CTUIR GRANDE RONDE SUBBASIN RESTORATION PROJECT ANNUAL REPORT

A Columbia River Basin Fish Habitat Project

Northwest Power Planning Council Project # 199608300

Report covers work performed under BPA contract # 72551
Report was completed under BPA contract #72551
Report covers work performed from: May 1, 2017 to April 30, 2018

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Report Created: April 2018

"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."

CONFEDERATED TRIBES UMATILLA INDIAN RESERVATION

BONNEVILLE POWER ADMINISTRATION

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Introduction/Background Information

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Grande Ronde Subbasin Restoration Project was initiated by the Confederated Tribes of the Umatilla Indian Reservation in 1996 to protect, enhance, and restore riparian and instream habitat for natural production of anadromous salmonids in the Grande Ronde River Subbasin. The project works with other agencies and private landowners to promote land stewardship and enhance habitat for focal fish species, primarily spring Chinook salmon, summer steelhead, bull trout, and resident trout. Emphasis is placed on improving juvenile rearing habitat and adult spawning habitat by restoring natural channel morphology and floodplain function, cold water refugia, and complex aquatic habitat that supports required life histories for focal species.

During Fiscal Year 2017 (May 1, 2017-April 30, 2018), the CTUIR was involved in multiple planning processes and projects. Planning efforts included: Expert Panel, Grande Ronde Model Watershed Board and Technical Committees, and ongoing coordination with multiple agencies, organizations, and private landowners associated with fish habitat project development. Additionally, project staff continued BPA-CTUIR Accord land acquisition planning, identification, and development of future site specific fish habitat projects. Project development and initial planning included; baseline field surveys, assessments, development of conceptual project plans, coordination with private landowners, and initiation of environmental planning.

During the reporting period, project staff were focused on: 1) CC44 Southern Cross Conservation Property monitoring, adaptive management, and ongoing planting and wood additions, 2) Rock Creek Phase 3 project planning, design, environmental permitting, and construction preparations for summer 2018; 3) Bird Track Springs planning and design, permitting, and initiation of a 2 year construction period beginning in 2018; 4) Middle Upper Grande Ronde (MUGRR) Phase I project planning, design, and environmental permitting, 4) Winter Canyon planning and design, and 5) Dark Canyon and Catherine Creek-Southern Cross/Kinsley conservation easement fence construction. Additionally, CTUIR staff continued to coordinate with the Wallowa-Whitman National Forest on fish passage and habitat project planning and development in the headwaters of the Grande Ronde Basin.

Construction on the CC44 Southern Cross project was completed in fall, 2016, and CTUIR staff continued monitoring and evaluation, including water temperatures, groundwater elevations, vegetation, geomorphic and instream habitat, biological, and photo points within the Project area. Work during the reporting period also included coordinating, planning, field surveys, and initial project development/design for upcoming projects along the Grande Ronde River, Rock Creek, Winter Canyon Creek, and Lookingglass Creek. Activities included coordinating with project partners and private landowners to develop future project opportunities, baseline field investigations and surveys, development of conceptual plans, initiation of funding proposals, and initiation of environmental compliance planning in preparation for further project development and implementation in 2017 and beyond.

Background

The CTUIR retains aboriginal and treaty rights related to fishing, hunting, pasturing of livestock, and gathering of traditional plants within the Tribes Ceded Territory, including the Grande Ronde Subbasin. The CTUIR Department of Natural Resources (DNR) has developed and accepted a First Foods organization and approach to ecosystem management based on the cultural traditions and practices of the Longhouse. The organization follows the serving order of food and conceptually "Extends the Table" to manage for sustainability within the Ceded Territory. The First Foods are considered to be the minimum ecological products necessary to sustain CTUIR culture. The order is watershed-based beginning with water as the foundation and progressing to salmon (Pacific lamprey, steelhead, trout, and whitefish), deer, cous, and huckleberry. The First Foods provide clear linkages to treaty rights and natural resources and defines direction and goals that relate to the community culture. In conjunction with the First Food principle, the CTUIR DNR developed the River Vision (Jones K. L., 2008) that describes and organizes ecological processes and functions that provide the First Foods.

The River Vision outlines physical and biological processes encompassing 5 touchstones: **Hydrology, Geomorphology, Connectivity, Riparian Vegetation, and Aquatic biota** which together with the First Foods, provide an overall framework for guiding tribal programs in regards to protecting and restoring ecological processes and functions. Healthy watershed processes and functions are the fundamental elements that create diversity, resiliency, and the ability of our river systems to provide sustenance and natural resources to support our culture and heritage.

