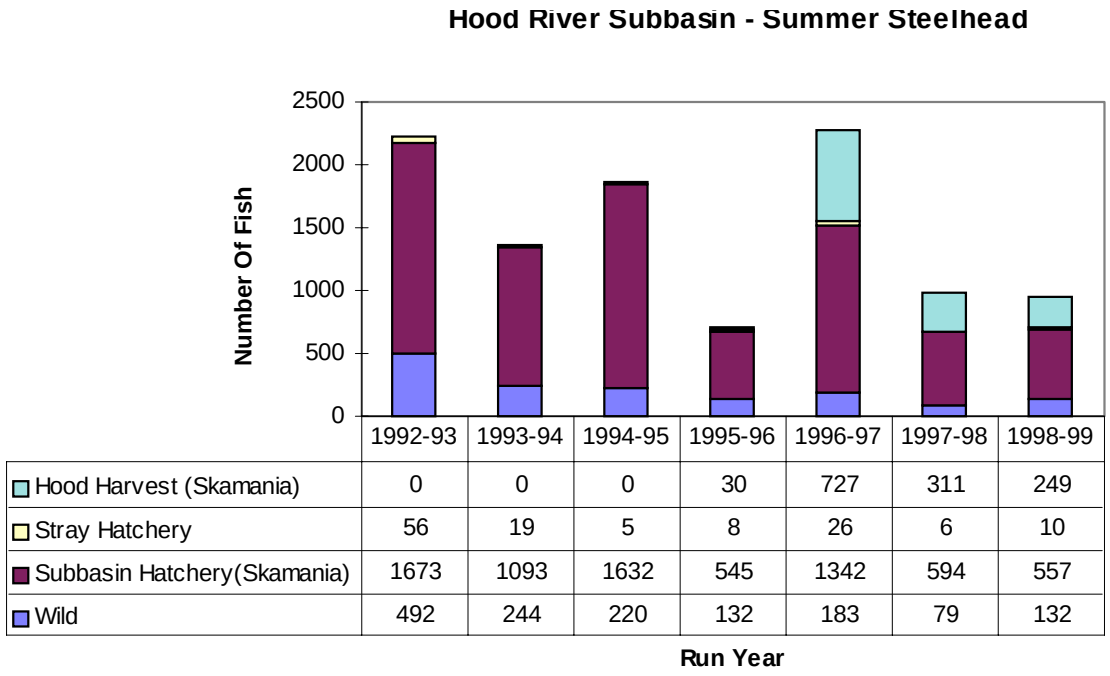


Figure 5. Adult summer steelhead escapement to the Powerdale Dam trap on the Hood River (RM 4.0), 1992-1999.

Steelhead in the Hood River are considered depressed by ODFW and CTWSRO, and were listed as Threatened under the Endangered Species Act in March 1998. Low numbers of wild summer steelhead returning to the Hood River have compelled the HRPP to collect Hood River native broodstock from the 1997-98 run year, one year earlier than planned. The first year of supplemental hatchery fish releases using Hood River stock was 1999. Approximately 19,500 smolts were acclimated and volitionally released from a portable acclimation raceway on the upper west Fork Hood River. Non-native summer steelhead (Skamania stock) have not been allowed above Powerdale Dam since August 1997.

Recent life history information collected on wild summer steelhead suggest that they migrate predominately as freshwater age-2 and age-3 smolts and return as ocean age-2 adults (Olsen et al., December 1998). Beginning in March of a given calendar year, summer steelhead enter the Powerdale Dam fish trap and migration continues through late April to early May of the following calendar year. The median migration date for wild summer steelhead occurs during July. Radio telemetry in 1994 through 1996 indicated that most wild summer steelhead spawn during March and April in the West Fork Hood River and tributaries.

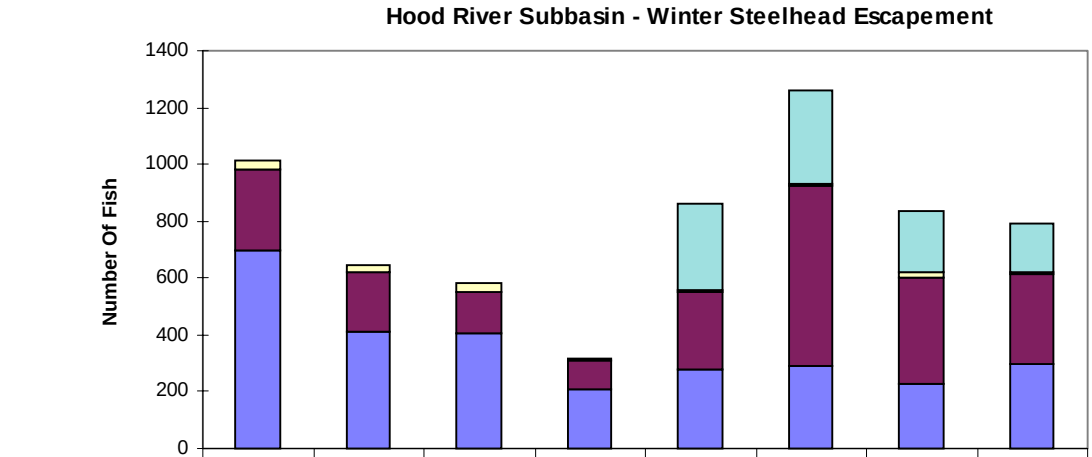
Winter Steelhead

Recent escapement data suggests that wild winter steelhead numbers have stabilized (Figure 6). Adult wild winter steelhead escapement for the 1991-92 run year was 699 and declined to 206 fish by the 1994-95 run year. Following the 1994-95 run year, wild winter steelhead numbers have slowly increased to 300 fish in the 1998-99 run year. This is below the HRPP spawning escapement goal of 1,200 adults for naturally produced winter steelhead. Along with summer steelhead, winter steelhead were listed as Threatened under the Endangered Species Act in March 1998.

Hood River winter steelhead have been collected for broodstock by ODFW since the 1990-91 run year. Starting with the 1995-96 run year, ODFW has collected hatchery broodstock from both wild and hatchery Hood River fish. Broodstock collection follows guidelines established in the ODFW Wild Fish Management Policy to protect the genetic integrity of the native population. Hood River stock hatchery winter steelhead were passed above Powerdale Dam beginning with the 1994-95 run year. The number of Hood River stock hatchery winter steelhead passed above Powerdale Dam will be regulated in accordance with guidelines established in the Hood River Annual Operating Plan (J. Newton, ODFW, *personal communication*).

The long term HRPP objective is to release 85,000 hatchery-reared winter steelhead smolts however, as part of a phased approach, 50,000 are to be released annually until 2002. In 2002, hatchery supplementation of winter steelhead will be re-evaluated. Winter steelhead are incubated and reared in Deschutes Basin facilities and volitionally released as full-term smolts

into the East and Middle Fork Hood River after acclimation. In the East Fork, CTWSRO, in cooperation with the EFID, uses one concrete bay at the EFID Sand Trap Facility to acclimate and release around 30,000 smolts. Additionally, on the Middle Fork, about 20,000 smolts are released from the Parkdale Fish Facility.



	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
Hood Harvest	0	0	0	0	301	328	215	166
Stray Hatchery	33	29	27	5	9	3	20	7
Subbasin Hatchery	284	208	148	107	271	638	373	316
Wild	699	412	406	206	280	289	227	300

Figure 6. Adult winter steelhead escapement to the Powerdale Dam trap on the Hood River (RM 4.0), 1991-1999.

Life history data for wild Hood River winter steelhead is limited for the Hood River. Wild winter steelhead in the Hood River typically migrate as age-2 and age-3 smolts and return as ocean age-2 and age-3 adults (Olsen et al. 1997). Hood River wild winter steelhead enter Powerdale Dam trap in early December and have completed migration by late June of the next calendar year. The median migration date occurs in April and early May. Radio telemetry indicates that wild winter steelhead spawn in most of the Hood River drainage and tributaries except the West Fork Hood River above Greenpoint Creek (Olsen et al. 1996).

Fall Chinook Salmon

Fall chinook salmon in the Hood River are at very low numbers (Table5) and are believed to be predominantly the progeny of hatchery strays (BPA 1996). Estimates of escapement to the Powerdale Dam fish trap ranged from 6 to 36 natural and 2 to 7 stray hatchery fall chinook

salmon for the 1992 to 1999 run years. Based on limited information, it is believed fall chinook salmon spawn in the mainstem and East Fork Hood River. Fall chinook salmon spawning downstream of Powerdale Dam are not documented or included in escapement estimates.

Table 5. Adult fall chinook salmon escapement to Powerdale Dam trap on the Hood River (RM 4.0), 1992-1999.

Run Year	Natural	Hatchery Stray	Total Escapement
1992	17	6	23
1993	6	4	10
1994	32	7	39
1995	8	4	12
1996	14	2	16
1997	28	2	30
1998	36	4	40
1999	19	0	19

Scale analysis indicates that naturally produced fall chinook salmon primarily migrate as sub-yearling smolts and return as 4 and 5 year old adults (Olsen et al. December 1998). Natural fall chinook salmon begin to enter the Powerdale Dam fish trap from early July to early August while stray hatchery fall chinook begin entering the trap in early to late September. Both natural and hatchery components of the run have completed migration by early November. No supplementation or hatchery program exists for fall chinook salmon on the Hood River.

Coho Salmon

The indigenous population of coho salmon in the Hood River subbasin have been classified by ODFW as extinct (BPA 1996). Most coho that return to the subbasin are out-of-basin hatchery strays (Table 6). Naturally produced adults have ranged from 0 to 23 adults since 1992. Based on radio telemetry studies, adult coho utilized the mainstem Hood River, East Fork Hood River, and Middle Fork Hood River. Adult coho salmon have been observed in Dog River (tributary to the East Fork), Neal Creek, and the mainstem Hood River. Juvenile coho salmon have been found in the East Fork Hood River, Baldwin Creek, Neal and Lenz creeks and in the mainstem Hood River (Olsen et al. 1996 and J. Newton, ODFW, *personal communication*).

Table 6. Adult coho salmon escapement to Powerdale Dam trap on the Hood River (RM 4.0), 1992-1999.

Run Year	Natural	Hatchery Stray	Total Escapement
1992	23	80	103
1993	0	33	33
1994	1	55	56
1995	11	40	51
1996	7	20	27
1997	7	6	13
1998	6	53	59
1999	11	20	31

Natural adult coho salmon enter the Powerdale Dam fish trap as early as the first two weeks of September and have completed their migration as late as December (J. Newton, ODFW, *personal communication*). The median date of migration occurs late September to early November (Olsen et al. 1997). No supplementation or hatchery program exists for coho salmon on the Hood River.

Pacific Lamprey

Little information is available on the historical abundance and life history information of lamprey *(Lampetra spp)* in the Hood River subbasin. Pacific lamprey were present historically within the subbasin and have declined to very low numbers (BPA and DOE 1996). Lamprey were reported as distributed throughout the subbasin in the early 1960s (Oregon Game Commission 1963). In recent years, lamprey have been observed only below Powerdale Dam. On August 3, 1999, a fish salvage effort by ODFW and CTWSRO prior to dam spillway repair work recovered six adult lampreys. Lamprey are important to Native American culture and are harvested in watersheds outside the Hood River as a traditional food. The causes of lamprey decline in the subbasin are not known.

Sea-run Cutthroat Trout

Sea-run cutthroat trout exists in small numbers on the Hood River and may be a spontaneous anadromous genetic trait of the resident cutthroat trout population. ODFW has listed sea-run cutthroat trout as a sensitive species (BPA and DOE 1996). No adult sea-run cutthroat has been captured in the Powerdale Dam fish trap since 1992 with the exception of 1997, when 3 fish were captured (Table 7). Hatchery juvenile sea-run cutthroat trout from Nestucca River, Alsea

River, and Big Creek stocks were released in the subbasin between 1973 and 1988 (ODFW and CTWSRO 1990).

Table 7. Sea-run cutthroat trout captured at Powerdale Dam fish trap (RM 4.0) on the Hood River, 1962-1999.

Year	Escapement	Year	Escapement
1962	8	1992	4
1963	27	1993	0
1964	17	1994	0
1965	27	1995	0
1966	57	1996	0
1967	101	1997	3
1968	134	1998	0
1969	177	1999	0
1970	18		
1971	45		

3.4 Current Distribution and Population Status of Resident Fish

Bull trout *(Salvelinus confluentus*), cutthroat trout *(O. clarki)*, rainbow trout *(O. mykiss)*, mountain whitefish *(Prosopium williamsoni*), bridgelip sucker *(Catastomus columbianus)*, sculpin (*Cottus spp.*) and dace *(Rhinichtys spp)* are indigenous species occurring in the Hood River subbasin. The general distribution of indigenous resident fish is presented in Table 8.

Bull Trout

Bull trout are native to the Hood River subbasin and are a species of special concern. Hood River bull trout are genetically distinct from other bull trout in Oregon (Spruell and Allendorf 1997). The population, including juveniles, is believed to number less than 300 and is classified as "*at high risk of extinction"* by ODFW (Buchanan et al. 1997). Bull trout were listed as Threatened under the Endangered Species Act in June 1998.

Table 8. Primary distribution of native resident fish within the Hood River subbasin (BPA 1996).

