Proposed Focused Investment Partnership

Hood River Salmon, Steelhead, and Bull Trout Habitat

The Hood River Watershed Group invites the OWEB Board to consider spawning and rearing habitat for Hood River populations of salmon, steelhead, and bull trout for statewide priority consideration. The 339-square mile watershed has one of the most diverse assemblages of anadromous and resident fish in the state. This includes spring and fall Chinook salmon, summer and winter steelhead, coho, Pacific lamprey, bull trout, sea-run and resident cutthroat trout, and rainbow trout. All of the anadromous populations of salmon and steelhead, as well as bull trout, are listed as threatened under the federal Endangered Species Act.

Ecological Significance to the State

The high fish-species diversity in the Hood River Basin is due to the watershed's geography. It is within the transition zone between the west and east side of the Cascade Range, with the Columbia River as a conduit. Ecologically, this is reflected by the presence of both winter and summer steelhead, and fall and spring Chinook salmon. Its glacier-fed streams provide very cold water, which supports two populations of bull trout.

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The Hood River is an essential basin within Oregon for recovery of the Lower Columbia Salmon and Steelhead ESU. This is due to the unique genetics and life history diversity of its populations. For example, the basin contains the only population of summer steelhead in the Lower Columbia ESU. With the exception of winter steelhead, the current extinction risks of salmon and steelhead populations within the Hood are very high (ODFW 2010). Tribal, state, and federal fisheries agencies estimate that recovery of Hood River winter steelhead and spring Chinook populations is likely with appropriate restoration and conservation actions. However, they have concerns about recovery of fall Chinook, summer steelhead, and coho. Furthermore, it would be challenging to successfully reintroduce chinook, coho, or steelhead runs from other stocks in the lower and middle Columbia because of the dissimilarities with Sandy and Deschutes River stocks (Rod French, ODFW 2014, pers. comm.) This highlights the unique genetic and life history traits of Hood River salmon and steelhead populations, which appear to be adapted to the more volatile conditions of the watershed.

Bull trout in the Hood River basin are thought to exist as two reproductively independent local populations (USFWS 2002, Rieman and McIntyre 1995). The "Clear Branch" population was isolated from the rest of the basin by the construction of Clear Branch Dam in 1968. This dam provides limited downstream fish passage during periods of spill and no voluntary upstream passage. Bull trout in this population inhabit Laurance Lake reservoir and two tributaries that flow into it. The "Hood River" population is distributed in the mainstem Hood River, Middle Fork Hood River, and a few Middle Fork tributaries. Fluvial migrants from the Hood River basin forage and winter in the Columbia River. The status of both local populations is tenuous (Starcevich & Jacobs 2010).

Pacific lamprey are re-colonizing the basin after the 2010 removal of Powerdale Dam, which was located at river mile 4 of the mainstem Hood River. The Confederated Tribes of the Warm Springs (CTWS) have been documenting this re-colonization and have found adults and ammocoetes up to river mile 1 of the East Fork Hood River. In addition to benefiting and expanding the range of this depleted species, lamprey will provide a valuable forage base to native fish.

Primary Limiting Factors and Threats

The Ecosystem Diagnostic and Treatment Model, developed for the Hood River Subbasin Plan, identified five primary limiting factors to anadromous salmonid production (Coccoli 2004). These were streamflow, habitat diversity, key habitat quantity, channel stability, and sediment load. The Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead also identified low streamflow and impaired habitat diversity as primary limiting factors to recovery (ODFW 2010). The primary limiting factors for the bull trout populations are fish passage, stream temperature, low streamflows in late summer, and natural stochastic and human-induced sediment impacts (USFWS 2002).

Stream Flow: The primary threats to streamflow are withdrawals for agriculture and off-channel hydropower production, as well as predicted reduction in summer streamflow from climate change. In some stream reaches, diversions for agricultural and hydropower production can withdraw 40% or more of the average natural flow from July to September. These diversions reduce the quantity of spawning and rearing habitat and can affect fish passage. **Figure 1** shows a comparison of instream water rights, established in 1983, and modeled average monthly flows in the East Fork Hood River downstream of a major agricultural diversion. Instream water rights are established at seven locations throughout the Hood River Watershed but are reliably met at only two of these sites. Low flows in September and October are particularly harmful for fall spawning species like Chinook salmon and bull trout.