The Subbasin historically supported viable and harvestable populations of spring/summer and fall Chinook salmon (*Oncorhynchus tshawytscha),* coho salmon (*O. kisutch*), sockeye salmon (*O. nerka),* summer steelhead *(O. mykiss),* Pacific lamprey (*Entosphenus tridentatus*), bull trout (*Salvelinus confluentus*), rainbow/redband *(O. mykiss sp.),* and mountain whitefish (*Prosopium williamsoni).* These native fishes are paramount to tribal cultures, economies and the region (CBFWA, 1990) and (CRITFC, 1995). Beginning in the late 1800's, fish populations started to decline with sockeye and coho extirpated in the early 1900's. The abundance of Chinook, steelhead, bull trout, and other fish species has also been dramatically reduced (NPCCa, 2004) and (NPCCb, 2004). With declining fish populations, Tribal governments and State agencies were obligated to eliminate or significantly reduce subsistence and sport fisheries by the mid 1970's. By the early 1990's, Snake River spring-summer Chinook and summer steelhead populations were suppressed to the point of triggering Federal ESA listings (spring-summer Chinook in 1992 and summer steelhead in 1997, and bull trout in 1998). Other native fish, including Pacific lamprey populations are also highly suppressed and with possible future ESA listing. The following tables illustrate estimated historic and current spring Chinook salmon and summer steelhead returns to the Grande Ronde Subbasin (NPCCa, 2004). Of particular note is an 87 percent decrease in spring Chinook and 70 percent decrease in summer steelhead populations from estimated historic levels.

The **CTUIR Grande Ronde Subbasin Restoration Project** (199608300), funded by Bonneville Power Administration (BPA) through the Northwest Power Planning Council Fish and Wildlife Program (NPPC), is an ongoing effort initiated in 1996 to protect, enhance, and restore fish habitat in the Grande Ronde River Subbasin. The project focuses on the mainstem Grande Ronde and major tributaries that provide spawning and rearing habitat for Threatened Snake River spring-summer Chinook salmon, summer steelhead, and bull trout. The project also provides benefits to other resident fish and wildlife.

The project is an integral component of Subbasin Plan implementation and is well integrated into the framework of the Grande Ronde Model Watershed (GRMW) established by the NPCC in 1992 to coordinate restoration work in the Subbasin. As a co-resource manager in the Subbasin, the CTUIR contributes to the identification, development, and implementation of habitat protection and restoration in cooperation with Federal, State, and local agencies. The CTUIR, ODFW, GRMW, and other participating agencies and organizations have made significant progress towards addressing habitat loss and degradation in the Subbasin (see http://www.grmw.org/).

The project was initiated in 1996 under the NPCC-BPA Early Action Project process. The project was proposed through the GRMW and NPCC program to provide the basis from which to pursue partnerships and habitat grant funds to develop and implement watershed and fish habitat enhancement activities in the Subbasin. Annual project budgets have averaged about $136,000 and ranged from a high of $200,000 in 1999. Annual operating budgets and associated tributary habitat efforts by the CTUIR were increased as a result of the CTUIR-BPA Accord Agreement with an annual average budget of $589,500. The project has historically administered multiple grants from various agencies, including Natural Resource Conservation Service (NRCS) Wetland Reserve Program (WRP), CREP, WHIP, and EQIP, OWEB, EPA-ODEQ 319, GRMW-BPA, CRITFC, NMFS, USFWS, ODOT, and NAWCA and developed an effective working relationship with multiple agencies and organizations.

The project has been successful in the development and implementation of several large-scale, partnership habitat enhancement projects and has developed effective interagency partnerships, working at the policy and technical levels with the Grande Ronde Model Watershed Program (GRMWP), federal and state agencies, and private landowners. A complete project overview and technical approach is described in the 2013 NPPC Project Proposal for the CTUIR Watershed Restoration Project (199608300) incorporated here by reference.

During the 20-year project history, the CTUIR has helped administer and implement a number of projects, enhancing nearly 50 miles of instream habitat. Conservation easements totaling about 1,900 acres on six large ranches/farms have been secured through a combination of NRCS WRP, CREP, and BPA programs (Figure 2). The project has constructed 18 miles of fence, 18 off-channel water developments, and installed over 160,000 trees, shrubs, sedge/rush plugs, and seeded over 800 acres with native/native-like grass seed. Improving habitat trends and biological response can be readily observed at a number of projects. A combination of both passive and active strategies have been developed and implemented, however project areas are in an early stage of recovery. Restoration efforts including: conservation easements, riparian/wetland enclosures, development of off-channel water sources, removal of livestock, re-vegetation, channel restoration, large wood additions and removal of dikes, old roadbeds and railroad prisms have resulted in improving trends.

