John Day Watershed Restoration Projects

Annual Report
2002 - 2003

DOE/BP-00004282-4

February 2004

This Document should be cited as follows:

Brown, Linda, "John Day Watershed Restoration Projects", 2002-2003 Annual Report, Project No. 199801800, 33 electronic pages, (BPA Report DOE/BP-00004282-4)

Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

The Confederated Tribes of the Warm Springs Reservation of Oregon

John Day Basin Office

FY 2003 Watershed Restoration Projects

Annual Report

Prepared by:
Linda Brown

Confederated Tribes of Warm Springs
John Day Basin Office

Prepared for:

U.S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife Division

Project Number: 98-018-00

Contract Number: 98BI-09782

27 February 2004

Table of Contents

Table of Figures

Table of Photos

Abstract

The John Day is the nation's second longest free-flowing river in the contiguous United States and the longest containing entirely unsupplemented runs of anadromous fish. Located in eastern Oregon, the basin drains over 8,000 square miles, Oregon's fourth largest drainage basin, and incorporates portions of eleven counties. Originating in the Strawberry Mountains near Prairie City, the John Day River flows 284 miles in a northwesterly direction, entering the Columbia River approximately four miles upstream of the John Day dam. With wild runs of spring Chinook salmon and summer steelhead, westslope cutthroat, and redband and bull trout, the John Day system is truly a basin with national significance.

The majority of the John Day basin was ceded to the Federal government in 1855 by the Confederated Tribes of the Warm Springs Reservation of Oregon (Tribes). In 1997, the Tribes established an office in the basin to coordinate restoration projects, monitoring, planning and other watershed activities on private and public lands. Once established, the John Day Basin Office (JDBO) formed a partnership with the Grant Soil and Water Conservation District (GSWCD), which contracts the majority of the construction implementation activities for these projects from the JDBO.

The GSWCD completes the landowner contact, preliminary planning, engineering design, permitting, construction contracting, and construction implementation phases of most projects. The JDBO completes the planning, grant solicitation/defense, environmental compliance, administrative contracting, monitoring, and reporting portion of the program. Most phases of project planning, implementation, and monitoring are coordinated with the private landowners and basin agencies, such as the Oregon Department of Fish and Wildlife and Oregon Water Resources Department.

In 2003, the JDBO and GSWCD proposed continuation of their successful partnership between the two agencies and basin landowners to implement an additional twelve (12) watershed conservation projects. The types of projects include off channel water developments, juniper control, permanent diversions, pump stations, and return-flow cooling systems.

Due to funding issues and delays, permitting delays, fire closures and landowner contracting problems, 2 projects were canceled and 7 projects were rescheduled to the 2004 construction season.

Project costs in 2003 totaled $115,554.00 with a total amount of $64,981.00 (56%) provided by the Bonneville Power Administration (BPA) and the remainder coming from other sources such as the Bureau of Reclamation (BOR), Oregon Watershed Enhancement Board, the U.S. Fish & Wildlife Service Partners in Wildlife Program and individual landowners.