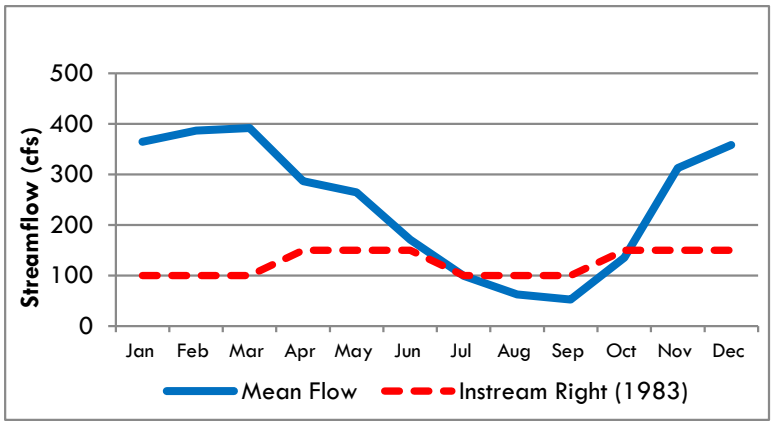


Figure 1. East Fork Hood River Instream Right and Mean Monthly Flows at Mouth (1980-2010)
Graph courtesy of Niklas Christensen, Watershed Professionals Network

In the winter, bankfull flows are important for cleaning silt from gravel beds, scouring out pools, and depositing new streambed material and wood. There is substantial concern among fish managers that winter withdrawals for hydropower production could interfere with these channel-maintaining processes.

At the current trend, by the year 2050, average air temperatures in the Hood River Basin are expected to increase by 2.3° F. This will lead to more precipitation falling as rain instead of snow, resulting in less snowpack, higher winter streamflows, and even lower summer streamflows (BOR 2014).

Instream Habitat Diversity & Key Habitat Quantity: The primary threats to instream habitat diversity and key habitat quantity (i.e., amount of primary habitat used by a fish species at a given life stage) include historic logging practices that removed large trees from riparian areas and flood plains and splash damming that scoured streams down to bedrock. Catastrophic landslides or debris flows, some of which are caused by clear cutting on steep ground, are a continuing threat.

Channel Stability & Sediment Load: Channel instability in the Hood River Basin is mostly due to the watershed's steep gradient, flashy hydrograph, and glacial influence. This can impact fish production by disrupting spawning beds during egg incubation and washing juveniles downstream. Past management activities (e.g., road building, timber harvest) have likely led to increased channel instability and loss of large woody debris has made stream channels less resilient to flood events (Coccoli 2004). Natural sediment sources include glacial runoff, landslides, and debris flows originating from the slopes of Mt. Hood. Turbidity and sediment inputs from human activities include runoff from forest and County roads, landslides caused by timber harvest on steep slopes, use of streams for irrigation water conveyance, and catastrophic failure of open irrigation canals.

Stream Temperature: Elevated stream temperatures are mainly a concern in Clear Branch downstream of Laurance Lake Reservoir and the Middle Fork Hood River to its confluence with the East Fork Hood River. The Middle Fork and its tributaries host the two bull trout populations. The year-round, maximum temperature requirement for bull trout is 50° F (Oregon DEQ). Stream temperatures might become a basin-wide threat in the future if air temperatures rise and summer streamflows decrease as predicted.

Fish Passage: Although most of the barriers to anadromous fish populations have been removed on public lands, fish passage might still be an issue on private lands. In addition, fish passage is a threat to bull trout due to Clear Branch Dam.

Cultural Considerations

The Hood River Watershed is part of the ceded lands of the Confederated Tribes of the Warm Springs Reservation. Tribal members harvest salmon and steelhead from the Hood River for subsistence and ceremonial purposes. Tribal fishing opportunity has become severely restricted because of low fish populations and the need to protect weak or threatened stocks. Hood River anadromous fish populations are co-managed by CTWS and the Oregon Department of Fish and Wildlife (ODFW). As a co-manager, CTWS is actively involved in habitat protection, restoration, fisheries enforcement, and monitoring (Coccoli 1999).

Economic Considerations

The economy of Hood River County, which shares the watershed's boundary, is primarily dependent upon irrigated agriculture. In 2012, gross agricultural commodity sales in Hood River

County were $112,094,000 (www.oain.oregonstate.edu). The County's agricultural land makes up 0.1% of the total agricultural land in Oregon, yet it contributed 3% of total crop sales in Oregon for 2012. This is due to the high economic value per acre of tree fruit production.