Species	Spawning and Adult Holding Areas	Rearing Areas or Juveniles Observed
Bull trout	Middle Fork Clear Branch Coe Branch and tributaries Pinnacle Creek Compass Creek	Middle Fork Clear Branch Coe Branch and tributaries Pinnacle Creek
Rainbow trout	Entire subbasin	Entire subbasin
Cutthroat trout	Entire subbasin	Entire subbasin
Mountain whitefish	Mainstem Hood River	Mainstem Hood River East Fork West Fork Middle Fork
Sucker	Below Powerdale Dam	Below Powerdale Dam
Sculpin	Entire subbasin	Entire subbasin
Longnose dace	Unknown	Unknown

Bull trout are primarily found in the headwater streams of the Middle Fork within the Mt. Hood National Forest. The largest proportion of the population is in Clear Branch above the Dam and in Laurance Lake (Table 9). Bull trout also inhabit Pinnacle, Compass, Coe, Eliot and lower Clear Branch creeks. Their narrow distribution makes the population vulnerable to a catastrophic event such as major wild fire or volcanic activity affecting the Middle Fork drainage (Pribyl et al. 1996). Since 1991, ODFW and the USFS have monitored the number and distribution of bull trout. Hood River bull trout remain in freshwater throughout their lives and exhibit fluvial, adfluvial and resident life history patterns (Buchanan et al. 1997). Adults have been captured in low numbers at Powerdale Dam since trapping began in 1961, suggesting that a small fluvial population migrating into the Columbia River has existed for years. Adult bull trout counts at the Powerdale trap have ranged from 6 to 28 since 1992 (Table 10). Most bull trout trapped at Powerdale eventually move up into the Middle Fork (C. Fiedler, USFS, *personal communication*).

The construction of Clear Branch Dam blocked upstream migration in 1969 and isolated a population above the structure. The USFS has operated a fish trap at the base of Clear Branch Dam since the Spring of 1997. Eight adults were captured at this trap between September 2, 1997 and January 1, 1998, with the highest catch in October. The decision was made in 1999 to pass every other fish entering the trap upstream, however, attraction into the trap has since been

poor. The reservoir outlet is 80 feet deep and is considered unsafe for fish passage. Bull trout can migrate downstream via the dam spillway when there is surface spill (Fiedler 1999).

Table 9**.** Peak counts of adult Bull Trout above and below Clear Branch Dam/Laurence Lake Reservoir. Source: ODFW, unpublished data

Year	Upper Clear Branch Creek	Lower Clear Branch Creek
1991	15 + (partial sample)	2
1992	19	2
1993	37	2
1994	6 (+29 at Lake delta)	2
1995	5	1
1996	18	0
1997	20	3
1998	30	0

Table 10**.** Adult bull trout captured at Powerdale Dam fish trap. Source: ODFW, unpublished data

Year	Count	Recaptured
1992	6	0
1993	2	1
1994	11	1
1995	11	1
1996	18	4
1997	6	1
1998	18	2
1999	28	3

Other Resident Salmonids

Native cutthroat and rainbow trout and mountain whitefish occur throughout most of the Hood River subbasin. Sampling to determine species distribution and relative abundance has been conducted in subbasin tributaries since 1991 on a biannual basis as part of HRPP monitoring and evaluation activities. Rainbow-steelhead have been found at all sampling sites except Robinhood Creek, where only cutthroat trout have been found. Tony and Tilly Jane creeks are the most productive sites sampled in the subbasin based on total biomass of rainbow-steelhead and cutthroat, while Greenpoint Creek has been the most productive for rainbow-steelhead (Olsen et al. January 1998).

Fish with characteristics of both resident cutthroat trout and rainbow trout are found in the Hood River subbasin. Genetic samples were gathered in 1994 and 1995 to be analyzed for potential hybridization between each species. A small, isolated population of genetically pure interior redband rainbow trout exists in North Fork Greenpoint Creek (Greg and Allendorf 1995). The ODFW and the USFS consider the redband rainbow trout a sensitive species. Cutthroat are the dominant species in Bear, Tilly Jane, and Robinhood creeks, and are common throughout Clear Branch above and below Laurance Lake reservoir. An isolated cutthroat population was recently found above a falls on Clear Branch a few miles above Laurance Lake (G. Asbridge, USFS, *personal communication).*

Non-native species found in the Hood River subbasin include brook trout, brown trout, smallmouth bass, kokanee, and brown bullhead.

4. HABITAT PROBLEMS, PROTECTION NEEDS, AND OPPORTUNITIES

4.1 Introduction

Aquatic habitat conditions in the Hood River subbasin are described in the Hood River Watershed Assessment Report (HRWG 1999) and in the Watershed Analyses for the East and Middle Fork Hood River (USFS 1996b) and the West Fork Hood River (USFS 1996a). The Assessment addresses all land ownership in the subbasin and the USFS Analyses focus primarily on federal lands. These reports offer detailed descriptions of the following elements: (1) key physical attributes of the subbasin and major tributary drainages; (2) natural watershed processes and function; (3) existing habitat conditions by watershed; (4) historic landscape conditions; and (5) historic and current fish species distribution and abundance. For analysis purposes, the Hood River subbasin was divided into four 5th-field and fifty 6th-field U.S.G.S. Hydrologic Unit Code watersheds. The Hood River Watershed Assessment generally followed the assessment methodology in the Oregon Watershed Assessment Manual (Watershed Professionals Network 1999 and NonPoint Source Solutions, Inc. 1997). Habitat surveys and evaluations administered by the HRPP and water quality monitoring by ODEQ also contributed to the Assessment. Together, these reports serve as the principal basis for the actions and strategies proposed in this Plan. Their key findings concerning historic and current habitat conditions are summarized below.

4.2 Historic Habitat Conditions

Vegetation and Landscape

Because few records describe landscape conditions prior to Euro-American settlement, the turn of the century was used by the USFS as a reference condition for watershed analysis (USFS 1996a; USFS 1996b). Prior to 1900, tree species were similar to those of today but their relative proportions differed. Douglas fir dominated the West Fork watershed, followed by western hemlock, red cedar, Pacific silver, noble and grand fir, and Englemann spruce. Large old-growth trees were found in Dee Flat and in the headwaters, sideslopes and canyons of Greenpoint Creek, Lake Branch, and the valley floor of the West Fork Hood River. In the Middle Fork watershed, most of Tony Creek and upper Bear Creek contained mature forest stands exceeding 21 inches in diameter, while other areas had a combination of earlier serial stages due to fire history. The primary forest type in the East Fork drainage was a mix of sapling/pole and small tree conifer forest. On the East side of the lower valley, pine-oak forests were probably prevalent and the middle valley was dominated by pine-oak stands on all but the north-facing slopes (Burke 1999).

Instream, Riparian and Wetland Habitat

Downed wood and debris jams were common in the West, Middle and East Forks of the Hood River around the turn of the century and would have created greater hydraulic and stream habitat complexity. Alder, willow and cottonwood dominated the gentler gradient floodplains while conifers dominated the riparian zone in higher gradient areas. Beaver ponds were noted as semi-common in the West Fork, and were probably at least semi-common throughout the subbasin. Large trees were transported into streams by bank erosion, windfall, landslides, floods and other pathways. These trees would have contributed to high quality instream habitat by (1) creating pools, log jams, encouraging formation of side channels, and other complex hydraulic habitats; (2) promoting riparian and floodplain development; (3) trapping gravel; (4) providing hiding cover for fish; and (5) providing a substrate for fungi, bacteria, and invertebrates. The potential for large wood recruitment was much greater historically, largely due to riparian logging since near the turn of the century. Hood River tributaries with a history of large-scale catastrophic disturbances would naturally have less instream wood and mature riparian vegetation (USFS 1996a; USFS 1996b) than those not subject to such events.

The lower East Fork Hood River consisted of a series of wide wetland complexes in a braided stream network, where downed logs, side channels, and continuous riparian forest stands were common. Depositional areas in low gradient, broad floodplains were likely to collect sediment and large woody debris and allow development of high quality spawning and rearing habitat. Reaches with significant depositional habitat in the East Fork mainstem were identified by the USFS as (1) between Baldwin and Tilly Jane creeks; (2) a half-mile from the Polallie Creek mouth upstream; and (3) from Cold Spring to Robinhood Creek. Two areas of the Middle Fork have similar potential for high quality fish habitat development: the lower Middle Fork, between Tony and Bear creeks, and the reach of Clear Branch inundated by Laurance Lake. In the West Fork, these areas likely included (1) West Fork mainstem from Moving Falls to Lake Branch creek and (2) between Ladd and McGee creeks (3) in Lake Branch mainstem from Mosquito to Divers creeks and (4) from Skipper to Washout creeks. Tributary streams believed to have had large volumes of instream wood and heavy salmonid use were Tony Creek, lower Dog River and the lower East Fork Hood River tributaries (USFS 1996a; USFS 1996b).

Patterns of Land Development and Resource Use

Established trails were used by Native Americans and later by non-Indian settlers as trade routes and access to hunting, gathering and fishing grounds. Native settlements were located at the Hood River mouth and at nearby sites. Intentional burning by Native Americans to maintain travel routes and berry patches is well documented (USFS 1996a, USFS 1996b). Native Americans maintained huckleberry fields in wet meadows around Lost Lake and Indian

Mountain. They collected camas, bear grass and other plants, hunted deer, elk and other game, and fished in the tributaries and main forks of the Hood River. Temporary camps were set up to collect and prepare foods. Peeled cedars are still found in the area today, the bark of which was used for clothing and basketry (USFS 1996a, USFS 1996b).

Sheep and cattle grazing were common on the upper slopes of the East Fork in meadow areas during early settlement prior to 1900. Around 1880, orchards and strawberry fields began to progress gradually up the valley, as acres of forest were transformed into pasture and fruit crops. Camas fields in the upper valley were drained in the 1890s to plant strawberry crops. Homesteaders in the lower East Fork valley intentionally set extensive fires. Many wetlands and stream channels were drained or diverted to reduce saturated soil conditions, and roads were constructed adjacent to and across streams. Possibly the biggest factor altering the vegetative pattern in the lower subbasin was the growth of the fruit industry, where orchards have replaced coniferous forest and riparian habitat networks (USFS 1996a, USFS 1996b). Removal of woody vegetation from small or intermittent streams within orchards for cold air drainage has created mono-typical incised channels on such streams (S. Pribyl, ODFW, *personal communication*).

Beginning in 1861, water-powered sawmills, dams, and mill ponds were operated in Neal Creek, the East Fork Hood River at Hines Dam, Hood River and in Greenpoint Creek. A few years later, farmers began to divert streams into hand-dug irrigation canals and ditches. Logs were transported in river channels or by flumes, horse teams and railroads. By 1913, the area around Parkdale had been logged and the flat land between the East and Middle Forks was cut. Timber harvest began in the East Fork Hood River on National Forest lands in the 1940s, where historic logging focused mainly on mature stands within the Pocket, Culvert, Engineers and Dog River drainages. While headwater areas have been subject to less alteration, timber harvest has significantly altered forest stands in the lower and middle Hood River subbasin (USFS 1996a, USFS 1996b).

Extensive use of splash dams is documented in the Hood River system through the 1940s. During the 1960s and 1970s, removal of woody debris from stream channels was an encouraged practice and believed to benefit fish passage. All large instream and riparian wood was cleared from the East Fork Hood River between Robinhood and Sherwood campgrounds as recently as 1979. The complex structural habitat capable of supporting historic population levels of anadromous fish within a flashy runoff environment is limited today by the effects of past riparian timber harvest, splash dams, and stream clearing (USFS 1996a, USFS 1996b).

Visitor use of National Forest and public and private forestland has increased due to population growth and the increasing popularity of outdoor recreation and tourism. Residential development and forestland conversion is ongoing in the subbasin.

4.3 Existing Fish Habitat Conditions

Hydrologic Modifications

The natural flow regime in the Hood River system has been altered by water diversions for irrigation and power generation, and to a lesser degree, municipal and domestic withdrawals. Forestry, agriculture and other land uses have probably had a cumulative effect on subbasin hydrology through altering vegetation cover characteristics, soil compaction and impervious surface, stream channelization, floodplain encroachment, wetland drainage and so forth, although this effect is not quantified.

The single largest water diversion in the subbasin occurs at the Powerdale Hydroelectric Project (FERC No. 2659). PacifiCorp diverts up to 500 cfs continuously from the Hood River at RM 4.5 and discharges it back instream at RM 1.5 below their powerhouse. Between 10 and 78 percent of the mean monthly streamflow at the Tucker Bridge gage (USGS No. 14120000) is diverted from the Powerdale bypass reach. Presently, minimum instream flow requirements range from 100 cfs between August and November to a maximum of 270 cfs from February through April. PacifiCorp has agreed to raise these flow requirements by up to 150 cfs during April through November as part of its pending FERC relicensing.

The majority of consumptive water use in the subbasin is for irrigation. There are five irrigation districts within the Hood River subbasin that supply water. Most diversions are from "live" streamflow as opposed to use of stored water. Reservoir storage in the subbasin is limited to 6,700 acre-feet or fewer than 2 percent of mean annual discharge. Laurance Lake at Clear Branch Dam is the largest reservoir with a volume of 5,600 acre-feet of storage for irrigation (USFS 1999). The total amount of water rights held by the five subbasin irrigation districts was estimated at 587.5 cfs (ODFW, unpublished data). However, mean actual consumptive water use from July through September has been estimated at 220 cfs, which is equivalent to around 37 percent of the estimated natural flow (594 cfs at the 80 percent exceedence level) for the same period (Oregon Water Resources Department, unpublished data). An estimate of total peak daily water use (consumptive uses excluding power generation) as reported by the irrigation districts, domestic water districts, and municipal suppliers was 304 cfs (HRWG 1999).