Figure 1. Upper John Day Basin Map

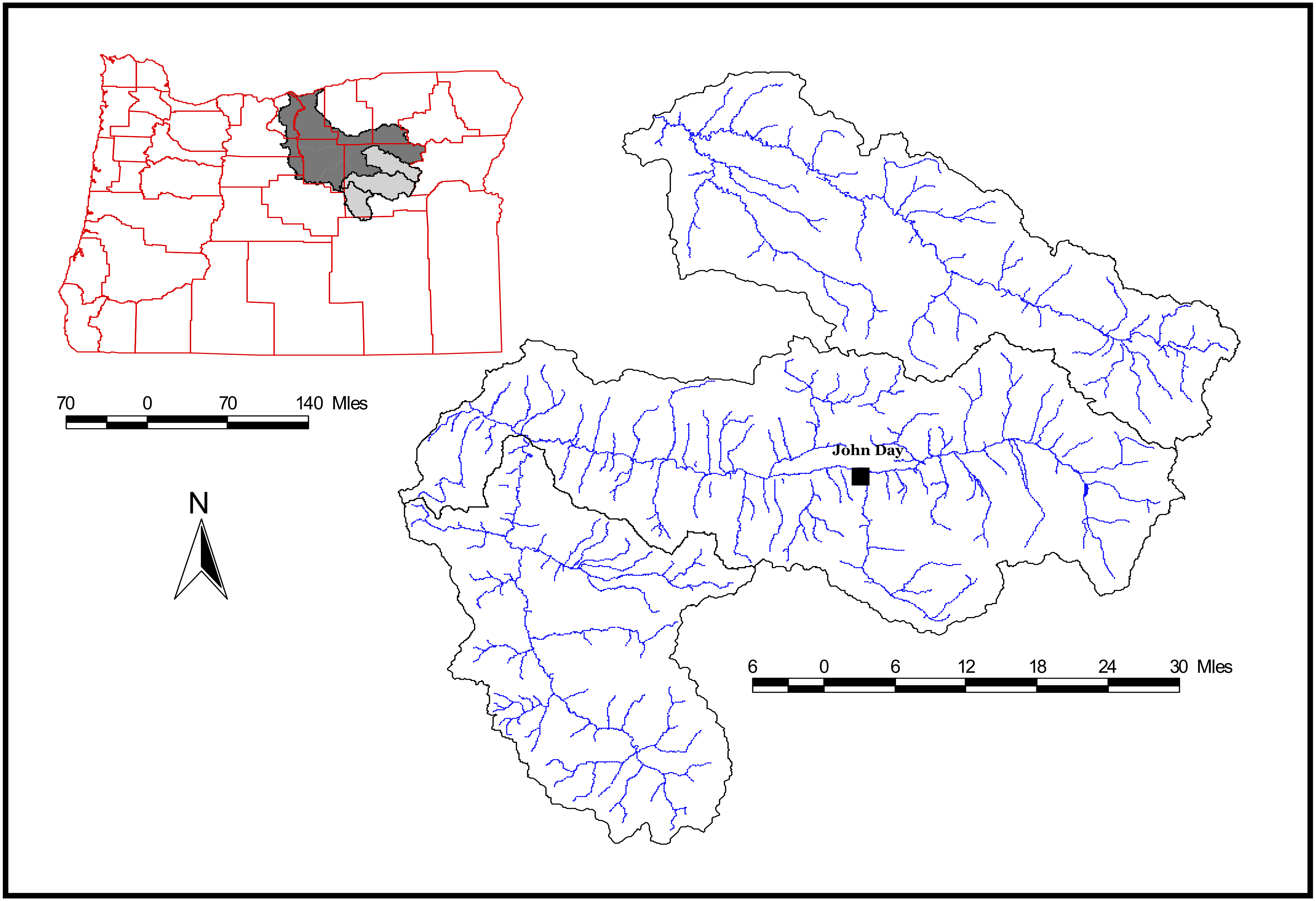


Figure 2. Upper Mainstem John Day River Project Location Map

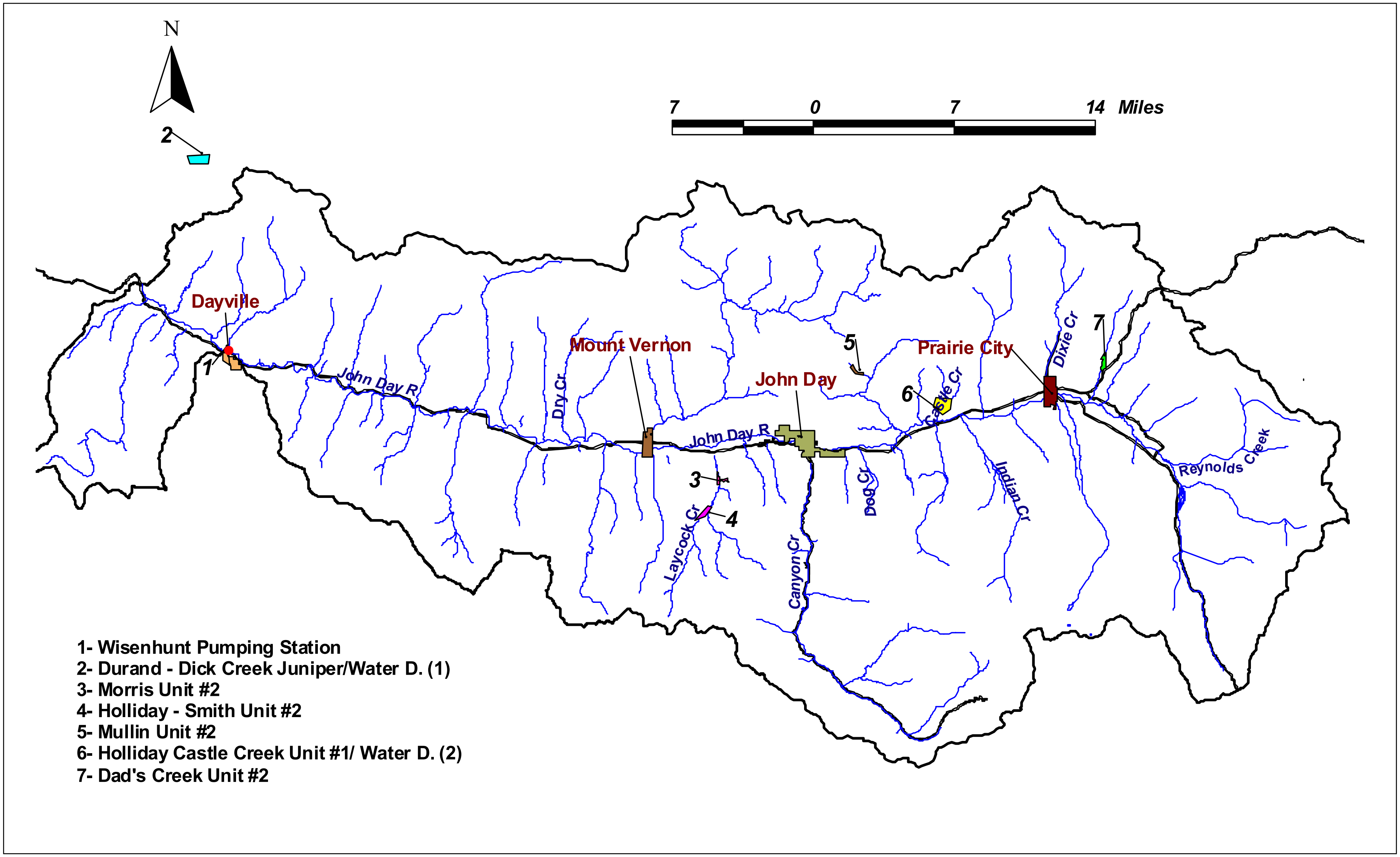
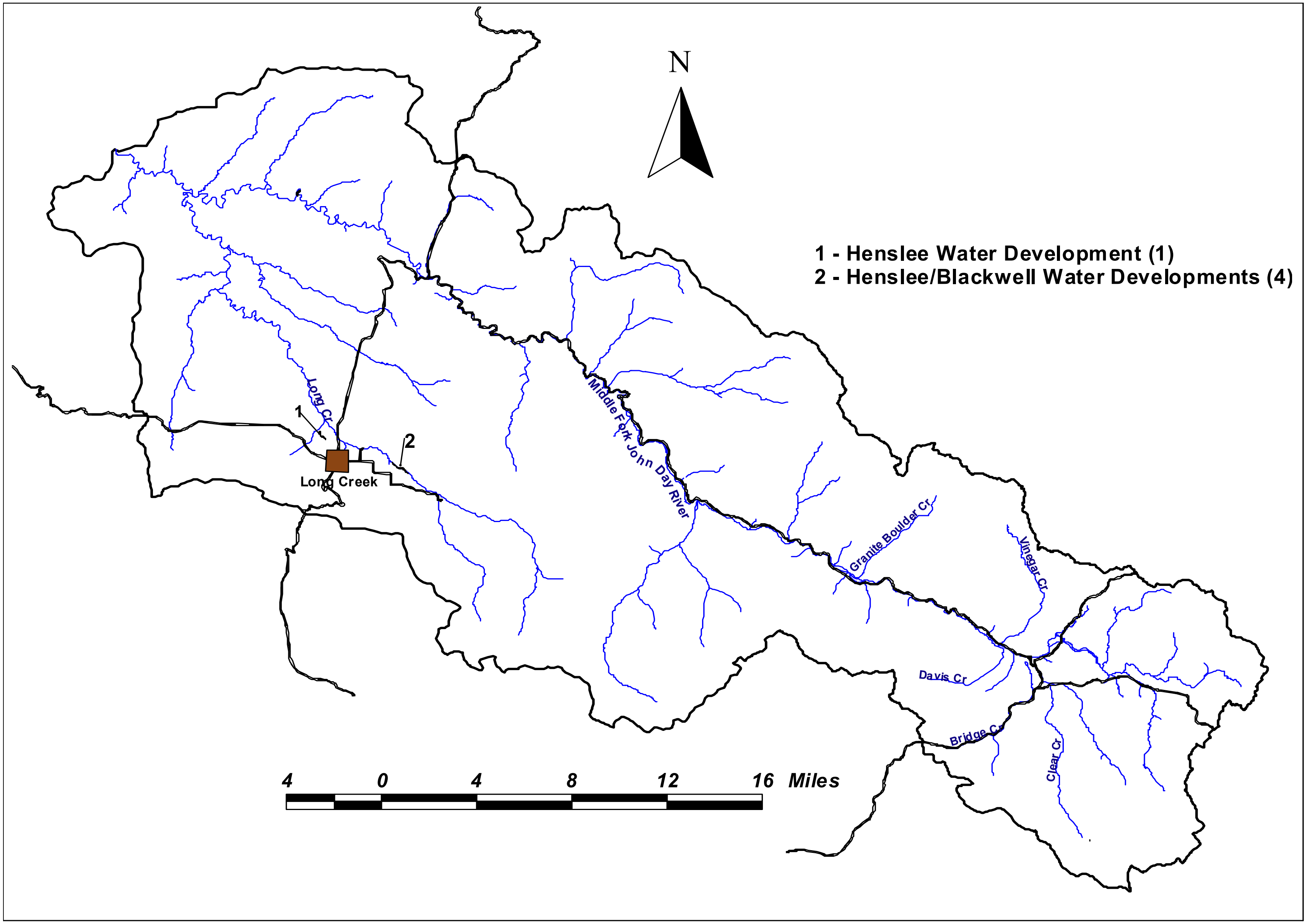


Figure 3. Middle Fork John Day River Project Location Map



Introduction

John Day Watershed Restoration is an on-going, interagency program that focuses primarily on converting inefficient, detrimental land-use practices through irrigation system upgrades, upland restoration and riparian fencing and planting. The program's objectives include removing fish passage impediments, increasing water flows, increasing water quality, and enhancing riparian and stream channel recovery. The program has received support from landowners and funding agencies alike, with a track record of over 60 successfully completed projects. Though benefits most readily apply to fish species, the cumulative effects apply to basin-wide watershed recovery.

Resource Issues

IRRIGATION DIVERSIONS

Historic practices involved finding some means by which to impound water and direct its flow into a ditch or open channel of some sort, which would then transport the water to the field needing irrigation. The landowners are limited to what resources, time, and expense they can expend on such irrigation water diversions. Thus landowners devised the temporary push-up diversion. These diversions are typically constructed by using heavy equipment, perhaps even a bulldozer, to push-up gravel and rocks from the streambed to form a miniature dam. These dams were often supplemented with sheets of plywood or metal, hay bales, or other large objects that could impound water and direct it into a conveyance channel (*see* Appendix 1, Photo 12. Typical gravel push-up diversion). Structurally, these types of diversions can be extremely inefficient due to their physical construction and site location.