The cost to install and maintain fruit trees is relatively high. In addition, fruit trees can sustain long-term damage if they are not watered sufficiently each summer. This means that, unlike other crops, fruit trees cannot be fallowed during a drought year. On the other hand, over-watering does not benefit fruit trees and can compromise fruit quality in addition to wasting water. This points to the multiple economic benefits of delivery system and on-farm water conservation projects.

Another economic consideration relating to the watershed and restoration efforts is hydropower production. The Middle Fork Irrigation District (MFID) and Farmers Irrigation District (FID) have hydropower projects within their irrigation delivery systems. This enables them to capture energy from their diverted irrigation water during the summer. They also have separate water rights to generate hydropower in the winter. Since construction of the power plants in the mid-1980s, they have generated nearly $90 million (Perkins 2013). This has helped fund extensive delivery system upgrades (e.g., over 100 miles of open canals and distribution lines converted to pressurized pipeline), on-farm irrigation efficiency upgrades, fish-screening projects, and removal of fish passage barriers within MFID and FID. The canal to pipeline conversion projects in these districts have saved approximately 25 cfs. A portion of this conserved water has been left instream and the remainder is returned downstream of the power plants.

The delivery system upgrades also enabled FID to eliminate 1,450 individual pumps, which has conserved 1.45 million kilowatt hours annually. At the same time, the FID and MFID plants together are generating roughly 47.5 million kilowatt hours annually, which is enough to power over 4,100 homes a year (Perkins 2013).

Addressing Threats

Addressing human-caused threats to fish populations in the Hood River Basin is inextricably linked with the local economy. From an ecological standpoint, if primary threats are not adequately addressed, Hood River salmon and steelhead will not recover to self-sustaining levels. From an economic standpoint, a certain amount of water is required to maintain existing agricultural and energy production. Conversely, healthy fish runs benefit the local economy through sport fishing revenues and preventing costly conflicts over water allocations.

The crux of the streamflow issue is determining how much water is actually needed for each sector ***if*** all available conservation measures are put in place and overlaying that with spawning and rearing habitat requirements. Fortunately, a coalition of local watershed partners and the Bureau of Reclamation recently rolled out the results of several studies, collectively called the Hood River Basin Study, which are helping local partners get closer to answering these questions (Christensen 2013a, Christensen 2013b, BOR 2014, Normandeau & Associates 2014). The study included evaluations of:

- Existing & future water demands for potable water, irrigation, and hydropower
- Climate change impacts to glaciers, snowpack, & stream flow
- Availability of groundwater to meet water demand

- New or expanded reservoir sites to meet water demand
- Relative impact of various water conservation measures
- Impacts to fish habitat from climate change and future water demand

Basin partners are currently considering water management alternatives to meet future human water demand and stream flow requirements for fish. These alternatives are illustrated in **Figure 2**, which shows four future streamflow scenarios on the East Fork Hood River under "median" climate change conditions[1] (abbreviated as "MI" in graph). "Base" represents current modeled conditions, whereas the colored lines show alternative futures. "Existing" shows predicted streamflows if climate change occurs but demand remains the same. "Demands" shows climate change plus increased water demand. "Conservation" shows climate change plus increased demand and increased conservation. "Storage" shows the combination of climate change, increased demand, increased conservation, and increased water storage in new or existing reservoirs. The conservation and storage scenarios are heartening, especially in light of the fact that the East Fork Hood River has the largest irrigation diversion (~130 cfs water right) and the most severe instream flow shortages.