There are two municipal water diversions in the subbasin. These are the City of The Dalles which uses up to 12 cfs from upper Dog River, and the City of Hood River, which holds water rights of 27.5 cfs mostly in the Lake Branch subwatershed but currently withdraws a maximum of about 6 cfs. Four water districts serving rural areas or towns hold water rights totaling approximately 14 cfs. Instream water rights are established at 7 locations and are consistently met at only two of these due to the use of senior water rights. The most severe instream flow depletion affecting subbasin anadromous fish habitat occurs in the East Fork Hood River below the East Fork Irrigation District diversion. At this location, up to 127 cfs is diverted and has

depleted all surface flow at times of drought or extreme low flows.

The density of forest and urban roads are generally moderate. The Mainstem Hood River has the highest road density among subbasin 5th field (U.S.G.S. Hydrologic Unit Code) watersheds at 4.2 miles per square mile. Overall road densities within the East, Middle and West Fork watersheds are 1.7, 2.5, and 2.9 miles per square mile, respectively. Road density on nonfederal lands in the West Fork watershed is 3.35 miles per square mile compared to 2.12 on federal lands (B. Holsom, USFS, *personal communication*). Indian Creek subwatershed, the lower third of which is within the urban growth boundary, has the highest road density in the Hood River subbasin among 6th field subwatersheds at 5.6 miles per square mile.

The risk of damage from debris torrents has been exacerbated in the West Fork and Lake Branch subwatersheds as a result of timber harvest rate, road construction, and removal of downed logs from intermittent channels (USFS 1996a). The West Fork has one of the highest rates of debris torrents on the Mt. Hood National Forest, with the majority of these events associated with clearcuts and roads. Forest road construction around meadows and within wet soils has changed the hydrology in the Tony Creek headwater area. As a result, road obliteration or preparation of roads for perpetual self-maintenance is a high restoration priority in upper Tony Creek (USFS 1996b).

Based on National Wetland Inventory (NWI), less than one percent of the subbasin is occupied by wetlands (HRWG 1999). The actual area of wetlands in the Hood River subbasin is likely underestimated by the NWI (Salminen 1999). Historic wetlands in the Odell, Indian, Lower Neal, Trout, Evans, and Lower East Fork subwatersheds have been drained for agriculture, transportation and other land uses. However, the impacts of ditching and drainage on base or storm flows has not been assessed and no wetlands inventory and functional assessment been conducted by Hood River County. This lack of information prevents the prioritization of wetland protection and restoration.

Fish Passage Problems

Man-made problems that obstruct or interfere with fish migration in the Hood River subbasin include (1) dams; (2) inadequate screens at irrigation and hydropower diversions; (3) delay or poor function at fish ladders; and (4) culvert barriers at road crossings. Upstream and downstream fish passage problems are identified at sixteen diversions and are considered a serious habitat problem within the subbasin (Table 11).

Fish passage concerns exist at PacifiCorp Powerdale Dam (RM 4.0) on the Hood River mainstem. Upstream passage is provided by a fish ladder operated and maintained by PacifiCorp. A fish trap in conjunction with the ladder is operated by ODFW. The Powerdale Fish Trap was constructed in 1996 as part of the HRPP to monitor anadromous fish returns, collect broodstock for supplementation, and prevent hatchery strays or control the numbers of

hatchery fish spawning in the subbasin above the dam. Spillway discharge is greater on the west bank than attraction flow to the fish ladder located on the opposite bank. As a result, fish are falsely attracted to the west side and jump onto the concrete spillway. The CTWSRO and PacifiCorp personnel investigated migration delay of spring chinook salmon and summer steelhead in the Powerdale project area using radio telemetry. In 1995, spring chinook salmon held an average of 66.0 days and summer steelhead 28.3 days respectively in the vicinity of Powerdale Dam, and only 21 percent and 31 percent passed the dam successfully (CTWSRO 1997). In 1996, after improvements to the fish ladder attraction flow, spring chinook salmon spent 21.0 days, and steelhead 25.2 days in the bypass reach with a 67 and 52 percent dam passage success rate, respectively. Chinook and steelhead spent an average of 4.5 and 8 days per fish near the powerhouse tailrace in 1995. In 1996, tailrace delay dropped to 1.6 and 3.1 days following channel modifications to improve attraction flow from the mainstem Hood River. Concerns persist that upstream passage in the Powerdale area needs further improvement, although ODFW observes some recycled hatchery steelhead re-enter the fish trap after as little as 24 hours. The most delay occurs when PacifiCorp raises the 75-foot spillway gate on the dam's eastside next to the fish ladder entrance (M. Jennings, CTWS, *personal communication*)

Fish screens at the 500-cfs Powerdale diversion do not meet current fish protection criteria. Testing in 1995 by PacifiCorp found that a proportion of downstream migrant salmonids were swept into the power canal (PacifiCorp 1998). PacifiCorp has proposed to replace the existing screens with criteria screens as part of FERC relicensing. Given the fish population status, the large amount of flow diverted, and the downstream position of this diversion, timely screen replacement by PacifiCorp is considered urgent. The current license expires in March 2000; however, screen construction is not expected until 2002 at the earliest. ODFW, CTWSRO and the HRWG asked PacifiCorp to adopt interim measures to protect downstream migrants; no clear response has been given.

ODFW recently conducted a survey of fish screens in the Hood River subbasin to identify needed upgrades at small pumped withdrawals as well as large irrigation diversions. Annual fish salvages conducted by the CTWSRO and ODFW in irrigation canals recover various numbers of trapped salmonids. After decades of having an unscreened operation, the EFID installed a Coanda-type passive screen on its East Fork Hood River diversion in 1996 in consultation with CTWSRO and ODFW. Biological evaluations on this facility are close to completion. Plans have been made for fish screen and upstream passage improvements at several other irrigation diversions and construction is anticipated within a few years.

Clear Branch Dam forms a complete barrier to the upstream migration of anadromous and resident fish, and has isolated a bull trout population above the dam. The USFS in cooperation with MFID has operated an upstream fish trap at the base of the dam since 1997. The current policy is for every other fish entering the trap to be transported upstream.

In 1998 the Oregon Department of Transportation, in cooperation with ODFW, surveyed

stream culverts along state Highways and County-owned roads in the subbasin. These surveys found 34 County road culverts in need of fish passage remediation, and 12 culverts on State Highway 35. Eighteen culverts were ranked as a medium priority by ODFW based on anadromous fish presence and availability of good or medium quality habitat upstream. Sixteen of these are located on County roads. No similar inventory is available for National Forest roads, however, the USFS plans to conduct such an inventory and has near-term plans to remediate passage in Pinnacle Creek and other subbasin locations (G. Asbridge, USFS, *personal communication*). The location of various types of migration barriers in the Hood River subbasin is found on Figure 7.

Table 11. Known or potential migration barriers affecting anadromous fish or bull trout in the Hood River Watershed, excluding road culverts.

Entity	Stream Name	River Mile	Barrier Type	Comments/ Status
EFID	East Fork Hood River	8.6	Water diversion - low flow barrier during critical summer low flows.	Cooperative solutions to be developed with EFID.
EFID	Neal Creek	5.0	Irrigation diversion. Fails screening criteria. Canal flow can overtop screen. Upstream passage impaired.	Preliminary design in progress.
MFID	Eliot Branch Diversion	1.0	Irrigation diversion. Possible barrier to steelhead. Design challenge- heavy sediment and debris load.	Design and permit in progress. Major debris flow in November 1999 buried diversion and caused subsurface flow for 300 yards from mouth.
MFID	Evans Creek	2.0 3.6 5.3	Three miles of steelhead and coho habitat blocked by lower two diversions.	MFID plans piping installation to eliminate diversions; cost-share with CTWSRO
USFS	Lake Branch Creek	0.9	Natural boulder cascade – anadromous passage varies with flow.	Excellent, low gradient upstream habitat.
ODFW	West Fork Hood River	0.25	Punchbowl Falls fish ladder inadequate maintenance may impede upstream migration of sp. Chinook and steelhead.	Needs annual maintenance and site access; may need additional water supply.
MFID	Coe Branch	0.75	Irrigation Diversion. Upstream passage of bull trout impeded, fails screen criteria.[1]	Design and Permitting in progress-scheduled 2000.
MFID	Clear Branch Dam	1.1	Storage Reservoir and Dam at Laurance Lake. Upstream passage barrier. Unscreened deep outlet - potential loss of bull trout into pressurized pipe system.[2]	Adult fish trap & haul operated. Spillway modified in 1992 & tested by ODFW. Tagged bull trout passed spillway & survived.
Dee Irrigation District	West Fork Hood River	6.1	Irrigation diversion. Possible barrier to adult spring chinook at low flows.[3]	Screen and bypass upgrades installed in 2000. Upstream passage options under review with irrigation districts.
FID	Hood River	11.5	Irrigation diversion. Fails screening criteria for approach velocity.[1]	Design & permitting in progress.
PacifiCorp	Hood River @ Powerdale Dam	4.5	Hydroelectric diversion. Existing screens fail screen criteria.[1] Downstream migrants swept into flume. Potential upstream passage problem and delay, SOP's & design improvements under discussion.	Screens replacement is agreed to as part of FERC relicensing. Construction schedule uncertain, possibly ~2002 or beyond. Modified spillway on ladder side in conceptual design.
Phoenix Pharms	Baldwin Creek	1.2	Diversion for U-catch trout pond operation water supply. Two possible barriers to steelhead. Fails screening criteria.	Cooperative solutions to be developed with operator/landowner.
Dee Forest Products	Tony Creek	0.75	Diversion Dam. Screening internal or absent. Barrier at most flows; 1.5-ft outfall drop onto bedrock.	Interim remediation performed in 1998 and 1999 by CTWSRO and ODFW. Results being evaluated.

[1] Bull trout fry criteria screening listed as Potential Conservation Action for Bull Trout in Pribyl, et al 1996
[2] Listed as Potential Conservation Action for Bull Trout in Pribyl, et al 1996
[3] CTWSRO, December 1998

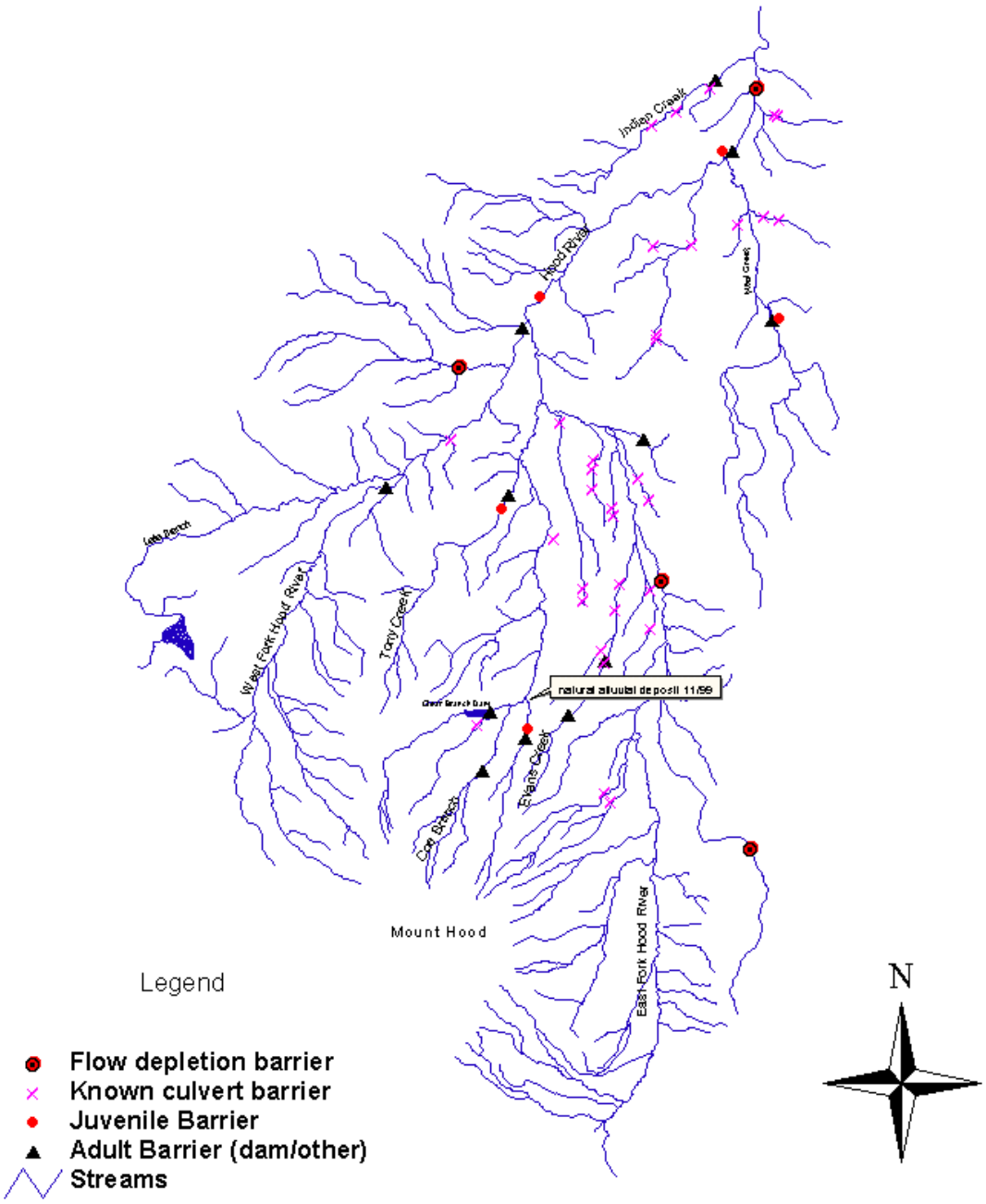


Figure 7. Locations of known fish passage problems in the Hood River watershed. Sources: ODOT and ODFW 1998, HRWG 1999.