These push-up diversions are also temporary in that they are not firmly secured in place, and so are prone to blowing out in high run-off events, and simply wearing away over the course of a season. Such diversions are routinely re-built every year, if not more often. These diversions may have represented a sort of quick-fix to the problem of diverting water, water that the landowners may have had legal title to since before the turn of the 20th century. The negative aspects of such methods are a) they involve repeated construction, and constant upkeep, and b) they do not take into account the need for fish passage, nor realize the cumulative impacts being made upon the channel bed and bank with each re-construction. These migratory barriers can become a problem at various times during the year as follows:

1) If stream flows are low in the spring and the push-up diversion is not "blown out"[1] or removed, a passage impediment can be created for adults migrating upstream to spawning areas.

2) When water temperatures in the mainstem and lower reaches of the tributaries cool in the fall, large numbers of rearing juveniles and stream resident adults outmigrate to overwintering areas. If diversions remain in place, they can become an impediment for outmigrants to move to more productive overwintering habitat areas.

3) If diversions are not blown out or removed in the spring prior to smolt outmigration they may become an impediment to smolt migration or entrain smolts.

---

[1] There is no requirement, and because of damage resulting from instream construction—little desire, to remove gravel push-up diversions following the irrigation season. However, if spring flows are insufficient to "blow out" the diversion, the structure often remains in place throughout the year.

4) As summer water temperatures compromise conditions in the mainstem and lower reaches of Rearing tributaries, juveniles and stream resident adults must migrate to areas of better water quality. If push-up diversions are installed prior to this migration (about the 1st of July) they can prohibit migration to upstream rearing areas.

In addition, whenever construction activities take place within the stream and along the banks, sediment load is increased, vegetation is impacted, and microhabitats are disturbed. The trend of the channel profile in such areas is toward wider, shallower channels. These indirectly lead to warmer waters and further streambank erosion.

Replacing these temporary, push-up diversions is a costly, labor intensive undertaking, however, and most landowners could not do it without some assistance. Fortunately, once assistance is provided, there are a variety of designs that can replace these structures, and may be tailored to fit the location and the landowner and resource's requirements. The types of systems that have been successfully installed within the John Day Basin, through partnerships with the CTWSRO, GSWCD, and North Fork Watershed Council include: permanent lay-flat diversions, pump stations, and infiltration galleries. The landowners that have participated in these projects have realized significant savings in water use and the amount of labor necessary to conduct otherwise arduous management practices. In addition, our monitoring efforts have documented significant riparian recovery and other improvements that will support increased salmonid populations within the basin.

OVERLAND RETURN FLOWS

Flood irrigation is the most common type of irrigation within the John Day Basin. Though this method may be less labor-intensive than operating a sprinkler system, it has its own drawbacks. The amount of water delivered to the field is difficult to measure. Most systems were constructed many years ago, when water efficiency was not such a pressing issue. Miles of open conveyance ditches through which water must travel before reaching the field to be irrigated often characterize these systems. During this travel time, evaporation, seepage, and spill losses can be significant. Besides the fact that water may be difficult to measure when diverted through historical means, irrigators may divert more than the legal rate and duty just to move their entitlement through the ditch. Once water reaches the fields, it often ponds up in lower areas, decreasing the desired productivity of that area. This may push grazing pressure over to riparian areas, or encourage the landowner to farm more riparian acreage in exchange for lost hay ground.

On some lands that are flood irrigated, ditches or other systems collect tailwater from fields and return it to the river. Return flows may serve to degrade further, water quality impaired stream reaches. If water is returned through open conveyance systems, which are exposed to solar radiation, they can be thermally elevated and may increase river temperatures.

Riparian Grazing

Historical descriptions suggest the John Day River once supported dense growths of aspen, poplar, willow and cottonwood galleries, composing thick, wide riparian corridors. High quality river habitat represented optimum conditions for the production of large numbers of salmon, steelhead, and resident trout. Beaver were also common along the river.

Riparian areas are lands next to streams and rivers where vegetation is influenced by the presence of water and in return influences the quality of the water present. The significance of riparian areas is far greater than their small size suggests. Riparian areas are comprised of diverse habitats, supplying food, water, shade and shelter for fish, wildlife, livestock and humans. Diversity of vegetation is an important characteristic of riparian areas in good condition. Woody and herbaceous plants slow water velocities thusly reducing erosion and water sediment levels. Vegetation cover shields soil from solar heating reducing the temperature of the soil and reduces evaporation and water temperatures. These areas act as sponges by holding water and extending the length of the stream flow season.

Riparian areas are attractive areas both for the landowner to direct their cattle, and for the cattle to occupy due to the continual supply of water and shade. Other factors, such as inefficient irrigation that causes ponding and growth of unpalatable vegetation, can push cattle into riparian areas to graze. Ranchers may have to spend considerable time riding cows around to keep them moving away from the same riparian areas they frequent.

Improper livestock management, excessive grazing and trampling can affect riparian areas by reducing or eliminating riparian vegetation, causing channel degradation, widening or incising of stream channels, and lowering of water tables. These cumulative effects are all detrimental to water quality and therefore fish populations.

The deterioration of riparian areas in the western U.S. began with the sever overgrazing by livestock in the late 1800's and early 1900's. This past land mismanagement has important implications for today's management practices. The protection of healthy riparian areas and the restoration of degraded areas must remain a high priority.

Juniper Encroachment

The uplands of the John Day valley once supported vast expanses of tall, plentiful native bunchgrasses, and open-canopy sagebrush communities. Mining, grazing, timber harvest, and intensive agricultural practices all have worked to change this natural scenario within the past 120 years. These changes resulted in habitat destruction, fragmentation, and the expansion of noxious weeds. It has been estimated that less than one percent of the native shrub steppe habitat remains in the Columbia Plateau region of Oregon. Most of these areas, which include the associated woodlands, grasslands, and shrub lands, have been altered. The principle factors facilitating such changes have been water diversions, dry-land agricultural conversions and excessive grazing.

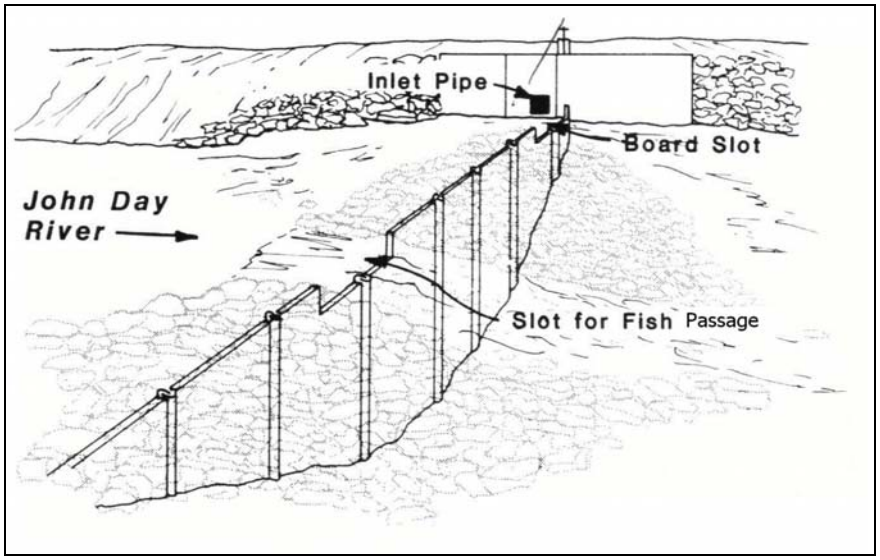
European settlement introduced changes that contributed to juniper expansion, including grazing and fire suppression. Grazing contributed to juniper expansion by decreasing vegetative competition, encouraging growth of shrubs that are safe sites for juniper seedlings to establishment. Fire suppression began with the decline of Native American populations in the U.S., who used fire to augment both their own and wildlife food supplies. Heavy livestock grazing, contributed to fire hazards by reducing grasses for fire fuel. These changes modified typical juniper dispersal from occasional trees scattered across open areas, or individuals existing on fire-retardant, rocky islands, to dense stands. The negative effects of dense juniper woodlands have build upon each other and include: intense nutrient and water competition; decreased soil infiltration; decreased plant diversity, especially native grass species; increased erosion; decreased wildlife habitat suitability and diversity.