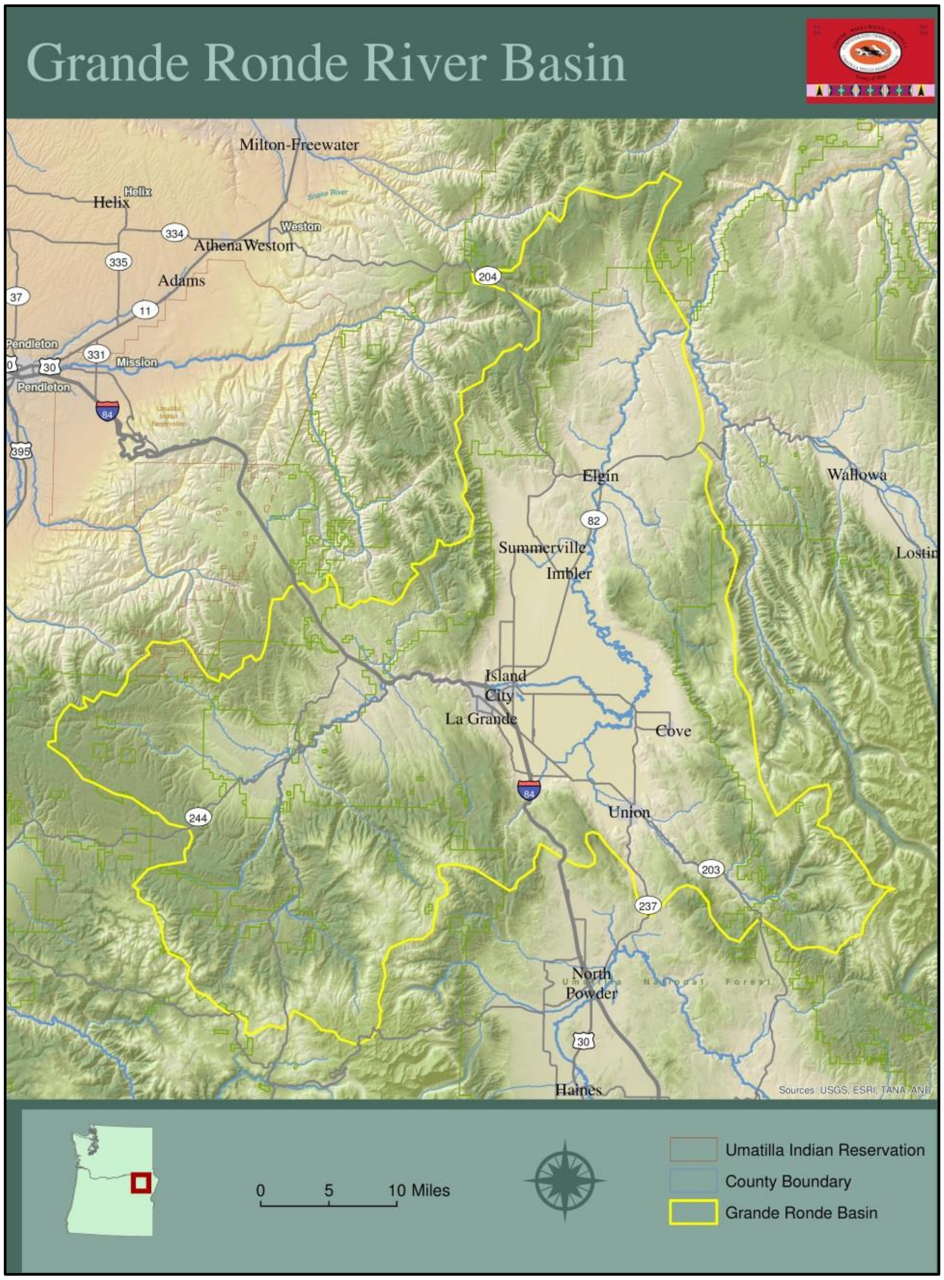
Project results are reported in various forms including Pisces status reports, project completion reports, and annual reports. The GRMW maintains a complete database on project implementation and results through development of project completion reports.

Description of Project Area

The project is located in the Grande Ronde Subbasin, in the southwest portion of the Blue Mountain Ecological province. The Subbasin encompasses about 4,000 square miles in northeastern Oregon and southeastern Washington. The headwaters of the Grande Ronde River originate near Anthony Lakes in the Elkhorn Mountains and flow northeast for about 212 miles before joining the Snake River in Washington at river-mile (RM) 169.