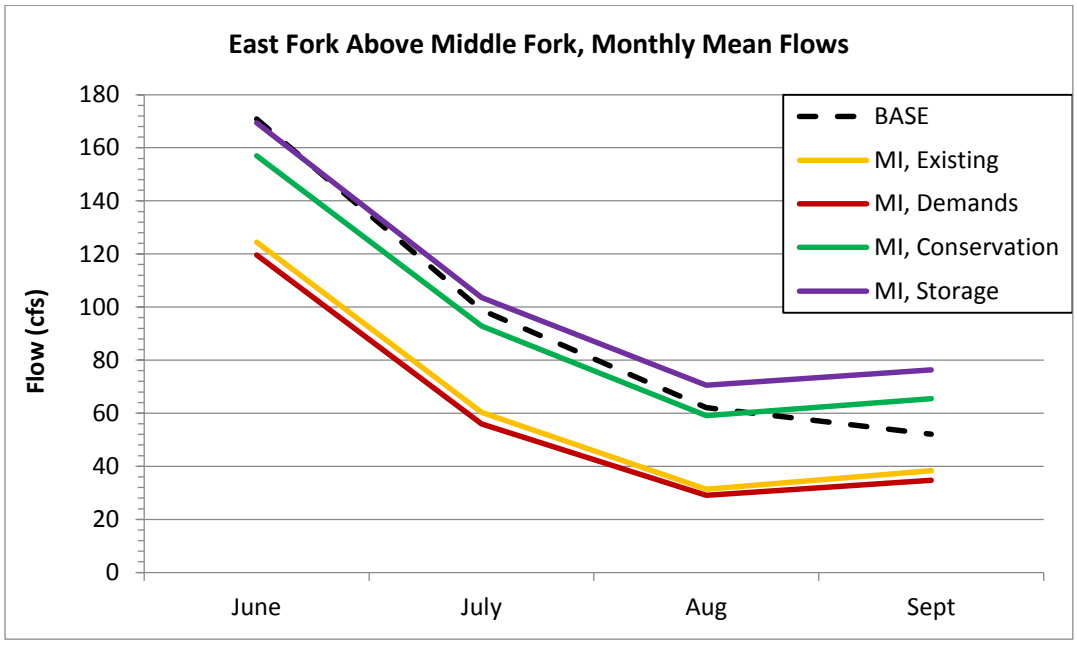


Figure 2. Predicted mean monthly streamflows for June – September at the mouth of the East Fork Hood River (Bureau of Reclamation 2014).

Threats to instream habitat and water quality need to be addressed with both management changes and restoration actions. The Lower Columbia Recovery Plan (ODFW 2010) prescribes measurable objectives for improving instream habitat in the Hood River Basin. These are described below and incorporated into **Table 1** on page 8. The Western Hood River Subbasin TMDL and resulting Water Quality Management Plan identify actions to improve water temperature, including streamflow augmentation and shading (DEQ 2001).

[1] BOR developed three climate change models, which included "warmer/wetter", "median", and "warmer/drier". The median model

Ecological Objectives and Anticipated Outcomes

Our primary ecological goal for the basin is to achieve self-sustaining populations of the native anadromous and resident fish in the Hood River Watershed. Specific desired and expected ecological outcomes include:

- Streamflows that meet the needs of each life history stage of salmon and steelhead populations
- A sufficient quantity of complex instream habitat to create and maintain spawning and rearing habitat for salmon and steelhead populations
- Riparian zones and floodplains that provide sufficient numbers and size class of trees for shade and future LWD recruitment
- Water quality conditions (i.e., temperature, turbidity, pesticide levels) that support native fish populations

Accomplishments to Date and Major Projects Remaining

Water Conservation: In the last 30 years, irrigation districts in the Hood River Valley have replaced over 115 miles of open canals and lateral lines with sub-surface pipelines, resulting in the elimination of hundreds of end-spills and approximately 30 cfs of water left instream or returned downstream of the MFID and FID power plants. (Note: 4.9 cfs are protected with a Conserved Water Agreement.) At the farm-level, about 40% of orchard land has been converted from low efficiency (e.g., hand lines, solid-set impact sprinklers) to high efficiency (e.g., solid-set rotator or micro-sprinklers) irrigation systems. This has saved an estimated 22 to 44 cfs, which has been either left or returned instream.

It is estimated that approximately 22 miles of open canals and 60 end spills still remain, mostly in the East Fork Irrigation District (Christensen 2013a). In addition, an estimated 12,000 acres of agricultural lands are still irrigated with low efficiency irrigation systems. If all open canals and end spills were eliminated, approximately 23 cfs could be left instream. If all remaining agricultural lands converted to high efficiency sprinkler or drip systems, between 32 and 64 cfs could be left instream. (Range due to implementation effectiveness by individual farmers.)

Fish Habitat Improvement: Instream habitat and adjacent riparian zone improvement projects are a significant part of restoration efforts in the basin. Just in the past 6 years, 2,820 pieces of large wood were placed along 4.25 miles of stream and 33 acres of riparian zone were enhanced. The specific proposed actions ODFW (2010) has identified to promote recovery of Hood River salmon and steelhead include 33.6 miles of large wood placement projects, 20.1 miles of side channel restoration, and 19.2 miles of riparian habitat restoration. (The 33.6 miles of large wood placement should be comprised of 330 sites with five key pieces/site. Riparian habitat restoration extends 30 meters on each side of the stream.)