Expansion of western juniper, once a controlled, native species, has altered much of the watershed function. Historic juniper distribution averaged one or two trees per acre. Today there may be 200 to 8,000 young junipers per acre. Currently, juniper and pinyon-juniper woodlands cover 24 million ha in the western United States. Though there is considerable controversy over the benefits and detriments of such expanded juniper ranges, data exists to show that the recent phenomenon of juniper expansion indicates declines in other ecosystem functions. Juniper woodlands have expanded into a variety of plant communities, including grassland, shrub steppe, aspen, ponderosa, and riparian communities.

As stated previously, many upland wildlife species depend on both upland and riparian habitats for water, food, and seasonal cover. In return, the status of the upland vegetation affects forage potential, wildlife cover, and sediment contribution to the water supply. The program supports an expansion of the Restoration program by addressing water supplies sequestered within dense juniper stands. Juniper removal treatments will mirror the Restoration Program objective to increase water flows and water quality. In evapotranspiration rate alone, one mature juniper can cycle up to 30 gallons of water a day. Where upland improvements such as juniper removal have occurred, sequestered water is released to flow freely and be of use to the native aquatic and terrestrial species.

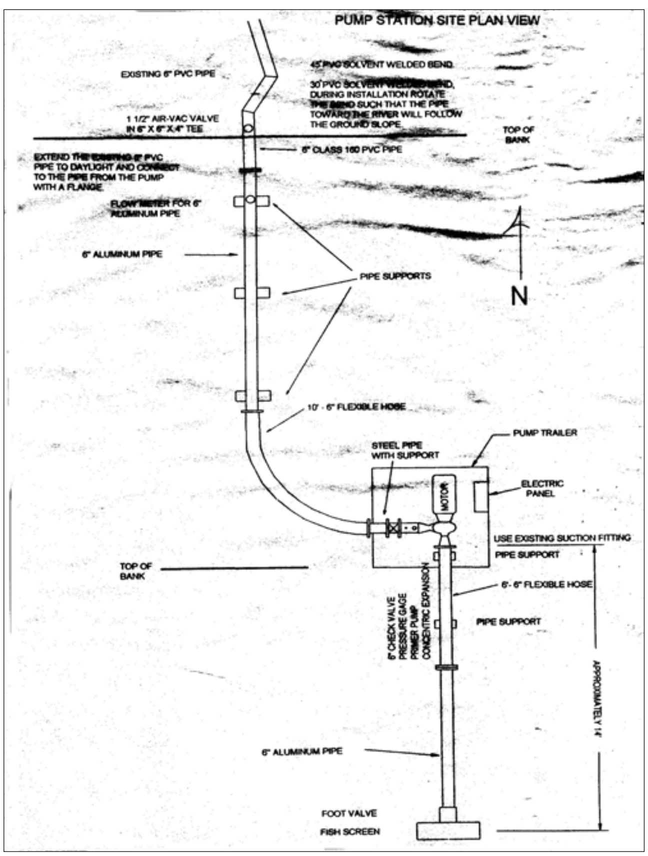
Background on Project Types

PERMANENT DIVERSIONS



The most inexpensive replacement for temporary push-up diversions is permanent lay-flat diversions. First, interlocking steel pilings are driven upright in the keyway until the tops are at the natural riverbed grade. A fishway is cut in the steel so that its bottom is at the grade of the spillway. The spillway is constructed using precast concrete sections set on grade and bolted together (to reduce forming and concrete placing in the water). The floor of the spillway is poured in the precasts and the lay-flat stanchions are welded onto weld plates. Splashboards can be placed against the braces to raise the water to improve diversion. Oftentimes a new head gate and water-measuring device is installed at the point of diversion. Any existing fish screen/wheel can usually be left in place to continue to screen fish from the ditch.

These structures ensure fish passage at all flows. The head gate is set at the level of the sill such that flashboards are not required for diversion until late in the year, compared with the push-up diversion of years past. The bottom of both the fishway and the spillway are set at the same elevation as the existing streambed. When flashboards are placed in the spillway, flow over the fishway is increased. The sheet piling seals the structure so that the water passes over the top. The turbidity of the water -—the measure of suspended materials – decreases. The costs for operation and maintenance are decreased substantially. The flashboards permit a more even diversion rate and help maintain a consistent flow. This establishes a controllable structure and provides consistent and accurate delivery of the water right.



Pumping stations are another alternative to temporary push-up diversions. These designs are limited to local energy sources and cost of the project. However, where such designs are practical, they present significant improvements to the process of irrigation water withdrawal. Pump stations enable efficient water use and measurement. Oftentimes they may be relocated closer to the point of application, thereby leaving water instream for a longer distance, and loosing less to evaporation or leakage through lengthy conveyance channels. Also, they may enable many lengths of old conveyance systems to be removed.

Generally, these projects involve installation of a pump sump and pump station with a fish screen on the intake and a totalizing flow meter. Buried PVC pipe is installed to connect the pump station to the fields of use or the existing conveyance system. As with all construction projects, spoils and streambanks are re-shaped, grasses and hardwoods are planted to reduce erosion and increase the rate of recovery, and any fences removed during the construction process are rebuilt.

Riparian Revegetation

Following construction activities at all sites where river banks have been disturbed either from historic practices or during the process of construction, the spoils are re-shaped and banks are planted with a variety of riparian vegetation to speed bank recovery. Plantings range from native grasses to cottonwood shoots. In this way, the issue of vegetation recovery is addressed at every project site. In addition, two separate nursery projects address the issue of re-planting riparian species along river channels. Funding was directed to the Monument Nursery in 1999 and then to the Native Plants Nursery located on the Forrest Ranch on the mainstem John Day River in 2003. These projects are described in greater detail below.

Return Flow Cooling Systems

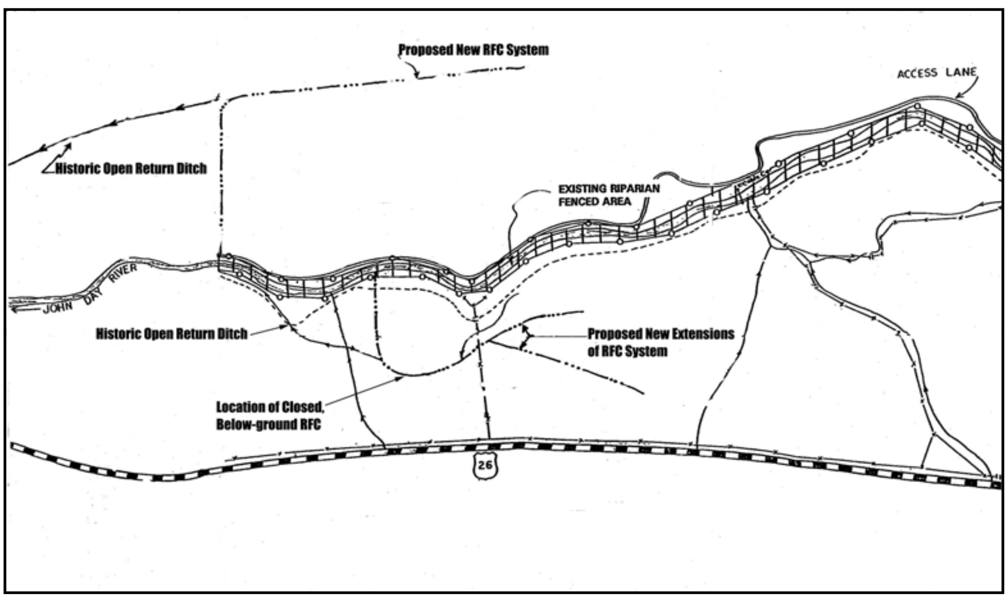


Figure 4. Typical Return Flow Cooling System Design

A project that does not address water use, but rather water returns, is the return-flow cooling projects. When fields are flood-irrigated, it is common for excess water to "pond up" in low spots on the field. These areas quickly become rank and useless for cultivating a crop. Therefore, the landowner will construct a ditch system that leads into a shallow ditch system, typically made of wood, to drain these low, wet spots of excess irrigation water. Though this design sends water back to the stream or river from which it was diverted, the water is subjected to intense thermal loading and nutrient collection as it travels back to the river. The water may degrade the stream or river when it re-enters. In addition, the wooden conveyance systems in place today were installed 50 or more years ago. Now they are rotting and leaking, loosing the water they were intended to carry.