Instream and Riparian Conditions

ODFW analyzed stream channel and riparian conditions based on 1993 and 1994 survey data collected in 51 reaches or a total of 63 miles of the Hood River and major tributaries (ODFW 1995). Habitat conditions were compared to regional benchmark values developed by the ODFW Aquatic Inventory Project.

On an overall basis, this analysis rated pool area and frequency as "below desirable" in the majority of subbasin reaches surveyed – only 13 miles of the total stream length surveyed met the ODFW benchmark value for desirable pool area. The greatest proportion of desirable pool habitat was found in Lake Branch and the West Fork Hood River. Reaches within Neal Creek, Middle Fork, and East Fork Hood River had the poorest ratings for pool area and frequency in the subbasin. Gravel availability rated below desirable in most reaches surveyed with only 22 percent of the stream length surveyed meeting the benchmark. Spawning gravel availability may have worsened since the survey data was collected due to flood scour in 1996 (J. Newton, ODFW, *personal communication*). As a result, gravel re-deposited at stream bank elevations wetted only under higher flows. Gravel quality (fine sediment levels) was somewhat better, with 41 percent of total stream length surveyed meeting the regional benchmark for desirable levels of fines. Lower Evans Creek had excessive fine sediment levels of up to 44 percent. Bank erosion throughout the reaches surveyed was low except for moderate erosion along the lower West Fork Neal Creek. Natural streamflow is raised by 45 cfs when the EFID conveys irrigation water down the West Fork Neal Creek channel to the Eastside Lateral Canal.

None of the surveyed reaches met the criteria for desirable numbers of large-diameter conifers in the riparian area. The volume and quality of instream large woody debris in survey reaches was generally insufficient with the exception of Lake Branch. Evans Creek, Lake Branch, and Dog River all had a desirable number of large wood pieces, but only Lake Branch exceeded the desirable benchmark value for wood volume. Hood River and Neal Creek both had reaches that were very low in both wood pieces and volume.

Several stream reaches present opportunities to restore riparian and stream habitat structure and reconnect stream-floodplain interactions. These depositional reaches are capable of developing high quality spawning and rearing habitat if large wood can be restored to the riparian ecosystem. The East Fork drainage is considered to have the greatest potential for improvement as it is relatively accessible, is severely lacking in instream structure, has a broad valley floor and floodplain area, and contains habitat suitable to maintain a diversity of anadromous species (ODFW and CTWSRO 1990).

Half of the reaches with an active channel wider than 12 meters exceeded the target criteria of 60 percent shade, while over 80 percent of narrower streams exceeded the target criteria of 70 percent shade. As part of the Watershed Assessment, an air photo analysis of riparian shade and large wood recruitment potential of the Hood River Mainstem and lower river tributaries was conducted (Salmenin 1999a). Riparian conditions along 83 miles were assessed with the left and

right bank treated separately for a total of 167 miles. Riparian shade levels were high (>70 percent shade) along 51 percent of the total length of riparian areas, medium (40-70 percent shade) along 21 percent of the total length, and low (<40 percent shade) along 28 percent of the total length. Large wood recruitment potential was rated satisfactory along 61 miles or 36 percent of total riparian length and limited along the remaining 106 miles or 64 percent of total riparian length. Current woody debris recruitment is restricted by the factors listed in Table 12.

Table 12. Constraints for woody debris recruitment potential along the Hood River mainstem and lower river tributaries. Thirty six percent (61 miles) of riparian area assessed rated as satisfactory.

Constraint Type	No. of Miles Affected	Percent of Total Riparian Length
Small diameter forest stands	26	16%
Hardwood species	8	5%
Agriculture	25	15%
Development	10	6%
Infrastructure	22	13%
Natural site conditions	15	9%

ODFW Aquatic Inventory Protocol habitat surveys need to be conducted in the following streams or stream reaches currently or historically supporting anadromous fish: Lenz Creek (tributary to Neal Creek); Baldwin, Graham, Emil, Tieman, Evans, and Trout creeks (East Fork tributaries); upper East Fork and upper Middle Fork Hood River; Tony, Bear, Rogers creeks and Coe and Eliot branches (Middle Fork tributaries); and Jones, Elk, and McGee creeks (West Fork Hood River tributaries). Habitat survey data has been collected by the USFS on a number of streams on National Forest lands using a federal protocol.

A conservative assessment of channel modification has also been completed. Road and railroad bed confinement was found to be most prevalent, with at least 21 miles of major streams affected (HRWG 1999). Streams most affected by channel modification are the upper East Fork Hood River, the lower mainstem Hood River, and Neal Creek. Confinement of the East Fork Hood River from the construction, reconstruction and maintenance of State Highway 35 is a significant and continuing impact to aquatic habitat particularly along “The Narrows” and below Dog River to Baseline Road (USFS 1996a). Approximately 8 miles of the East Fork Hood River is constrained by Highway 35 and associated bank armoring. State Highway 35 is subject to frequent flooding and washouts, prompting more riprap, bank armoring, and stream channelization by the Oregon Department of Transportation to protect the road. Neal Creek is also heavily impacted. Channelization and bank armoring has led to a loss of meander, shorter stream length, and channel incision; cutting off Neal Creek from its floodplain.

Water Quality

Several subbasin stream reaches exceed the Oregon 17.8 °C water temperature standard for general salmonid use and are listed as impaired water bodies on the Clean Water Act 303-d list. The 17.8 °C temperature criteria (7-day moving average) is moderately exceeded in portions of Indian, Whiskey, Neal and Odell creeks; Hood River below Tucker bridge; East Fork Hood River below the EFID diversion; and in Lake Branch below Lost Lake. The peak 7-day moving average at the mouth of Neal Creek during 1998 was 20.7 °C (HRWG 1999). Average daily maximum temperatures in the East Fork Hood River at RM 3.7 were 21.0 °C and 21.5 °C in July and August from 1992 to 1995 (USFS 1996b). The 10 °C bull trout temperature standard is exceeded periodically in the Middle Fork Hood River, Clear Branch above and below Laurance Reservoir, and lower Compass Creek.

The pH standard of 8.5 (maximum observation of 8.9) was exceeded in the lower end of the bypass reach below the Powerdale Dam in spring 1995 and 1996, but no pH exceedence was measured by ODEQ in the subbasin in 1998 or 1999. Elevated phosphorus and nitrogen concentrations have been measured in Odell, Neal, Trout, Whiskey, Lenz, McGuire, and Indian Creeks. Elevated ammonia levels of 4.6 mg/L and 0.34 mg/L were measured in the Hood River mainstem during 1995, while more recent sampling by ODEQ has detected little or no ammonia (HRWG 1999).

The effect of pesticide and herbicide use on aquatic life in the subbasin is a matter of serious concern although little comprehensive monitoring has occurred to date. A preliminary study conducted by ODEQ in Spring 1999 found levels of organophosphate insecticides chlorpyrifos (sold under trade names Lorsban and Durban) and azinphos methyl (Guthion) exceeding state or EPA-recommended standards in Neal and Indian creeks. Levels of azinphos methyl also exceeded the state standard at the mouth of the Hood River. These results have triggered a concerted effort by ODEQ, Oregon State University, and Hood River growers to reduce pesticide contamination and implement best management practices. Further monitoring is planned.

Sediment delivery into streams due to human activity occurs as a result of roads, undersized culverts at road crossings, and irrigation systems. Sediment delivery from irrigation systems occurs through canal failures, landslides, ditch erosion, return flows or end losses, and inter-basin transfer of glacial silt from glacial streams to non-glacial streams used as conveyance channels. Sediment monitoring data analysis by the USFS suggests that most fine sediment production in the West, Middle and East Fork watersheds is related to roads and forest management-related debris flows. Road maintenance practices including ditch scraping and winter sand and gravel application may be locally significant sediment sources, along with livestock concentration areas, exposed soils at construction sites, and heavy-use recreation areas or trails.

Location of Habitat Strongholds

Critical aquatic and terrestrial habitat strongholds within the subbasin are listed in Table 13 along with target species usage. Habitat strongholds are defined as those areas known to provide especially productive or important spawning, rearing, and adult holding habitat and may serve as refuges from which fish populations colonize other areas.

Table 13. Aquatic habitat strongholds in the Hood River subbasin.

Location	Species and Life Stages
Hood River mainstem	Bull trout – adult holding Summer and Winter steelhead - adult holding Spring chinook - adult holding
West Fork Hood River	Spring chinook, Summer steelhead – spawning, rearing, adult holding
Lake Branch watershed	Spring chinook - spawning and rearing Summer steelhead - spawning and rearing Rainbow trout – spawning and rearing
Green Point watershed	Rainbow trout (redband also) - spawning and rearing Winter steelhead - spawning and rearing
Middle Fork mainstem	Bull trout - overwinter rearing habitat Winter steelhead - spawning and rearing
Laurance Lake[1]	Bull trout - rearing
Clear Branch, Coe Branch and Pinnacle Ck	Bull trout - spawning and rearing
East Fork mainstem below Dog River	Winter steelhead - spawning and rearing
Robinhood Ck	Cutthroat (pure strain) - spawning and rearing

[1] reservoir

Biological Processes

Nutrient cycling, algal growth and pH, detrital processes and food supply were identified as an information gap in the Hood River Watershed Assessment. It is evident, however, that the supply of marine-derived nutrients by anadromous fish carcasses is depressed due to low spawning escapement. While the optimum carcass density to maintain watershed productivity likely varies among systems, studies using stable isotope analysis found that the growth rate and the marine-derived nitrogen content in juvenile coho increased rapidly with increasing density of spawning fish of up to 200 spawners per kilometer or 322 spawners per mile (Bilby et al. 1997). In the Hood River subbasin from 1995 to 1999, the estimated carcass density of steelhead and chinook combined was less than 20 fish per mile. Pacific lamprey carcasses were an additional source of marine nutrients under historic conditions, now absent in most of the subbasin.

Beaver ponding and beaver interaction with riparian areas have been found to provide highly productive winter habitat for certain species of salmonids, and to moderate and augment streamflows in small streams (e.g., Naiman et al. 1988, Pollock et al. 1995). In the Hood River subbasin, beavers are present in areas of low stream gradient where adjacent land uses tolerate beaver activity. Numerous beaver dams and beaver activity are common along the lower East Fork and lower Evans Creek (ODFW 1995). The degree of beaver influence on subbasin-scale habitat and hydrology prior to European settlement is unknown. However, the steep, confined topography of the Hood River subbasin may constrain the amount of beaver habitat compared to gentler gradient, less confined systems (J. Torland, ODFW, *personal communication*). For example, beaver ponding was considered a small-scale, semi-rare event under reference conditions in the West Fork drainage and was absent in the Green Point subwatershed. No information about beaver ponding elsewhere in the subbasin was found. Although trapping records do not correlate to beaver abundance, an average of 41 beavers were trapped annually from Hood River County between 1955 and 1997, with a peak of 83 in 1957 (ODFW 1998, unpublished data).

Riparian and Floodplain Protection Needs

Lower gradient unconfined channels with associated floodplains and their riparian areas are especially sensitive to management impacts and should be protected within riparian reserves or by other specific management directions. Riparian reserves and special management areas are established for riparian zones, floodplains and wetlands in the Hood River subbasin on the Mt Hood National Forest in the 1994 Northwest Forest Plan and 1990 Mt Hood Forest Plan. The West Fork Hood River and Lake Branch are designated as a Tier 1 Key Watershed directly contributing to anadromous fish conservation and warranting watershed analysis prior to any management activity. Currently, protection of riparian and floodplain areas outside of National Forest boundaries rely on the state Forest Practices Act for timber-related activities.

Residential and recreational development along streams is increasing and threatens riparian function and connectivity between streams and flood plains. For non timber-related development, riparian protection relies on Division of State Lands Fill -Removal and Wetland Regulations where applicable, and the County floodplain land use ordinance. The floodplain ordinance requires a 100-foot building setback from the ordinary high water line (excepting water-dependent uses) and verification by a certified engineer or hydrologist. The County also uses 1984 Federal Emergency Management Agency (FEMA) flood maps to prevent building in the 100 year floodplain, however, these maps do not identify flood elevations. In the past, however, the County has allowed residential development inside the 100-year floodplain when mitigated by an engineering plan. County planners consider the 1984 FEMA maps and the 100-foot setback inadequate to protect property and ecological values. An urgent need exists to

identify critical riparian areas vulnerable to channel shifting and migration, catastrophic flows, and local flooding associated with intermittent streams and wet areas. The HRWG and the MFID formally requested County officials to update the floodplain ordinance to improve stream protection and avoid increasing flood hazards in 1997 but no action has been taken. Measures to protect streamside vegetation are lacking. Areas of immediate concern include Neal Creek, Hood River Mainstem and lower East Fork subwatersheds, and portions of Indian Creek. Increased protection of these floodplain areas will avert the need for more difficult and costly remediation in the future.