The Subbasin is divided into three watershed areas—the Lower Grande Ronde, Upper Grande Ronde, and Wallowa watersheds. Approximately 46 percent of the Subbasin is under federal ownership. Historic land uses include timber harvest, livestock grazing, mining, agriculture and recreation.

FIGURE 1 UPPER GRANDE RONDE SUBBASIN VICINITY



A comprehensive overview of the Subbasin is contained in the Grande Ronde Subbasin Plan (NPPC, 2004). The CTUIR Grande Ronde Subbasin Restoration Project focuses primarily on the Upper Grande Ronde portion of the Subbasin, which includes approximately 1,650 square miles with 917 miles of stream network (about 221 miles of salmon habitat). However, past project development and success of the program in terms of the types of projects that have been developed and the partnerships that have formed, are leading to watershed restoration project opportunities throughout the Subbasin. Figure 1 illustrates the vicinity of the Grande Ronde Subbasin within the Blue Mountain Province and key projects that have been completed, are underway, or planned under the CTUIR's Grande Ronde Subbasin Restoration Project.

Grande Ronde Subbasin fish populations have declined and habitat degradation is widespread in tributary streams. Mainstem Columbia River harvest, development of Columbia and Snake River hydroelectric projects, and habitat degradation has played an important role in the demise of Grande Ronde Subbasin fisheries (NPCC 2004a and b).

Although hatchery programs currently support subsistence and sport fishing opportunities for steelhead and limited Chinook salmon, there remains significant need to re-build viable and harvestable fish stocks throughout the Subbasin.

TABLE 1 SUMMARY OF ESTIMATED HISTORIC AND CURRENT GRANDE RONDE SPRING CHINOOK SALMON RETURNS BY POPULATION (DATA PROVIDED BY B. JONNASSON, ODFW PERS. COMM. 2004)

	Estimated Historic Returns		**Estimated Current Returns**					
Population	count	% of total	count	% of total	**Miles of spawning habitat**	**Adults /Mile Template**	**Adults /Mile Current**	**% Decrease Historic to Current**
Wenaha Spring Chinook	1,800	15%	453	30%	*45.60*	39.48	9.94	75%
Minam Spring Chinook	1,800	15%	347	23%	*42.54*	42.31	8.16	94%
Wallowa-Lostine Spring Chinook	3,600	30%	211	14%	*56.10*	64.17	3.76	95%
Lookingglass Spring Chinook	1,200	10%	190	12%	*29.82*	40.24	6.37	81%
Catherine Creek Spring Chinook	1,200	10%	188	12%	*29.82*	40.24	6.30	84%
Upper Grande Ronde Spring Chinook	2,400	20%	132	9%	*79.11*	30.34	1.67	84%
Total	**12,000**		**1,521**		***283.00***	**42.4**	**5.37**	**87%**

TABLE 2 SUMMARY OF ESTIMATED HISTORIC AND CURRENT GRANDE RONDE SUMMER STEELHEAD RETURNS BY POPULATION (DATA PROVIDED BY B. JONNASSON, ODFW PERS. COMM. 2004)

	Estimated Historic Returns		**Estimated Current Returns**					
Population	count	% of total	count	% of total	**Miles of spawning habitat**	**Adults /Mile Template**	**Adults /Mile Current**	**% Decrease Historic to Current**
Lower Grande Ronde	2,400	16%	608	14%	253.84	9.45	2.39	75%
Joseph Creek	3,600	24%	945	21%	223.10	16.14	4.24	74%
Wallowa River	3,750	25%	1,193	27%	173.45	21.62	6.88	68%
Upper Grande Ronde	5,250	35%	1,755	39%	613.96	8.55	2.86	67%
Total	**15,000**		**4,500**		1,264.35			**70%**

Figures 2 and 3 display estimates of historic and current abundance, productivity, and life history diversity predicted through the Ecosystem Diagnosis and Treatment (EDT) Method for Grande Ronde Subbasin Chinook salmon and summer steelhead, respectively (NPCC, 2004a and Mobrand, 2003). Graphs illustrate that current abundance, productivity, and life history diversity for spring Chinook and summer steelhead has been reduced from estimated historic levels.