Water returning from irrigation usage to the stream channel heats due to solar radiation. Our solution has been the return-flow cooling (RFC) system. These involve replacing the existing wooden or dirt return ditches with continuous perforated pipe below ground from the low areas to the river. This will collect the ponded water and direct it underground, where it may cool by as much as 20 °F before entering the river. The point of outflow from the system may create thermal refugia for fish and other organisms that rely on cool waters for survival.

OFF CHANNEL WATER DEVELOPMENTS

Off-site watering developments will create alternate water sources for cattle that otherwise would need river access, thus reducing the impact on the riparian area from cattle. These water developments are placed as to encourage more dispersed grazing and more even utilization of available forage.

Off site watering developments are typically spring-fed or draw water from a stream via a PVC pipeline. Site preparation includes any necessary ground leveling and installation of the trough foundation. When a spring is accessed and relative elevations allow, a collection system utilizing gravity-fed pressure is installed. If a stream is accessed, a solar pump may be used to supply water through a pipeline. Post-construction activities include system tests, shaping spoils, and seeding all disturbed areas. Projects are installed under cost-share agreements with landowners. Facility designs are site specific and the selected option must meet the "needed and feasible" criteria.

JUNIPER CONTROL

The program supports an expansion of the Restoration Program by addressing water supplies sequestered within dense juniper stands; juniper removal will mirror the Restoration Programs objective to increase water flows and water quality. The health of upland ecosystems is important to the health of the lower river systems, as the upland systems contribute water and sediment to rivers. The juniper removal program is based on the interrelationship of upland integrity and watershed health, as vegetation health on the uplands affects erosion and therefore water quality in the rivers. Upland wildlife species rely on the quality of riparian areas for seasonal food and shelter, and annual water.

This program targets 500+ acres per year for juniper removal where junipers have formed dense woodlands along drainages, streams, or around springs. Trees are reduced to maximum densities of 2 to 6 trees per acre. Tree carcasses lie where fallen unless they accumulate so that they cover the ground and prevent moisture and sunlight from reaching the seed sources below. The landowner is allowed to remove or burn the tree carcasses after five years. Treatment sites are surveyed for available native grass seed sources prior to juniper removal, and evaluated for potential water release. Photo points are established within each removal site, and yearly monitoring of plant species growth will be conducted, once pre-treatment, and for five years following removal treatments. Small areas of old growth juniper will be left intact as wildlife shelter areas. Adjacent drainages, streams, or springs will be observed for renewed flow following juniper removal. During 2002, 464 acres of juniper were treated for encroachment at 4 sites on tributaries to the mainstem John Day River.

Project Descriptions

PROJECT: JUNIPER CONTROL FOR WATERSHED RESTORATION

Project Background; The Juniper Control program supports an expansion of the Restoration Program by addressing water supplies sequestered within dense juniper stands; juniper removal will mirror the Restoration Programs objective to increase water flows and water quality. The health of upland ecosystems is important to the health of the lower river systems, as the upland systems contribute water and sediment to rivers. The juniper removal program is based on the interrelationship of upland integrity and watershed health, as vegetation health on the uplands affects erosion and therefore water quality in the rivers. Upland wildlife species rely on the quality of riparian areas for seasonal food and shelter, and annual water.

This program targets 500+ acres per year for juniper removal where junipers have formed dense woodlands along drainages, streams, or around springs. **During the 2003 season 487 acres were cut.** Trees are reduced to maximum densities of 2 to 6 trees per acre. Tree carcasses lie where fallen unless they accumulate so that they cover the ground and prevent moisture and sunlight from reaching the seed sources below. The landowner is allowed to remove or burn the tree carcasses after five years. Treatment sites are surveyed for available native grass seed sources prior to juniper removal, and evaluated for potential water release. Photo points are established within each removal site, and yearly monitoring of plant species growth will be conducted, once pre-treatment, and for five years following removal treatments. Small areas of old growth juniper will be left intact as wildlife shelter areas. Adjacent drainages, streams, or springs will be observed for renewed flow following juniper removal.

Photo 1. Juniper encroachment in the John Day Basin.

Locations and acreages

Unit Name	Acers
Durand – Dick Creek	80
Holliday – Castle Creek #1	80
Holliday – Smith Unit #2	80
Mullins – Unit #2	80
Morris – Unit #2	82
Dads Creek – Unit #2	85

Project Objective: Release sequestered water from drainages and uplands suffering from extreme juniper encroachment. Improve base flows for spawning and rearing habitat. Improve upland and riparian condition.

Project Description:

1. Develop monitoring plan for the project site.
2. Complete site design and layout.

3. Installed permanent photo point locations.
4. Administer subcontracts to cut juniper.

Project Monitoring:

Monitoring Objective: Evaluate improvement in water flow rates in selected drainages after removal of dense juniper stands. Monitor rate of riparian and upland recovery.

Monitoring Completed: Permanent photo points were installed and pre- and post-project photographs were taken. Stream flows were recorded and measurement weirs installed on Dad's Creek and Slaughterhouse Gulch.

Project Cost:

Bonneville Power Administration	$ 9,960(20%)
OWEB	$30,000(60%)
Local Landowners	$10,000(20%)
Total	$49,960

Start Date: 1 April 2003   Phase Two - Completion Date: 31 January 2004

Ongoing Project

Photo 2. Juniper Cutting at Holliday Castle Creek Unit #1

Photo 3. Juniper Cutting at Holliday Smith Unit #2

Photo 4. Juniper Cutting at Morris Unit #2

Project: Off Channel Water Developments

Project Background; This program has been developed to encourage Riparian Fencing in pastures where cattle grazing is an annual event. With the installation of Off Channel water sources traditional "water gaps" are no longer necessary along the stream, eliminating bank damage and stream degradation in these areas.
These water developments are placed as to encourage more dispersed grazing and more even utilization of available forage.

The project also includes upland developments that supply a water source not only for livestock but for wildlife as well. Both solar and gravity feed systems are employed with each site designed for maximum efficiency and water supply. With the elimination of "water gaps" riparian recovery and aquatic habitat improvement is greatly increased.

During 2003 six sites were developed and an additional 3 sites located.

These sites will be developed following the spring rains for exact placement of the spring boxes.

Photo 5. Water Development for Wildlife and Livestock Use.

Project Objective: Construct Off-Channel water developments in conjunction with riparian fencing projects to increase rates of riparian recovery. Eliminate need for water gaps in riparian corridor fences. Develop upland sources of water for wildlife and livestock use to encourage more even utilization and distribution on uplands.

Photo 6. Installation of Off-Channel water developments.

Project Description:

1. Develop monitoring plan for the project site.
2. Identify water development sites.
3. Complete site design and layout.
4. Installed permanent photo point locations.
5. Administer subcontracts to install developments.
6. Rebuild fences removed during construction.
7. Plant grasses to increase rates of recovery.

Project Monitoring:

Monitoring Objective: Evaluate improvement in water quality and rate of channel and riparian recovery in conjunction with Riparian Fencing projects.