Land acquisition or purchase of conservation easements should be pursued in especially sensitive or productive riparian or wetland areas where the FPA or other land use controls offer insufficient protection. A timely effort to identify land parcels, willing landowners, land trust partners, and funding sources is recommended.

Upland Watershed Protection Needs

Large gaps in the forest canopy resulting from timber harvest and road construction have increased the risk of peak flows in Divers, Trout, Lake Branch, Evans, and Long Branch subwatersheds (USFS 1996a; USFS 1996b). Subwatersheds with a large proportion of area within the rain-on-snow elevation range (e.g., 1500 to 4000 feet) are most susceptible to flood damage. Neal, Tony, Lake Branch, Greenpoint, and North Greenpoint creeks are in the highest risk category with the Greenpoint watershed identified as especially vulnerable due to widely fluctuating air temperatures, shallow rocky soils, and large open slopes that can accumulate deep snowpacks (USFS 1996a).

Closed-canopy stands intercept snow and insulate the snowpack, resulting in less accumulation and a slower melt than in open areas or deciduous stands (USFS 1996a). The USFS compared the risk of increased flood damage due to logging activity in the Middle, East and West Fork drainages using an Aggregate Recovery Percentage (ARP) model (Table 14). Stand age and harvest data were used to determine the percentage of drainage area that are considered “hydrologically recovered”. Recovery is assumed at a 70 percent canopy closure and 8-inch average stand diameter, conditions associated with a 35-40 year-old forest in the West Cascades. In general, an ARP value above 75 percent is considered recovered (Christner 1982) with an accepted value of 65 percent for the eastside. The 1990 Mt. Hood Forest Plan prohibited reductions in recovery below 65 percent in all federally owned watersheds (USFS 1996b) and adjusted recovery values according to sensitivity to mass wasting. As a result, the Lake Branch recovery threshold was adjusted upwards to 82 percent.

Table 14. Subwatersheds at risk of peak flow damage as reflected by an Aggregate Recovery Percentage (ARP) Model utilizing 1991 satellite image vegetation data (USFS 1996a, 1996b).

Subwatershed	**Watershed**	**ARP Value %**	**Threshold of Concern** (% recovery target)	**Risk Rating**
West Fork Hood River	West Fork	69.0	75	CONCERN
Red Hill Creek	West Fork	70.5	75	CONCERN
Marco Creek	West Fork	69.7	75	CONCERN
Tumbledown Creek	West Fork	74.9	75	CONCERN
Long Branch	West Fork	62.4	75	AT RISK
Green Point Creek	West Fork	71.0	75	CONCERN
Dead Point Creek	West Fork	74.3	75	CONCERN
Lake Branch	West Fork	66.1	82	AT RISK
Laurel Creek	West Fork	66.9	82	CONCERN
Divers Creek	West Fork	56.0	82	AT RISK
Tony Creek	Middle Fork	66.8	75	CONCERN
Lower East Fork Hood River	East Fork	68.1	75	CONCERN
Trout Creek	East Fork	50.1	75	AT RISK
Evans Creek	East Fork	41.1	75	AT RISK

Trout and Evans were the least recovered subwatersheds followed by Tony Creek and Lower East Fork Hood River. Dog River, Bear, and Crystal Spring creeks are at or slightly above recovery. The other East and Middle Fork subwatersheds are well above the recovery threshold and pose little risk of peak flow erosion hazard. Hydrologic recovery was not evaluated for those subwatersheds without significant federal land ownership, and the State Forest Practices Act does not address cumulative effect of harvest and roads on non-federal lands.

4.4 Past and Current Habitat Restoration

CTWSRO, ODFW, USFS, irrigation districts and others have implemented several habitat rehabilitation projects within the Hood River subbasin. In most cases, these projects have been designed to improve spawning and rearing habitat and to eliminate potential barriers to upstream and downstream fish passage.

- **East Fork Irrigation Diversion Screens**
  In a major corrective action accomplished in 1996, the EFID East Fork Hood River diversion (RM 8.6) was screened. This diversion was operated without a fish screen for decades while diverting a high proportion of streamflow (127 cfs or up to 100 percent of streamflow during drought), entraining juvenile and adult fish into an irrigation canal. Post-irrigation season fish salvages suggested that this unscreened diversion significantly increased the egg-to-smolt mortality rates within the East Fork Hood River drainage. In cooperation with the EFID, CTWSRO and ODFW approved installation of a Coanda screen design provided that mortality was below 5 percent including losses due to descaling. Biological testing using chinook and steelhead fry and steelhead smolts to date has shown little or no mortality or injury of fish passing the screen. Testing of the fish return bypass and screen efficiency is scheduled for the year 2001.

- **Riparian Fencing and Restoration**
  Between 1996 and 1999, CTWSRO completed 4 riparian fence and revegetation projects on Neal Creek and on Lenz Creek (tributary to Neal Creek). These were Early Action Projects funded by BPA. One and three-quarter miles of riparian area between RM 1.5 and 3.5 were fenced to exclude livestock, 250 feet of severely eroding streambank were bio-engineered with willow and rip rap rock set back from the wetted channel. About 330 conifers, 300 dogwood, and willows were planted inside the fenced riparian area by HRWG volunteers. These projects will improve water quality and habitat by restoring shade, reducing nutrient runoff and erosion, and encouraging other landowners to participate in stream stewardship. Another riparian fence was completed in 1998 at a dairy operation on Wishart Creek (tributary to the East Fork Hood River) through NRCS, ODEQ, and ODFW efforts. Many additional opportunities for cooperative livestock fencing and revegetation exist on other tributaries.

- **Powerdale Dam Hydroelectric Project Relicensing**
  The National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), ODEQ, CTWSRO, and ODFW have worked with PacifiCorp in the FERC relicensing process for the Powerdale Dam hydroelectric facility. PacifiCorp agreed to provide higher minimum flows below the dam from May through November and to install a new fish screen at the power canal intake that meets current fish protection criteria. It is anticipated that FERC will issue a new license in 2002. Agency concerns about potential delays in screen replacement and the need for interim protection measures have been communicated to PacifiCorp and FERC.

- **US Forest Service Restoration Activities**
  Since the late 1980s, the USFS has completed several dozen instream restoration projects on subbasin National Forest lands (G. Asbridge, Hood River Ranger District, *personal comm*unication) to mitigate habitat degradation due to historic forest management practices. Large woody debris structures have been placed in depositional areas in upper East and West Forks of the Hood River, and in Lake Branch, Clear Branch, Robinhood, and McGee creeks. These structures aim to increase habitat diversity and trap or retain gravel in the low flow channel where available to fall spawning fish. On the East Fork Hood River near Sherwood Campground, a levee was set back to allow the stream to meander and to restore stream-floodplain interaction. The District implements projects to control road-related surface erosion and slope failures as funding allows. These have included sediment monitoring, road closures, fill removal, revegetation, culvert replacement, and ditch maintenance. The 1994 Northwest Forest Plan established supplemental riparian reserves and management guidelines to help restore and improve riparian and instream function on National Forest lands.

- **ODFW Habitat Restoration**
  Projects implemented by ODFW have been designed to minimize egg-to-smolt mortality rates and to improve passage of upstream and downstream migrant salmonids. In 1990, the ODFW eliminated a developing migration barrier at "Moving Falls" located near RM 3.0 in the West Fork Hood River. In cooperation with private landowners and irrigation districts, ODFW continues to work towards the proper screening of water diversions throughout the subbasin. Salmon and Trout Enhancement Program volunteers have assisted with several projects to improve spawning and rearing habitat in tributary streams. Rock structures and log deflectors were placed in Neal, Tony, and Clear Branch creeks in the 1980s to provide instream fish habitat and stream roughness.

- **Green Point Creek Restoration Project**
  In 1995, with guidance from ODFW and the USFS, the FID placed logs in the lower mile of Green Point Creek and planted riparian vegetation. The woody debris placement was intended to restore habitat complexity in a reach of stream depleted of natural wood supply by historic splash damming and other activities (USFS 1996b). The goal of the riparian component was to restore native plant diversity and provide conifers for eventual recruitment of instream woody debris.

- **Irrigation System and Water Use Efficiency Projects**
  The three major irrigation districts have invested to varying degrees in measures to conserve water and decrease operation and maintenance costs associated with open unlined canal distribution systems. Replacement of open ditch and canal segments with pressurized pipe eliminates seepage losses, soil erosion and canal-related landslides. Piping provides the opportunity to withdraw less water, restoring instream flow for fish. FID estimates that 20,000 acre-feet will be returned instream between April and October upon completion of their water conservation plan. About 10 percent of the Hood River Valley growers participate in a new program using soil moisture sensors to improve orchard water

efficiency. The Hood River Grower-Shippers Association, HRSWCD, and OSU Extension have initiated the Integrated Fruit Production program to promote environmentally sustainable orchard practices including reduced pesticide, fertilizer and water use. In 1997, the City of Hood River returned up to approximately 4.5 cfs to Lake Branch in the West Fork drainage as a result of improvements to their spring water supply collection facility. Previously, water in excess of municipal demand was diverted and spilled at a downstream reservoir, bypassing approximately 14 miles of anadromous habitat.

5. LIMITING FACTORS

5.1 Summary

This plan is intended to correct or address limiting factors that impair ecosystem processes and productivity. A number of factors limit the biological potential of the Hood River subbasin. Several of these are associated with the natural physical characteristics of the basin, while others are related to human activities. Primary physical constraints include (1) glacial sediment loading; (2) high stream gradients and valley confinement; and (3) rapid runoff and high peak flows. In addition, subbasin water chemistry has been characterized as having relatively low productivity potential reflected by low specific conductance, alkalinity, hardness and trace elements (O'Toole and ODFW 1991). Significant limiting factors related to human activities in the subbasin are listed and summarized below:

1. **Upstream and downstream passage barriers:** The upstream migration of salmon, steelhead, and resident trout is blocked or impeded at numerous locations by diversion dams and other structures, resulting in the failure to seed historically utilized spawning and rearing habitat. Unscreened or inadequately screened water diversions result in mortality of downstream migrant salmonids either by becoming trapped in canals or entrained into powerhouse turbines at the PacifiCorp Powerdale Hydroelectric project.

2. **Lack of habitat structure and diversity:** The structural habitat capable of supporting historic population levels of anadromous fish is lacking in much of the subbasin (ODFW and CTWSRO 1990; USFS 1996a; USFS 1996b; HRWG 1999). Given its rapid runoff and confined channel characteristics, the lack of instream habitat structure is believed to be an especially significant limitation. Timber harvest, and other land use practices, have resulted in simplified channels and riparian zones with little instream or recruitable large woody debris. Inadequate large wood recruitment has reduced pool area, complexity and frequency. The availability of flood refuge, hiding cover, over-wintering and productive early rearing habitats (i.e., shallow lateral habitats and side channels) has been diminished. Sediment deposition, transport and meander processes have been altered causing many channels to downcut and disconnect from their floodplain, while others have widened and aggraded. Most channels lack the instream wood structure to trap and retain gravel for spawning and invertebrate production and are dominated instead by coarse boulder and rubble substrates. Gravel tends to wash up on the stream banks during high flows where it remains dry during lower flows and is unavailable especially to fall spawners.

3. **Water quality and riparian degradation:** Water quality monitoring indicates that summer and early fall water temperatures exceed preferred ranges for salmonid life stages in a number of stream reaches. Elevated nutrients, high pH episodes, and pesticide contamination have been measured. Road construction, power transmission lines, livestock over-utilization, forestry and agricultural land use have altered or removed riparian vegetation decreasing shade, bank stability and water retention capabilities; raising summer water temperatures; and reducing insect drop and allocthonous input to the aquatic food chain.

4. **Low summer/fall instream flows:** Low flow conditions below water diversions during critical periods can diminish or even dewater aquatic habitat and may impede anadromous or resident fish migration. Low summer flows contribute to warm water temperatures and water quality impairment. Land use activities affecting subsurface storage and recharge (stream channelization, road and wetland drainage, imperviousness) have also likely contributed to lower summer flows.

5. **Increased sediment and turbidity:** Seasonally high turbidity and sediment loading is a natural aspect of aquatic habitat within the subbasin given its geology, steep terrain and glacial characteristics. Eliminating or controlling human activities that add sediment and cause chronic or prolonged turbidity is critical to the biological productivity of subbasin habitat. Surface erosion and mass wasting associated with roads, undersized culverts, bank erosion, irrigation ditches, livestock, construction, and recreation raise the natural sediment load and increase turbidity. Glacial silt is imported into several non-glacial tributaries that are used to convey irrigation water from East and Middle Fork Hood River sources.