Fish Passage Improvement: Since 2000, twenty-seven fish passage projects have been completed in the Hood River basin. The most significant was the removal of Powerdale Dam by PacifiCorp. Pending fish passage projects include the removal of the Odell Creek Dam and two fish passage barriers on Evans Creek. In addition, a fish trap and haul program around Clear Branch Dam is being explored by MFID, USFS, NOAA, and ODFW.

Water Quality Improvement: Two major areas of water quality improvement in the basin have been the reduction in turbidity and pesticide levels. Turbidity levels have been reduced by eliminating the use of streams for irrigation water conveyance, converting open canals to pipelines, and improving or decommissioning forest roads. More specifically, 20 stream-miles are no longer used for irrigation water conveyance. This has reduced turbidity on naturally clear streams like Neal, Emil, and Evans Creek, which do not normally carry sediment-laden glacial runoff. Converting open canals to pipelines has improved turbidity by putting a stop to canal failures that sent thousands of tons of fine sediment every year into fish-bearing streams. There have also been a number of road decommissioning projects, particularly on Forest Service land, that have reduced sediment delivery to local streams.

The Hood River Watershed was the first basin to participate in the Oregon Department of Environmental Quality's Pesticide Stewardship Partnership (PSP) Program. DEQ initiated a pesticide monitoring program in 1999. Initial results showed chlorpyrifos and azinphos methyl levels above state instream criteria in several Hood River tributaries. In response, watershed partners including the Hood River Soil and Water Conservation District, Columbia Gorge Fruit Growers (CGFG), Oregon Department of Agriculture, OSU Extension Service, and CTWS developed a program to reduce instream pesticide levels. Highlights of this effort include a Best Management Practices handbook put out by CGFG, trainings put on by OSU Extension Service for pesticide applicators, and free riparian stream-buffer plantings in orchards. Monitoring over the past decade has shown that organophosphate concentrations and detection frequency have declined significantly. The success of this ongoing program showcases the cohesiveness and efficacy of the longstanding Hood River Basin partnership.

A significant future water temperature improvement project is on Clear Branch below Laurance Lake Reservoir. The current proposal is to keep the reservoir and downstream releases cooler by siphoning off irrigation water from the reservoir's surface and sending cold bottom water into Clear Branch. In addition, mid to late summer streamflows will be increased by releasing more reservoir water during this time period. This project will be a major undertaking on the part of MFID and its partners, and will particularly benefit threatened bull trout and steelhead populations.

As average air temperature increases with climate change, stream temperature might become a more widespread concern. Efforts to protect and increase streamflow will be critical to maintaining appropriate spawning and rearing stream temperatures. Projects to increase riparian shade will also be important.

Table 1 lists major pending projects deemed essential for recovering salmon, steelhead, and bull trout populations in the Hood River Basin. If these projects were implemented over the next 25 years, it would require roughly $2.6 million per year in funding. Although this is a significant amount, a combination of funding sources could realistically provide this. Key sources include CTWS, who expect to invest approximately $6.5 million in Hood River basin capital improvement projects between 2015 and 2027, NRCS, USFS, OWEB, and local irrigation

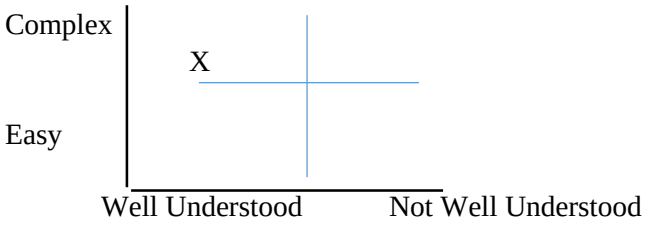
districts. Other potential funding sources include Oregon Water Resources Department, Bureau of Reclamation, and Energy Trust of Oregon. Over the next 6 years, progress will be made on all of the major project types listed in **Table 1**.