Monitoring Completed: Permanent photo points were installed and pre- and post-project photographs were taken.

Project Cost:			
	Local Cost Share	5,000.00	(25%)
	BPA Contribution	15,000.00	(75%)
	TOTAL	$20,000.00	

Start Date: April 2003 Completion Date: December 2003

Ongoing Project

PROJECT: NATIVE PLANTS NURSERY

Project Background; The Monument has been the only local source available to provide plant materials used in agency restoration programs. The nursery is well established in the basin with sufficient land, water, and labor to increase the nature and extent of available materials. However the current cost of some materials prohibits widespread use for conservation purposes. In 1999 alone, the Monument Nursery distributed approximately 4000 units of riparian plants. The establishment of a Native Plants Nursery on the Forrest Mitigation Property mainstem site will increase access to native plants for riparian planting and restoration projects on both the Middle Fork John Day and mainstem John Day Rivers. With the addition of this location, costs for native plants can be kept to a minimum and diversity of plant species can be maximized, encouraging additional riparian restoration projects. The Forrest Conservation Property Nursery has been planted with cottonwood and several species of willow from various locations throughout the basin, mock orange from the South Fork John Day River and big sagebrush for upland restoration efforts. Plans are to include Mountain Mahogany and Bitterbrush in plantings this fall. The nursery is currently home for more than 800 shrubs and trees. The nursery is also being used as a demonstration model for solar pumping and irrigation.

Project Objective: Develop a Native Plants Nursery to supply materials to riparian restoration projects.

Project Description:

1. Complete the location survey, cultural survey and design layout.
2. Purchase materials for fencing, weed control and irrigation.
3. Prepare Nursery site for planting.
4. Install fencing weed cloth and irrigation system.
5. Collect and plant cuttings and other plant materials.

6. Maintain nursery, monitor plant growth and development; determine proper time for transplanting to restoration sites.

Photo 7. Planted Cuttings along the Middle Fork John Day River

Photo 8. Young trees Planted in the Native Plants Nursery at the Forrest Mainstem Property.

Project Monitoring:

Monitoring Objective: Evaluate improvement in water quality and rate of channel and riparian recovery from planting of riparian plants.

Monitoring Completed: Permanent photo points were installed and pre- and post-project photographs were taken. Stake row survival transects installed on Forrest and Oxbow Mitigation Properties.

Project Cost:

Local Cost Share	1,500.00	(33%)
BPA Contribution	500.00	(11%)
BOR Contribution	2,500.00	(56%)
TOTAL	$ 4,500.00	

Ongoing Project

PROJECT: WISENHUNT PUMPING STATION

Photo 9. Wisenhunt Diversion pre-construction.

Project Background: Currently, water for irrigation is diverted using annually installed push-up structures. Typically, these types of diversions are reconstructed at least on an annual basis and frequently as river flows decline during the summer irrigation season. Materials used in the construction of the diversion are generally excavated from the riverbed and surrounding stream channel. Commonly, materials such as boulders and concrete support the gravel and cobble structure while tin, plywood, or plastic/fabric cloth seal the upstream face of dam

Structurally, these types of diversions can be extremely inefficient due to their physical construction and site location. Commonly, the diversion is left in place following the end if the irrigation season. While in place, the diversions can become a partial to total barrier to migrating fish, depending upon river flow condition, affecting both the up- and downstream movement of subadult and the upstream movement of adult anadromous and resident fish. Subsequent spring high flows generally wash the diversions away (although on some low snow pack years they may not), necessitating reconstruction of the dam the following irrigation season. In addition to the potential issues with fish passage, the process of diversion construction, which periodically requires use of heavy equipment in the river, may cause significant bank/streambed scouring and a gradual lowering of the riverbed. To eliminate the use of the gravel push-up diversion, we replaced at rate and duty, the annually installed diversion with a pressure pump system. This pump station represents part of phase two of the project to retire the Throop Snyder Diversion and approximately 0.7 miles of inefficient open conveyance ditch. This diversion is a potential fish barrier and the landowners are anxious to replace it.

Project Objective: Remove a fish passage impediment, potentially improving stream flows by removing an inefficient diversion structure and replacing them with a pressure pump system.

Project Description:

1. Input and analyze data collected under the 2001 monitoring plan for the project site.
2. Complete the engineering survey and design layout.
3. Replace annually installed push-up diversion with pump station.
4. Install PVC pipe to connect existing irrigation conveyance system to pump station.
5. Install measuring device.
6. Rebuild fences removed during construction.
7. Plant grasses and hardwoods on both banks to increase rates of recovery.

Project Monitoring:

Monitoring Objective: Evaluate improvement in water quality and rate of channel and riparian recovery.

Monitoring Completed: Permanent photopoints were installed and pre- and post-project photographs were taken.

Project Cost:	Local Cost Share	1,573.00	(06%)
	BPA Contribution	39,521.00	(94%)
	TOTAL	$41,094.00	