6. **Channel modifications:** Channelization, road fill, bank armoring and other encroachment has narrowed stream channels and limited meander inside floodplains and constrains stream function in portions of the subbasin. This has created shorter channels, steeper gradients, higher velocities, loss of storage and recharge capacity, bed armoring, and entrenchment. Channel modifications in Neal Creek interact with each flood event to further incise the streambed. The Hood River mainstem, the East Fork Hood River, and Neal Creek are most affected by channel modifications. Construction and maintenance of state Highway 35 has realigned and confined the East Fork into a narrow channel bordering the Highway, causing the river to steepen and preventing it from stabilizing within the valley floor. Historic modifications like splash damming and stream clean out also have had lasting effects on habitat development potential in the subbasin.

7. **Loss of marine nutrients:** Subbasin water chemistry has been characterized as having relatively low biological potential reflected by low specific conductance, alkalinity, hardness and trace elements (O'Toole and ODFW 1991). Loss of nutrients from anadromous adult

spawning carcasses due to extremely low population levels and migration barriers further depress the biological productivity of the subbasin.

8. **Upslope watershed conditions and altered peak flows:** A combination of natural characteristics including steep gradients, low flood storage capacity, and a high proportion of watershed area vulnerable to rain-on-snow events produce rapid runoff and high peak flows in the subbasin. Because of these natural factors, subbasin streams are especially sensitive to cumulative forest management activities including road building. Low road densities and the maintenance of a high percentage of closed-canopy forest cover within the rain on snow zone are needed to avoid chronic increases in peak flows that would undermine stream productivity and the potential for successful instream restoration.

5.2 Desired Future Conditions

The desired future conditions for the Hood River subbasin habitat would include the following general characteristics needed to restore natural ecosystem function and processes and support increased aquatic species diversity, abundance and habitat utilization:

- Anadromous and resident fish migration and distribution unimpeded by human barriers
- Excellent water quality
- Healthy, mature riparian zones that shade and contribute large wood to stream channels
- Streams have a complex habitat structure, i.e., abundant large wood, frequent deep pools, side channels, and diverse lateral habitats
- Natural streamflows preserved or restored to the maximum degree feasible
- Streams are able to access and interact with their floodplains during high water
- Adequate spawning gravel supply including within the low-water channel
- Watershed disturbances are localized and infrequent

Proposed Standards for Desired Future Conditions

1. **Fish passage:** Anadromous and resident salmonid redd distribution is more extensive compared to past surveys. Entrainment of juvenile salmonids in irrigation and power canals is substantially eliminated.

2. **Gravel supply:** Future habitat surveys and spawning surveys show increased gravel availability in wetted low flow channel approaching or meeting AIP benchmark values.

3. **Habitat structure:** Pool area, frequency, residual depth, woody debris pieces and volume approaches or meets AIP benchmark values. The number of side channels and shallow lateral habitats show an increasing trend.

4. **Species diversity and abundance:** Anadromous fish carcass biomass is increasing towards optimum levels, lamprey, coho, sea-run cutthroat, bull trout and fall chinook show an increasing trend along with steelhead and spring chinook salmon. The density and species richness of benthic invertebrates, including intolerant taxa, show a positive trend as measured by bioassessment scores.

5. **Water quantity:** Instream water rights met or exceeded with 98 percent reliability at most sites. At remaining sites, efficiency or conservation measures provide reliable minimum flows adequate to insure successful adult upstream fish migration and improve water quality. Natural flow regimes remain unaltered by additional reservoir storage. Cooperative or legal measures are in place to insure that instream flow restoration is not threatened by future diversion increases.

6. **Water quality:** Surface fine sediment levels less than 15 percent in all reaches. Forest road density no greater than 2.5 mi/mi^2 in 6^{th}-field subwatersheds. Summer water temperatures less than 64° F on a 7-day average basis, peak temperatures less than 68° F unless all human impacts (e.g., riparian conditions, water withdrawals, and reservoir storage) have been addressed to the maximum possible level. Oregon state temperature standards including 50° F bull trout standard met, unless all human impacts have been addressed to the maximum possible extent. Phosphorous and nitrogen concentrations should be less than 0.5 mg/L total phosphorous and 0.3 for nitrate, while pH values should not fall outside the range of 6.5 to 8.5. Pesticide concentrations in water and sediment meet or exceed regulatory requirements or levels considered harmless to aquatic life.

7. **Upland habitat conditions:** Forest road densities are no greater than 2.5 mi/mi^2 in 6^{th} field subwatersheds. A high percentage of closed canopy forest cover is maintained in all subwatersheds (e.g., 65 percent or more depending on vulnerability to rain on snow damage).

8. **Riparian conditions and stream-floodplain interactions:** A significant increase is measured in total stream length where riparian stands are classified as " Satisfactory" for wood recruitment per the OWEB watershed assessment manual, ODFW Aquatic Inventory Protocol, or federal standards. A significant increase is measured in total stream length where riparian stands are classified as " Satisfactory" for stream shade levels per the OWEB watershed assessment manual, ODFW Aquatic Inventory Protocol, or federal standards along stream segments where natural vegetation would provide shade. Monitoring after restoration projects involving removal of levees and other confining structures along streams indicates an increase in meander/stream length. An increase in the number of side channels is observed over time.

6. HABITAT PROTECTION AND RESTORATION ACTIONS

6.1 Summary

This Plan aims to protect and restore aquatic habitats, and to correct problems that limit natural production in the Hood River subbasin. Proposed habitat protection and restoration measures are listed in Tables A through E at the end of this Chapter. Table A lists those measures that cover the whole subbasin, while Tables B through E lists other activities by major watershed area.

It is anticipated that CTWSRO and ODFW will implement many of these measures or projects with the help of BPA funds, GWEB grants, and Wyden Amendment funds; while different entities will implement other listed projects using other funding sources. The lead agency, project partners, funding sources, and cooperators will be determined for each project or activity as individual project planning proceeds. Projects and/or their relative priorities may change in the future based on new information.

6.2 Goals, Strategies, and Tasks for Habitat Protection

Habitat protection is essential for fish recovery efforts to succeed over the long term. Effective protection will prevent or minimize additional habitat loss and degradation, and avoid the need for more difficult and costly habitat remediation in the future. Protection opportunities are available through state, federal and local regulatory and permit processes and must be maximized. Sustained efforts are needed to insure that plans, laws, policies and guidelines established to protect aquatic habitat are fully enforced. Educational activities, landowner incentive programs, land acquisition and other voluntary measures offer other important and complimentary opportunities to protect habitat.

Habitat Protection Goals for the Hood River Subbasin

Goal 1: Prevent degradation of existing high quality anadromous and resident fish habitats in the Hood River subbasin and watershed areas that most directly influence the condition of floodplain and riparian areas. This includes encouraging management of recreational uses to protect sensitive areas, and avoiding establishment of new recreation sites in sensitive riparian areas.

Goal 2: Control risks and prevent land use or management activities that threaten or constrain natural ecosystem processes, including threats to natural hydrology and flow regimes, connectivity between streams, floodplains and riparian zones, and proposals that would impair the condition of upland habitats.

Strategies and Tasks to Meet Hood River Subbasin Habitat Protection Goals

Strategy 1: Seek to insure that all state, federal and local regulations, permits, plans and guidelines enacted to protect fish habitat are enforced by working closely with Hood River County; Oregon Division of State Lands; Departments of Agriculture, Water Resources, Transportation, Environmental Quality, and Forestry; USFS; and where appropriate, EPA, NMFS and USFWS. *Note:* This strategy is currently in place, however, its effectiveness has been limited by the availability of personnel and budgetary constraints.

Tasks

1. Review and comment on Oregon Forest Practices Act (FPA) and Fill-Removal permit applications to promote enforcement of provisions that protect water quality and the integrity of fish bearing streams.
2. Review and comment on USFS proposals and plans to insure that the 1994 Northwest Forest Plan Aquatic Conservation Strategy objectives are met.
3. Review and comment on ODOT plans and proposals for Highway 218 and Highway 35 with the potential to affect streams.
4. Review and comment on Hood River County land use applications that affect water quality and floodplains.
5. Participate in local and state planning efforts and review and comment on other development proposals with the potential to affect streams, floodplain and riparian areas, and upland habitat quality.
6. Evaluate and address the need in the HRPP for a habitat biologist position for greater and more comprehensive participation in protection activities. *Note*: Habitat protection activities for the HRPP have been the responsibility of existing staff in conjunction with broader project duties.

Strategy 2: Work in cooperation with federal, private and local government agencies, landowners, land trusts, and other parties to avoid or minimize future aquatic habitat loss and degradation on private and public lands.

Tasks

1. Coordinate with landowners, the Natural Resource Conservation Service, land trust organizations, and realtors to identify private land conservation opportunities including incentive programs (e.g., CREP), donated or purchased easements or land acquisition to expand riparian and wetland buffers or protect sensitive lands.
2. Develop other land and resource management plans, including use of conservation easements or land acquisition that will result in improved water quality and stream habitat in the subbasin.
3. Advocate for timely updates and resource inventories of local land use plans to prevent further development and degradation of floodplains, wetlands, riparian and other sensitive areas.
4. Support the implementation and enforcement of provisions of the Hood River Agricultural Water Quality Management Area Plan and the Total Maximum Daily Load plan process to prevent agricultural and other water pollution.
5. Work with Hood River County Public Works and ODOT to increase stream protection

in routine road maintenance activities. Map rural road ditches that drain directly to streams, and encourage alternative ditch design and maintenance practices to avoid sediment and herbicide delivery to streams.

Strategy 3: Implement educational approaches that focus on habitat protection in cooperation with the HRWG, Hood River County and others.

Tasks

1. Support educational efforts and projects promoting use of best management practices by landowners, local government and other agencies.
2. Continue active participation in and support of the HRWG (watershed council) including HRWG Action Plan development and implementation.
3. Support educational efforts that inform recreational users (whitewater boaters, ORV users, mountain bikers, etc) about watershed health and fish habitat protection.

6.3 Goals, Strategies, and Tasks for Habitat Restoration

In the Hood River subbasin, restoration actions believed to have the greatest potential direct or immediate effect on habitat productivity include proper screening at water diversions, adult fish passage improvements, and instream flow restoration. Pesticide contamination detected by ODEQ in 1999 is also of serious concern and must be addressed.

Restoration is the process of repairing damage caused by humans to the diversity and dynamics of indigenous ecosystems (Jackson et al. 1995). While some habitat problems lend themselves to passive restoration, others require active treatment. Active and passive approaches are proposed in this plan. Examples of subbasin problems requiring active treatment include failing culverts and artificial migration barriers, while passive restoration is likely to be appropriate for riparian areas impacted by livestock after livestock are excluded. For streams heavily damaged by historic splash dams and riparian timber harvest, reliance on passive recovery of stream habitat may not be the best approach given the long time frame needed for natural recovery. Extreme channel degradation, lack of pools, poor gravel retention, and low wood debris recruitment potential in certain locations may justify active restoration (e.g., large wood placement) after careful evaluation of whether and how the treated reach may respond. Although case studies of instream restoration and enhancement projects have shown that many have failed to meet objectives (e.g., Bestcha et al 1994), substantial adaptive experience has been developed locally by the USFS and others in the design, implementation and monitoring of instream projects to accelerate recovery of natural stream processes.

Habitat Restoration Goals for the Hood River Subbasin

Goal 1: Correct existing habitat problems and improve water quality to help restore the natural production capacity of the Hood River subbasin to meet HRPP goals, including the long-term goal of restoring self-sustaining spring chinook salmon and winter and summer steelhead

populations.

Goal 2: Restore natural watershed processes and healthy riparian corridors that support hydrologic and ecological functions essential to anadromous and resident fish populations in the Hood River subbasin with guidance from historical landscape information, federal Watershed Analyses, and the Hood River Watershed Assessment.

Strategies and Tasks to Meet Hood River Subbasin Habitat Restoration Goals

Strategy 1: Develop partnerships with federal, state, private and local government agencies and individuals to implement habitat restoration and improvement projects.

Task

1. Work with the HRWG (council) members and the HRSWCD to help identify opportunities for partnerships and cost sharing as part of the HRWG Watershed Action Plan and the Hood River Agricultural Water Quality Area Management Plan.

Strategy 2: Maintain or improve passage for upstream and downstream migrant resident and anadromous salmonids and lamprey in the subbasin.

Tasks

1. Remove artificial fish passage barriers at dams and water diversions, or otherwise provide effective upstream and downstream passage.
2. Provide fish screens that meet state and federal protection criteria at all water diversions.
3. Identify and eliminate fish passage problems at road culverts on all land ownership.
4. Work with irrigation districts to eliminate use of natural stream channels for irrigation water conveyance in favor of pipe or artificial conduits.
5. Restore fish passage above partial natural barriers in situations where access to historic habitat is impeded.

Strategy 3: Restore the instream structural complexity of stream channels and reconnect instream-riparian, stream-floodplain, and wetland-stream linkages.

Tasks

1. Expand comprehensive physical and biological stream surveys in anadromous stream segments and re-survey selected anadromous streams altered by severe flooding in 1996.
2. Identify areas most easily restored to provide more refuges and reconnect historic channels or productive habitat types by removing road fill from stream channels where feasible, relocating road segments, and restoring streams to historic channels.
3. Work with ODOT to develop a long term solution for channel confinement and ongoing flood repairs caused by Highway 35 that alleviates impacts to the East Fork Hood River.
4. Work with USFS, Hood River County, Longview Fibre Company, and interested private landowners on projects involving large woody debris placement, boulder placement, and side channel restoration.
5. Investigate wetland restoration opportunities that offer downstream hydrology and/or water quality benefits.