Table 1. Estimated Costs for Implementing Major Future Projects

Project Type	Quantity	Unit Cost	Total Cost
On-farm Irrigation Efficiency (i.e., sprinkler upgrades)	12,000 acres; water savings = 32 – 64 cfs	$0.4 million/cfs (for 32 cfs)	$12.4 million[1]
Delivery & distribution pipelines	22 miles & ~60 end spills; water savings = ~23 cfs	~ $1 million/cfs	$29.4 million
Instream habitat restoration: large wood placement	33.6 miles	$80,000/mile	$2.7 million
Instream habitat restoration: side channels/floodplain enhancement	20.1 miles	$330,000/mile	$6.6 million
Riparian habitat restoration	19.2 miles	$310,000/mile	$5.9 million
Alternate surface water outlet system at Laurance Lake		Lump sum	~$5-6 million
Clear Branch Fish Passage: trap and haul infrastructure for upstream & downstream passage		Lump sum	~$1.5 – 2 million
Odell Dam Removal	One dam removal; new irrigation diversion; stream restoration	Lump sum	~$250,000
Evans Creek Fish Passage	Two culvert replacements	$600,000 each	~$1.2 million
		Grand Total	**~$66 million**

[1]This pays for all materials but assumes the landowner installs the system, which costs about as much as the materials on a per acre basis.

Complexity of Proposed Priority



Understanding of Priority: The actions that basin partners need to take to recover salmon, steelhead, and bull trout populations are fairly well understood. Ecological objectives and specific actions have been well documented in assessment and planning documents developed by HRWG, USFS, ODFW, DEQ, and USFWS.

Complexity of Priority: Recovering salmon, steelhead, and bull trout and their habitat includes, among other things, providing sufficient instream flows. This hinges on implementing major water conservation projects over the next two to three decades while addressing the demands for irrigation water and hydropower production. Providing economic incentives and realistic legal mechanisms to protect instream flow will be an important part of this effort. Perhaps more difficult will be ingraining a sense of necessity and personal responsibility for water conservation.

Partnerships

The Hood River Watershed Group has been a highly effective, diverse, and productive partnership for the past 20 years. The primary partner organizations and agencies are listed below, along with a brief description of their primary role and contributions:

1) Hood River Watershed Group: In addition to facilitating the basin's longstanding partnership, HRWG staff have produced key planning documents over the past 15 years. These include the Hood River Watershed Assessment (Coccoli 1999), the Hood River Subbasin Plan (Coccoli 2004), and three Hood River Watershed Action Plans (Coccoli 2002, Stampfli 2008, Thieman 2014).
2) Hood River Soil and Water Conservation District was instrumental in forming the HRWG and serves as its fiscal sponsor and staff employer. It has also been a leader in promoting and implementing on-farm irrigation efficiency projects. Between 2008 and 2014, the SWCD assisted with upgrades on ~800 acres, saving ~3 cfs.
3) Confederated Tribes of the Warm Springs has made substantial investments into the watershed. This includes rebuilding stocks of spring Chinook and winter steelhead with hatchery supplementation, investing millions of dollars in habitat restoration and protection, and supporting the PSP program.
4) U.S. Forest Service: Over half the watershed is within the Mt. Hood National Forest and is locally managed by the Hood River Ranger District. The District began watershed restoration projects in the mid-1980s and has played an integral role in watershed restoration planning and implementation for the past three decades.
5) Middle Fork, East Fork, Farmers & Dee Irrigation Districts: All of the watershed's major irrigation districts have implemented numerous and substantial watershed improvement projects.
6) Hood River County has recently played a vital role in watershed planning by initiating the Hood River Basin Study.
7) Natural Resource Conservation Service has been very active in the basin for several decades. As the Soil Conservation Service, it helped fund construction of Clear Branch Dam in 1968. Since 2002, NRCS has provided cost-share for 2,814 acres of on-farm irrigation efficiency upgrades.
8) Oregon Department of Fish and Wildlife has monitored the anadromous fish populations, as well as bull trout, in the Hood River Basin over the past two decades.
9) Oregon Department of Environmental Quality has played an active role in the Watershed through its Pesticide Stewardship Partnership (PSP) program, TMDL implementation, and water quality projects related to turbidity.
10) Mid-Columbia Agricultural Research & Extension Center- OSU Extension has played a critical role in disseminating best management practices and integrated pest management strategies to Valley orchardists. This has been and continues to be key to instream pesticide level reductions.
11) Columbia Land Trust recently acquired the 400-acre Powerdale Lands along the mainstem Hood River. They have also been actively pursuing conservation easements on important private lands in the basin.

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