Start Date: **1 May 2002** Completion Date: **1 September 2003**

Appendix 1

TYPICAL PERMANENT DIVERSION INSTALLATION PHOTOS

Photo 12. Typical gravel push-up diversion

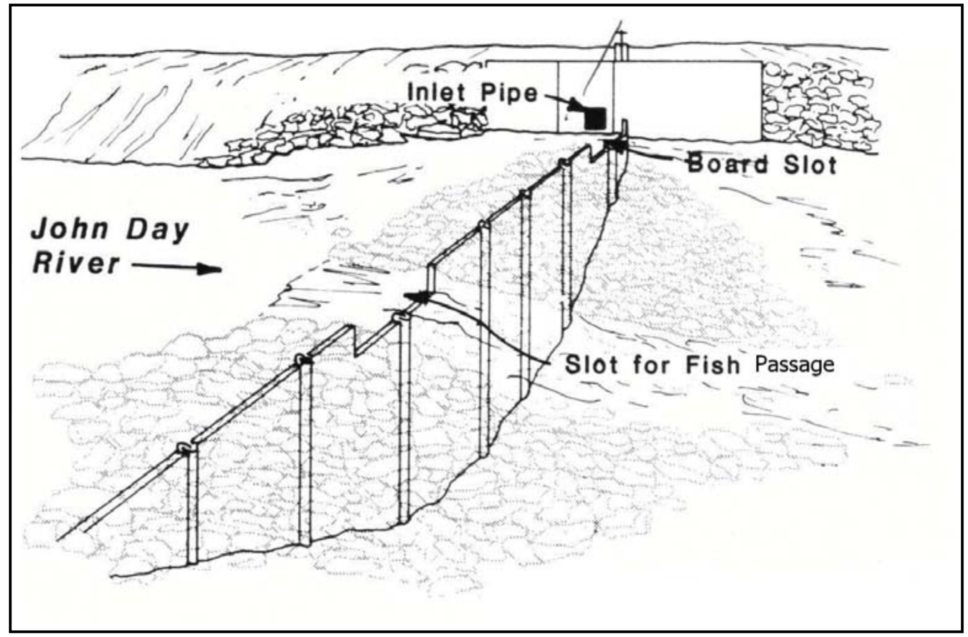


Figure 5. Typical permanent diversion design drawing

Photo 10. Installation of Pre-cast Sill Boxes

Photo 11. Filling Pre-cast Sill Boxes

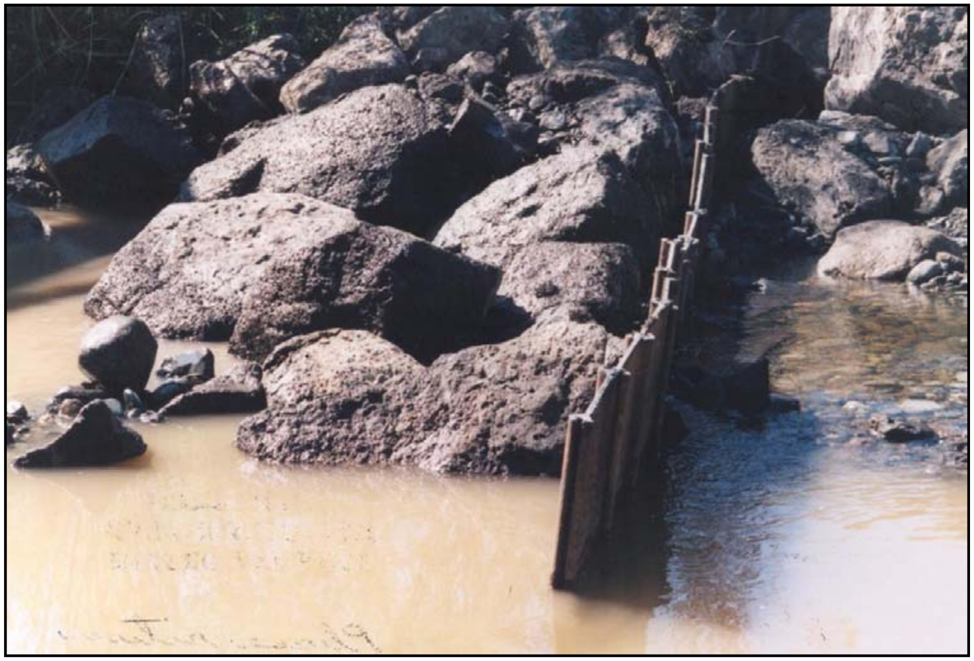


Photo 13. Installation of sheet steel piling

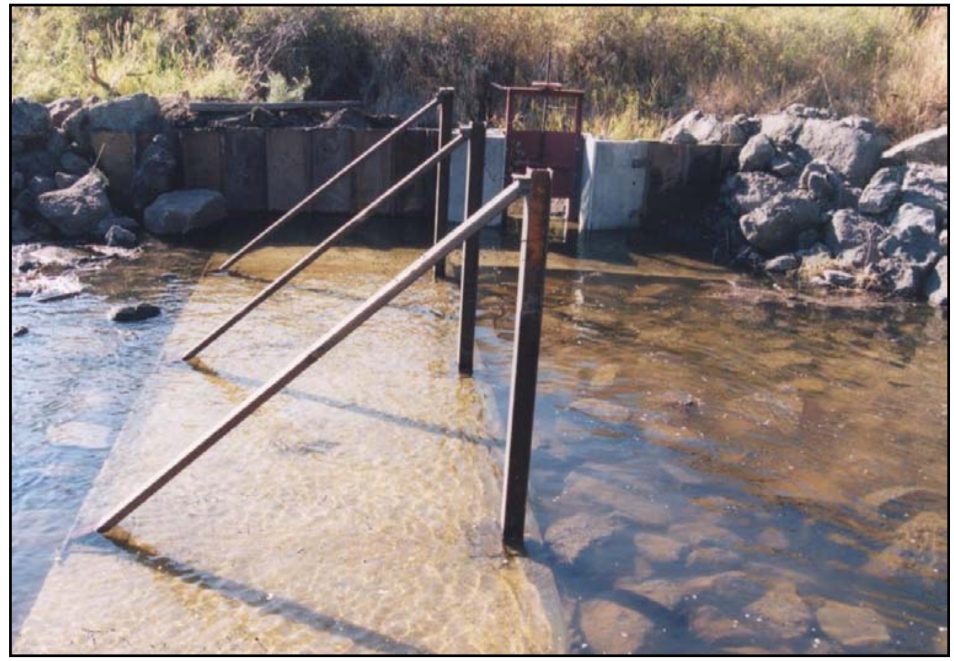


Photo 16. Typical permanent diversion, lay flat stanchions up, no flashboards

Photo 15. Typical permanent diversion with flashboards installed

Photo 14. Typical permanent diversion, flashboards not installed

Photo 18. Typical permanent diversion, flashboards installed

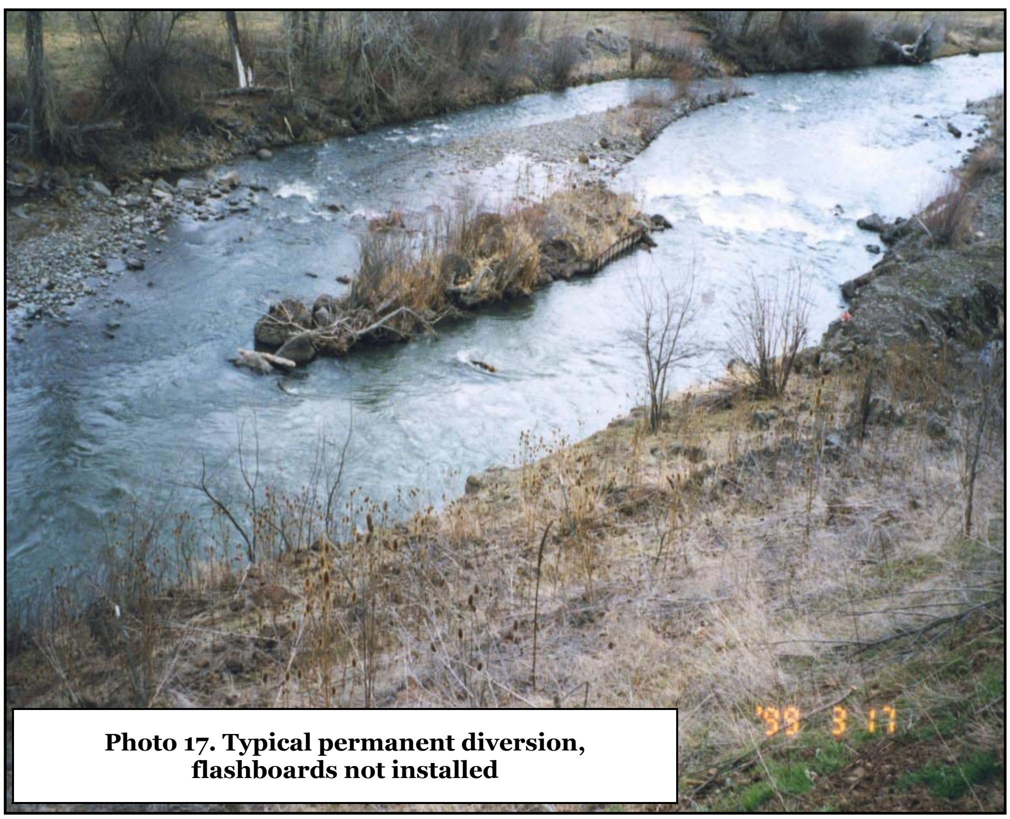