Strategy 4: Improve instream flows below water diversions through FERC licensing proceedings and by active cooperation with water providers to increase the efficiency of water systems and water users.

Tasks

1. Convert open distribution canals and ditches to pressurized pipe or lined canals in partnership with irrigation districts.
2. Assist in developing legal mechanisms for water right transfers in specific situations where transfers can help restore instream flow to benefit fish and wildlife resources without negative impacts or tradeoffs between species or locations.
3. Implement water conservation and instream flow restoration measures including increased water use efficiency in orchards, pastures, residential, and other water uses.
4. Insure that the new FERC license for Powerdale Dam includes provisions for increased minimum instream flows in the bypass reach as agreed to by CTWSRO and ODFW.

Strategy 5: Improve water quality through cooperative efforts with SWCD, Irrigation Districts, ODA, ODEQ, Grower Shippers Association, OSU Extension, NRCS, EPA, Hood River County, landowners, and others that implement projects and promote practices to reduce thermal pollution, and sediment, pesticide, and nutrient delivery to streams.

Tasks

1. Seek to fully implement the Hood River Agricultural Water Quality Area Management Plan produced by the HRSWCD and Oregon Department of Agriculture.
2. Continue to monitor water quality for pesticides, nutrients, bacteria, sediment, pH, and temperature.
3. Complete forest road hazard and conditions inventory on Hood River County and adjacent land and develop maintenance plans in cooperation with the county and private timber companies.
4. Identify and implement projects to correct poor road surfaces, undersized culverts, inadequate drainage, and other problems on all roads including private roads and driveways; support such projects on federal lands.
5. Stabilize, decommission, and/or close forest roads in areas not scheduled for timber harvest; and control wet season recreation road access in sensitive areas.
6. Exclude livestock from riparian areas in cooperation with private landowners.
7. Encourage use of farm conservation plans and improved pasture management.
8. Restore stream nutrients historically contributed by high numbers of spawned-out anadromous fish by placing fish carcasses from excess brood or other locations in the stream.
9. Encourage relocation of recreation sites away from riparian areas.
10. Support landowner education, incentive programs, and projects that promote use of conservation practices to improve water quality.

6.4 Proposed Actions and Prioritization

The five tables on the following pages list proposed habitat protection and restoration actions

for the Hood River subbasin in order to meet or carry out the goals, strategies and tasks outlined above. Specific actions are assigned a *relative* priority ranking from 1 to 3, with 1 being the highest priority (Tables A through E). Both the project proposals and their relative priorities may be modified in response to new information.

In general, actions that protect riparian and upland habitat in good condition or that remediate known fish mortality problems are considered the highest priority under this plan and will generate the greatest benefits toward meeting the goals of the HRPP. The rationale for prioritization was based on the following factors:

1. **Potential benefits and cost effectiveness in addressing limiting factors:** actions that promise to provide the greatest immediate or long term benefit in a cost efficient manner.
2. **Fish species benefited:** projects and activities that directly benefit spring chinook salmon, winter steelhead, summer steelhead, bull trout, other native salmonids or lamprey.
3. **Urgency of implementation:** projects that satisfy a more immediate need or where timely action now can avert the need for more costly remediation in the future.
4. **Landowner or cooperator participation:** projects with willing landowners or cooperators who will maintain long term involvement and are invested in a successful outcome.
5. **Outlook for cost sharing and partnerships:** projects and activities having a high likelihood of financial and/or in-kind contribution from other agencies and stakeholders.
6. **Project feasibility:** projects and activities that are technically feasible and present a minimum of logistical constraints including permit acquisition.

TABLE A. HOOD RIVER SUBBASIN - PROPOSED ACTIONS

Priority[a]	Location	Species[b]	Deficiency	Limiting Factor[c]	Potential Action
2	Scattered sites	StS, StW, ChS, ChF, Co, But, Rb, Ct	Inadequate screens on small pump withdrawals	1	Upgrade screens via ODFW small screen program
1	Lower tributaries	StS, StW, ChS, ChF, Co, But, Rb, Ct	Pesticide contamination detected in 1999	3	Continue monitoring studies, work with growers, distributors, OSU, ODA, SWCD to change orchard practices
2	Various streams	StS, StW, ChS, ChF, Co, But, Rb, Ct	Stream habitat survey absent, incomplete or outdated	NA	Conduct stream surveys on selected streams
1	Lower half subbasin	StS, StW, ChS, ChF, Co, But, Rb, Ct	Wetland information to guide protection and restoration	2, 3, 4, 8	Conduct wetland inventory & functional assessment
1	Entire	StS, StW, ChS, ChF, Co, But, Rb, Ct	Protection of critical or sensitive riparian areas, floodplains	2, 3, 5, 6	Inventory parcels, work with landowners, land trust organizations to acquire easements, donations
3	Entire	StS, StW, ChS, ChF, Co, But, Rb, Ct	Macro invertebrate and food chain productivity	3 ,5, 7	Investigation needed
1	Entire	StS, StW, ChS, ChF, Co, But, Rb, Ct	Undersized road culverts or barriers at road culverts	1	Remediate known problem culverts and conduct broader survey
3	Entire	StS, StW, ChS, ChF, Co, But, Rb, Ct	Nutrient cycling, algal growth, pH dynamics information	3, 5, 7	Investigation needed
1	Entire	StS, StW, ChS, ChF, Co, But, Rb, Ct	Forest road sediment delivery to streams	3, 5	Locate remediation sites, develop cooperative plan for upgrades, maintenance & management strategies
1	Entire	StS, StW, ChS, ChF, Co, But, Rb, Ct	Rural road and highway sediment & herbicide delivery to streams, poor ditch practices	3, 5	Locate and map sensitive ditch lines draining directly to streams; develop cooperative maintenance plan to upgrade and pursue alternative practices
1	Scattered sites	StS, StW, ChS, ChF, Co, But, Rb, Ct	Continuing encroachment and loss of floodplain and riparian habitat	2, 3, 5, 6	Revise County floodplain maps and ordinances to address channel migration zones and retention of riparian vegetation

[a] Relative priority ranking: 1 = High, 2 = Medium, 3 = Low.
[b] StS = summer steelhead, StW = winter steelhead, ChS = spring chinook salmon, ChF = fall chinook salmon, Co = coho salmon, Rb = rainbow trout, Ct = cutthroat trout, But = bull trout.
[c] Limiting Factors: 1 = fish passage, 2 = habitat structure, 3 = water quality and riparian conditions, 4 = low flows, 5 = sediment and turbidity, 6 = channel modifications, 7 = marine nutrients, 8 = altered peak flows.

TABLE B. HOOD RIVER MAINSTEM DRAINAGE - PROPOSED ACTIONS

Priority[a]	Stream	Location	Species[b]	Deficiency	Limiting Factor[c]	Potential Action
1	Hood River	Powerdale Dam	StS, StW, ChS, ChF, Co, But, Rb, Ct	Inadequate fish screen	1	Install new screen in hydro diversion
1	Hood River	Powerdale Dam	StS, StW, ChS, ChF, Co, But, Rb, Ct	Inadequate fish screen at auxiliary intake for fish ladder	1	Install new screen at Auxiliary water supply intake
2	Hood River	Powerdale Dam	StS, StW, ChS, ChF, Co, But, Rb, Ct	Upstream passage delay	1	Operational plan and/or structural modifications to improve passage
1	Hood River	Farmers Canal Diversion	StS, StW, ChS, ChF, Co, But, Rb, Ct	Inadequate fish screen	1	Replace existing screen and fish bypass
1	Neal Creek	EFID Diversion	StW, ChF, Co, Rb, Ct	Inadequate fish screen and adult passage, sediment	1,5	Construct pipe and invert siphon to Eastside Canal, remove diversion and screen
2	Neal Creel	Lower West Fork	StW, ChF, Co, Rb, Ct	Confined channel, few pools, low complexity	2, 6, 8	Pull back or remove old road fill, add large woody debris
1	Neal Creek	Scattered sites	StW, ChF, Co, Rb, Ct	Low riparian shade and instream habitat complexity	2, 3, 5	Exclude livestock, protect/enhance riparian vegetation
3	Neal Creek	Meadowbrook Rd to Dethman Ridge Rd	StW, ChF, Co, Rb, Ct	Floodway encroachment; confinement; vegetation removal, upslope ditching	6, 8	Landowner education, riparian improvements, investigate options for flood scour reduction, wetland restoration
1	Neal Creek	QVL-Hanel Mill Yard	StW, ChF, Co, Rb, Ct	Log yard runoff to waterways	3	Improve settling ponds and drainage facilities
3	Odell Creek	Scattered sites	Rb, Ct	Low or moderate riparian shade, water quality	3	Exclude livestock, protect/enhance riparian vegetation

[a] Relative priority ranking: 1 = High, 2 = Medium, 3 = Low.
[b] StS = summer steelhead, StW = winter steelhead, ChS = spring chinook salmon, ChF = fall chinook salmon, Co = coho salmon, Rb = rainbow trout, Ct = cutthroat trout, But = bull trout.
[c] Limiting Factors: 1 = fish passage, 2 = habitat structure, 3 = water quality and riparian conditions, 4 = low flows, 5 = sediment and turbidity, 6 = channel modifications, 7 = marine nutrients, 8 = altered peak flows.

TABLE C. WEST FORK HOOD RIVER DRAINAGE – PROPOSED ACTIONS

Priority[a]	Stream	Location	Species[b]	Deficiency	Limiting Factor[c]	Potential Action
1	West Fork Hood River	Punchbowl Falls	StS ,StW, ChS, ChF, Rb	Unreliable access for fish ladder operation and maintenance	1	Schedule maintenance, replace access ladder. Evaluate wing wall or other method to increase flow
2	West Fork Hood River	Moving Falls to West Fork Bridge	StS, StW, ChS, ChF, Rb	Lack of instream habitat complexity and gravel retention	2	Place large wood debris
2	West Fork Hood River	Dry Run to Elk Creek	StS, ChS, Rb	Lack of instream habitat complexity and gravel retention	2	Place large wood debris
1	West Fork Hood River	Dee Irrigation Diversion	StS, ChS, Rb	Upstream fish passage (also excessive leakage from unlined canal)	1, 4	Improve passage at range of flows or cooperate with districts for alternate water supply plan
2	West Fork Hood River	BPA Powerline	StS, ChS, Rb	Vegetation management and access road impairs riparian zone and water quality near prime spawning grounds	3, 5	Improve road and vegetation management to alleviate erosion and other impacts
1	West Fork Hood River	From Ladd Creek to Twin Bridges	ChS	Shoreline camping, illegal fishing, presents risk to spring chinook spawning success in prime area	3,5	Restrict recreational access during spawning period, coordinate with OSP for increased patrols
3	McGee Creek	(1) Lower mile (2) Approx. RM 2.0 and up	StS , ChS	(1) Lack of pools, habitat complexity, gravel retention (2) Possible culvert, logjam barrier	2,1	Place large wood debris Evaluate passage barriers
3	Elk Creek	Lower 1 - 2 miles	StS, ChS, Rb	Lack of instream habitat complexity & gravel retention; possible culvert barrier at RM 2.0	2,1	Place large wood debris Evaluate passage barrier
3	Lake Branch Creek	Partial barrier	StS, ChS, Rb	Upstream passage to high quality habitat currently impeded by natural cascade	1	Research historic anadromous use of upper Lake Branch; improve passage if appropriate

[a] Relative priority ranking: 1 = High, 2 = Medium, 3 = Low.
[b] StS = summer steelhead, StW = winter steelhead, ChS = spring chinook salmon, ChF = fall chinook salmon, Co = coho salmon, Rb = rainbow trout, Ct = cutthroat trout, But = bull trout.
[c] Limiting Factors: 1 = fish passage, 2 = habitat structure, 3 = water quality and riparian conditions, 4 = low flows, 5 = sediment and turbidity, 6 = channel modifications, 7 = marine nutrients, 8 = altered peak flows.

TABLE C CONTINUED. WEST FORK HOOD RIVER DRAINAGE – PROPOSED ACTIONS

Priority[a]	Stream	Location	Species[b]	Deficiency	Limiting Factor[c]	Potential Action
1	West Fork Hood River	Green Point Creek to mouth	StS ,StW, ChS, Rb	Low summer flows, not meeting instream water right	4	Work with irrigation districts to improve delivery system, improve water use efficiency, reduce water diverted
1	Green Point Creek	Below FID diversion	StW, Rb	Low summer flows, no minimum flow protection established	4	Work with FID to improve delivery system, improve water use efficiency, reduce water diverted
3	Lake Branch	Scattered sites	StS, ChS, Rb	Lack of instream habitat diversity and gravel retention	2	Place large wood debris
3	Green Point Creek	Lower 2 miles	StW, Rb	Lack of instream habitat diversity and gravel retention	2	Place large wood debris
2	Ladd Creek	Point of recent channel change	StS, ChS, Rb	Delivers glacial sediment further upstream in the West Fork	5	Investigate risk/benefit of rerouting to former channel to improve water quality in the West Fork

[a] Relative priority ranking: 1 = High, 2 = Medium, 3 = Low.
[b] StS = summer steelhead, StW = winter steelhead, ChS = spring chinook salmon, ChF = fall chinook salmon, Co = coho salmon, Rb = rainbow trout, Ct = cutthroat trout, But = bull trout.
[c] Limiting Factors: 1 = fish passage, 2 = habitat structure, 3 = water quality and riparian conditions, 4 = low flows, 5 = sediment and turbidity, 6 = channel modifications, 7 = marine nutrients, 8 = altered peak flows.