Photo 17. Typical permanent diversion, flashboards not installed

Appendix 2

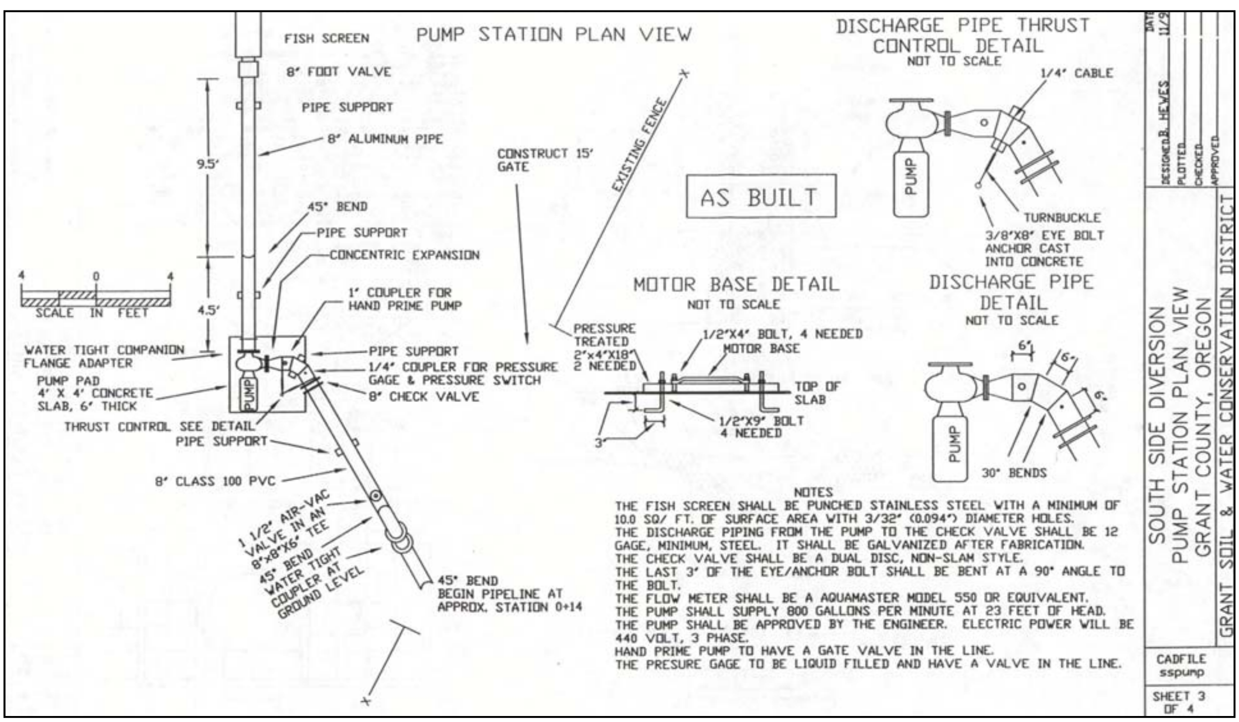
TYPICAL PUMPING STATION INSTALLATION PHOTOS AND PLANS

Photo 20. Suction Pipes from River to Pumps.

Photo 19. Typical Pump Station Setup

Photo 21. Turbine Pumps and Valves.

Figure 6. Typical Pumping Station Design Plans



Appendix 3

TYPICAL RETURN FLOW COOLING INSTALLATION PHOTOS AND PLANS

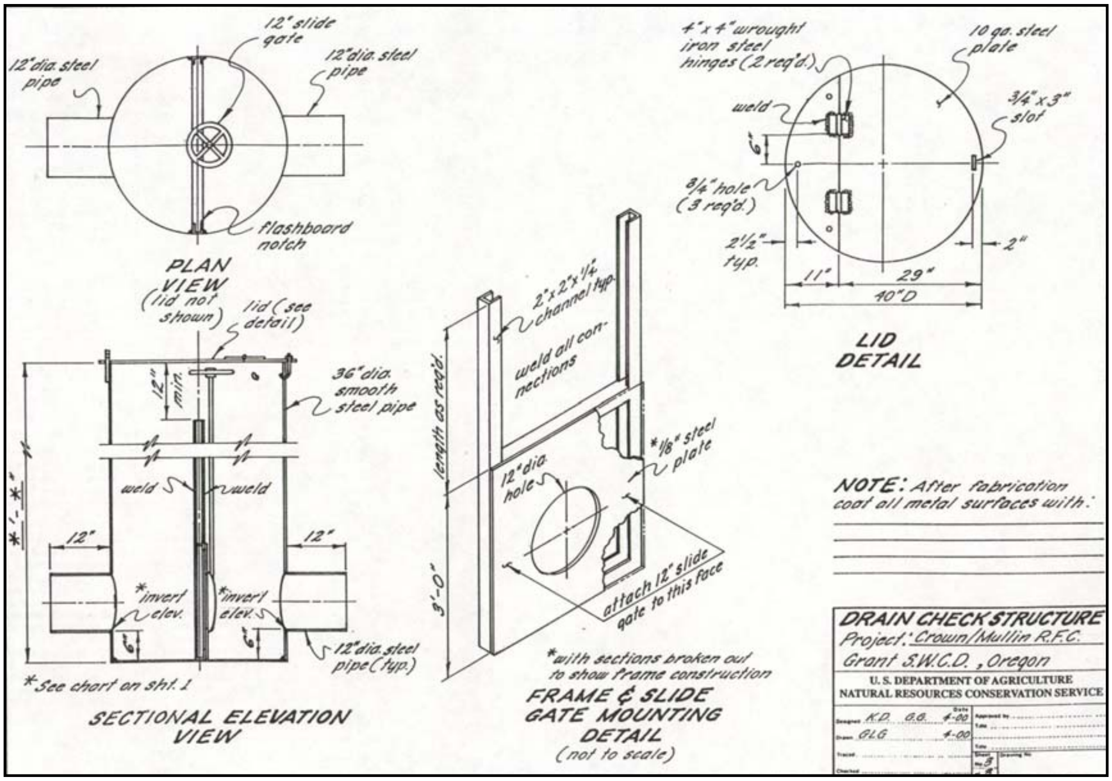


Figure 7. Return Flow Cooling System drains and chimney.

Figure 8. Typical RFC design plans.

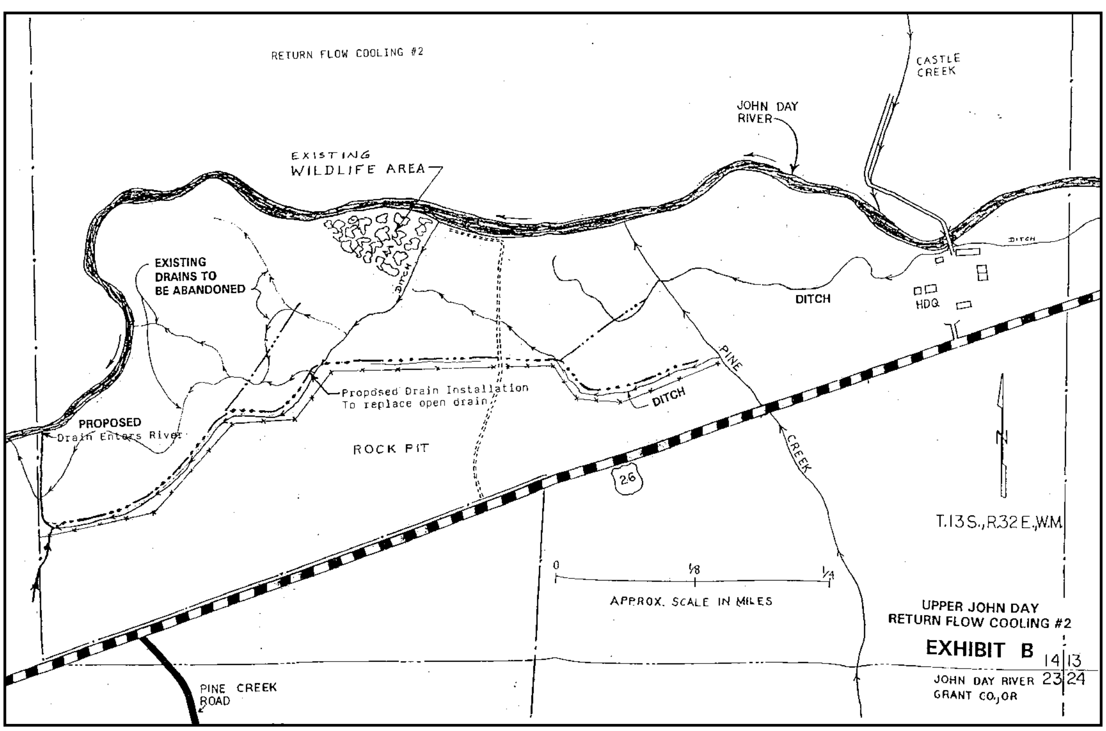


Photo 22. Irrigated field prior to RFC installation.

Photo 23. Installation of RFC.

Photo 24. Field immediately following RFC installation

Photo 25. RFC location following vegetation regrowth.

Photo 26. RFC Drain Chimneys

Photo 27. RFC river outlets.