TABLE D. MIDDLE FORK HOOD RIVER DRAINAGE – PROPOSED ACTIONS

Priority[a]	Stream	Location	Species[b]	Deficiency	Limiting Factor[c]	Potential Action
1	Middle Fork Hood River & lower Clear Branch	Clear Branch to mouth	StW, ChS, But, Ct	Low summer flows, not meeting instream water right	4	Work with MFID to improve delivery system, improve water use efficiency, reduce water diverted
1	Middle Fork Hood River	Clear Br Dam to Coe Branch	StW, ChS, But, Ct	Fish spawning habitat gravel supply limited by dam	2	Introduce spawning gravel as needed and wood structure to retain gravel
3	Rogers Spring Creek	Below Red Hill Drive	StW, ChS, Co, Ct	Poor gravel supply	2	Place gravel
1	Middle Fork Hood River	Tony Creek to Bear Creek	StW, ChS, But, Co, Ct	Low habitat complexity; poor gravel supply	2	Place large wood debris
2	Clear Branch	Below Clear Br Dam, and in Laurance Lake Reservoir	StW, ChS, But, Ct	Heat discharge in late summer/fall as cool water depleted via deep outlet; blue-green algal blooms, high pH	3	Investigate cost-benefit of reconfiguring reservoir outlet for improved temperature control; further investigation of algal blooms
1	Tony Creek	Dee Mill Diversion	StW, ChS, But, Co, Ct	inadequate screen; temporary adult passage	1	Install new fish screen and long-term upstream passage or decommission & develop alternative water supply
1	Tony Creek	Aldridge diversion	StW, ChS, But, Co, Ct	Inadequate fish screen	1	Install new fish screen
2	Coe Branch	MFID diversion	StW, But, Ct	Inadequate fish screen and fish passage	1	Install new screens and fish ladder
3	Eliot Branch	Mouth upstream 300 yards	StW, But, Ct	Natural debris torrent (11/99) 8 ft deep. No surface flow	1	Explore options to restore surface flow, wait and see what nature does
3	Eliot Branch	MFID diversion	StW, But, Ct	Inadequate fish screen and fish passage	1	Install new screens and fish ladder

[a] Relative priority ranking: 1 = High, 2 = Medium, 3 = Low.
[b] StS = summer steelhead, StW = winter steelhead, ChS = spring chinook salmon, ChF = fall chinook salmon, Co = coho salmon, Rb = rainbow trout, Ct = cutthroat trout, But = bull trout.
[c] Limiting Factors: 1 = fish passage, 2 = habitat structure, 3 = water quality and riparian conditions, 4 = low flows, 5 = sediment and turbidity, 6 = channel modifications, 7 = marine nutrients, 8 = altered peak flows.

TABLE E. EAST FORK HOOD RIVER DRAINAGE – PROPOSED ACTIONS

Priority[a]	Stream	Location	Species[b]	Deficiency	Limiting Factor[c]	Potential Action
1	East Fork Hood River	Below EFID diversion to Middle Fork	StW, Co, Ct	Extreme summer instream flow depletion at times	4, 3, 1	Work with EFID to develop strategic plan to improve delivery system, improve water use efficiency, reduce water diverted
1	East Fork Hood River	EFID Diversion	StW, Co, Ct	EFID diversion facilities rely on maintaining push up dam and impacts channel	1,6	Work with EFID to develop alternative to push up dam
1	East Fork Hood River	EFID Diversion and sand trap facility	StW, Co, Ct	EFID screen facility evaluations & NMFS approval not yet completed, sediment release unresolved	1,6	Work with EFID and NMFS to complete testing and assessment of fish screen and fish return; develop comprehensive operational plan with DEQ and fish agencies to resolve sediment release, fish salvage
1	East Fork Hood River	Baseline Rd to Pocket Creek	StW, Co, Ct	Channel altered and confined by OR HWY 35, frequent rip-rapping and flood maintenance impacts	2, 6, 8	Work with ODOT to set back dike, relocate HWY 35, or develop mitigation, maintenance, and stream enhancement plan
2	East Fork Hood River	Baseline Rd to Pocket Creek	StW, Co, Ct	Extremely low pool habitat	2	Monitor 1999 woody debris placement by USFS, evaluate adding large wood
1	East Fork Hood River	Baldwin Creek to Toll Bridge	StW, Co, Ct	Lack of connection to floodplain, low habitat diversity	2	Identify opportunities for side channel and wetland restoration; evaluate adding large wood
1	East Fork Hood River	Below NF boundary	StW, Co, Ct	Threat of floodplain development and further encroachment	2, 6, 8	Work with County to identify meander zones, update flood maps, and insure protective laws are enforced, consider easements/acquisition
1	Baldwin Creek	Below HWY 35	StW, Co, Ct	Partial barrier & inadequate fish screen at fish ponds	1	Install new screens and provide upstream passage
2	Baldwin Graham Tieman, Emil, Wishart	Scattered sites	StW, Co, Ct	Degraded riparian habitat, water quality	3, 5	Fence livestock; control other degrading activities, education and monitoring

[a] Relative priority ranking: 1 = High, 2 = Medium, 3 = Low.
[b] StS = summer steelhead, StW = winter steelhead, ChS = spring chinook salmon, ChF = fall chinook salmon, Co = coho salmon, Rb = rainbow trout, Ct = cutthroat trout, But = bull trout.
[c] Limiting Factors: 1 = fish passage, 2 = habitat structure, 3 = water quality and riparian conditions, 4 = low flows, 5 = sediment and turbidity, 6 = channel modifications, 7 = marine nutrients, 8 = altered peak flows.

TABLE E CONTINUED. EAST FORK HOOD RIVER DRAINAGE – PROPOSED ACTIONS

Priority[a]	Stream	Location	Species[b]	Deficiency	Limiting Factor[c]	Potential Action
3	Robinhood Creek	Scattered sites	Ct	Lack of habitat complexity and wood recruitment	2	Plant frost-resistant seedlings as shelterwood for other conifers, evaluate adding large wood
2	Trout, Wishart, Emil, Griswell Creek	Various segments	StW, Co, Ct	Inter-basin transfers import glacial silt into clear streams	1, 5	Work with MFID to construct piping alternatives to eliminate use of East Fork tributaries as conveyance
1	Evans Creek	3 irrigation diversions	StW, Co, Ct	No fish passage; glacial turbidity in lower half	1, 5	Remove or modify to provide fish passage; pipe Middle Fork source water

[a] Relative priority ranking: 1 = High, 2 = Medium, 3 = Low.
[b] StS = summer steelhead, StW = winter steelhead, ChS = spring chinook salmon, ChF = fall chinook salmon, Co = coho salmon, Rb = rainbow trout, Ct = cutthroat trout, But = bull trout.
[c] Limiting Factors: 1 = fish passage, 2 = habitat structure, 3 = water quality and riparian conditions, 4 = low flows, 5 = sediment and turbidity, 6 = channel modifications, 7 = marine nutrients, 8 = altered peak flows.

7. MONITORING

7.1 Introduction

Monitoring is necessary to evaluate the effectiveness of habitat improvements and conservation strategies implemented under this Plan. Baseline monitoring is continuing and has been conducted as part of the HRPP since 1991 (e.g., BPA project No. 8805303 and No. 8805304). Monitoring activities associated with the HRPP have included adult return counts, spawning ground surveys, hatchery and wild smolt emigration estimates, genetic evaluations, resident and anadromous fish distribution and abundance surveys, continuous water temperature monitoring, and stream habitat surveys.

In addition, bull trout, aquatic invertebrate, habitat surveys and monitoring of habitat restoration structures is conducted on federal lands by the USFS. Water quality monitoring in the subbasin is conducted by various entities, and most recently was expanded to include pesticide sampling. While some of this ongoing data collection may contribute information useful in evaluating actions implemented under this Plan, additional monitoring is needed to evaluate the physical and biological recovery associated with individual or combined action projects, to verify underlying assumptions, and to measure the effectiveness of methods used.

Ideally, monitoring associated with this Plan will attempt to determine whether and how much both individual and combined habitat improvements contribute to increased productivity within the subbasin or specific subwatershed areas. However, long time frames are needed to assess whether restoration efforts have improved fish production, and external factors and variables can influence results. For some projects, for example fish screen problems, the effect of improvements may be more straightforward and assessment relatively quick.

In general, the type of monitoring and data collection expected under this Plan is either baseline, implementation, project, or effectiveness monitoring (Mac Donald et al. 1991) or some combination of these. Baseline monitoring will be used to characterize existing conditions or those prior to treatment, and to establish a database for future comparisons or planning. Implementation monitoring will assess whether activities were carried out as planned, e.g., whether the project used best management practices or met the design criteria, while effectiveness monitoring will be used to evaluate whether a project generated the desired outcomes and to verify initial project assumptions. Project monitoring or evaluations are conducted to assess the impact of a particular activity.

Monitoring expected to accompany individual actions implemented in this Plan most likely will have a maximum duration of 5-10 years. As suggested in the Oregon Aquatic Habitat Restoration and Enhancement Guide (Oregon Plan for Salmon and Watersheds 1999), the level or intensity of monitoring activities will vary with the cost of the project, the degree of change anticipated, and whether the project is a common or experimental approach.

7.2 Monitoring Goals and Objectives

Monitoring activities to be conducted as part of habitat improvement efforts outlined in this Plan are based on the following goals:

- Indicate whether restoration measures were implemented as planned
- Determine whether projects met objectives
- Verify achievement of desired results
- Test soundness of underlying assumptions
- Provide feedback to make necessary adjustments or opportunity to improve future practices
- Allow for adaptive management strategies to respond to new information
- Be cost-effective and realistic

7.3 Anticipated Monitoring Activities

Anticipated and potential monitoring activities are listed below by project type. An explicit statement of objectives will be developed for each project with a plan and schedule for pre-and post project evaluations. Precise objectives will include an estimate of approximate costs, monitoring parameters, sampling locations, sampling frequency and data analysis techniques.

1. Fish Passage – Screening at Water Diversions

a) Baseline fish salvage data collection at unscreened or inadequately screened diversions.
b) Post-project coordination of co-managers, NMFS, irrigation districts to conduct hydraulic and biological testing to evaluate compliance with state and federal screen fish criteria, screen efficiency and juvenile fish injury rates.
c) Fish salvage data collection within canals at the end of the irrigation season to evaluate facility performance; compare to baseline fish salvage data.
d) Periodic inspections to identify any gaps in screens and to insure proper operation.

2. Fish Passage – Adult Upstream Barriers

a) Periodic physical and/or hydraulic inspection of passage structure (culvert, fish ladder, or other improvement).

b) Annual spawning ground surveys to assess habitat utilization above passage improvement.
c) A two or three pass electrofishing removal method (Zippin 1958 and Seber and Whale 1970) will be used to estimate juvenile use of habitat above passage improvements, comparing to baseline information in the sample reach if available.
d) Use other method as appropriate to determine fish migration success or evaluate

reduction in delay or amelioration of poor passage conditions.

3. Riparian Conditions

a) Monitor changes in fish distribution, relative abundance, or species composition associated with changes in stream and riparian conditions.
b) Monitor changes in substrate composition or channel morphology.
c) Plant survival and streambank erosion associated with riparian revegetation and stream bank bioengineering.
d) Pre- and post- project habitat surveys including shade, wood recruitment potential, and erosion.
e) Location of permanent photographic record points to document changes over time.
f) Water quality monitoring may include temperature DO, pH, nutrients, pesticides, and turbidity.
g) Monitor condition of riparian fencing and make adjustments where appropriate.

4. Instream Habitat Conditions

a) Counts and volumes of large woody debris.
b) Document influence of LWD on pool dimensions or effect on habitat structure –e.g. development of side channels.
c) Habitat structures built as designed - e.g. pool and refuge habitat availability at different flows.
d) Tracking of initial positions and downstream or lateral movement of woody debris placements after flood events using GPS or tags.
e) Substrate composition using pebble counts (Wolman1954) or similar methods.
f) Channel geometry and gradient, e.g. measurement of cross-sectional and longitudinal channel profiles.
g) Habitat characteristics using Aquatic Inventories Project (ODFW 1995) survey protocol and metrics including average pool-riffle ratio, residual pool depth, pool frequency, and pool area.
h) Location of permanent photographic record points to document changes over time
i) Establishment of permanent survey response reaches.
j) Monitoring of changes in fish distribution, relative abundance, species composition, and life stage utilization associated with stream and riparian improvement projects.
k) Instream flow measurements.

5. Upslope Watershed Conditions

a) Documentation of road miles treated, constructed, closed, and obliterated within each subwatershed.
b) Assessment of water flow capacity through upgraded or removed road culverts.

c) Water quality monitoring may include temperature DO, pH, nutrients, pesticides, and turbidity.

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