Chinook and steelhead populations furthest from historic potential are in geographic areas that have experienced the highest levels of anthropogenic influence with significant declines illustrated for Wallowa-Lostine, Catherine Creek, Lookingglass, and Upper Grande Ronde spring Chinook and Upper Grande Ronde, Wallowa, and Joseph Creek summer steelhead. Current productivity and life history diversity for spring Chinook in the Wenaha and Minam watersheds (primarily designated wilderness areas) is similar to estimated historic conditions (NPPC, 2004a).

FIGURE 2 EDT ESTIMATES OF ABUNDANCE, PRODUCTIVITY, AND LIFE HISTORY DIVERSITY COMPARED TO THE ESTIMATED HISTORIC POTENTIAL FOR GRANDE RONDE SUBBASIN CHINOOK SALMON (NPCC 2004A, FIGURE 8, PG. 54)

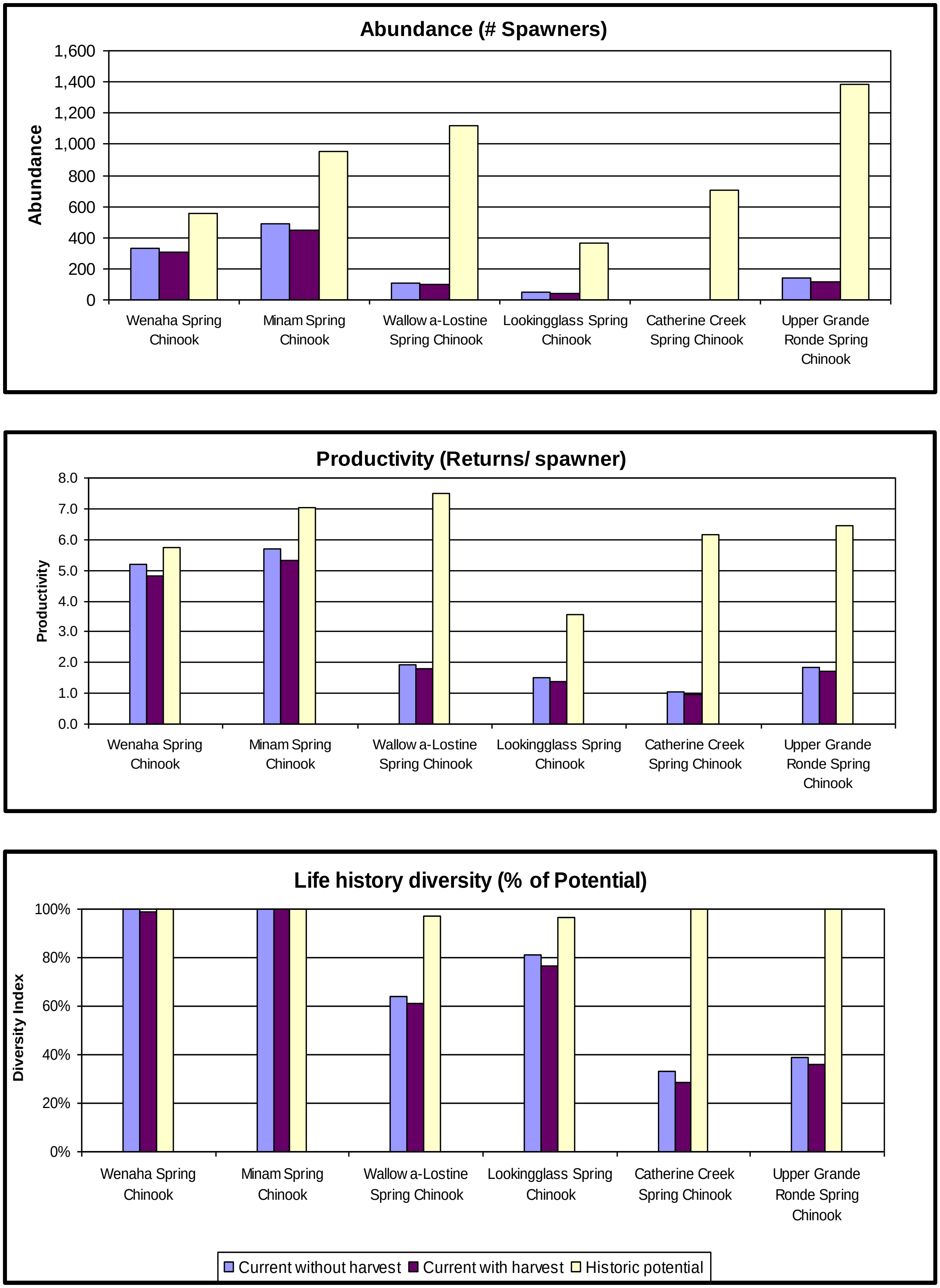
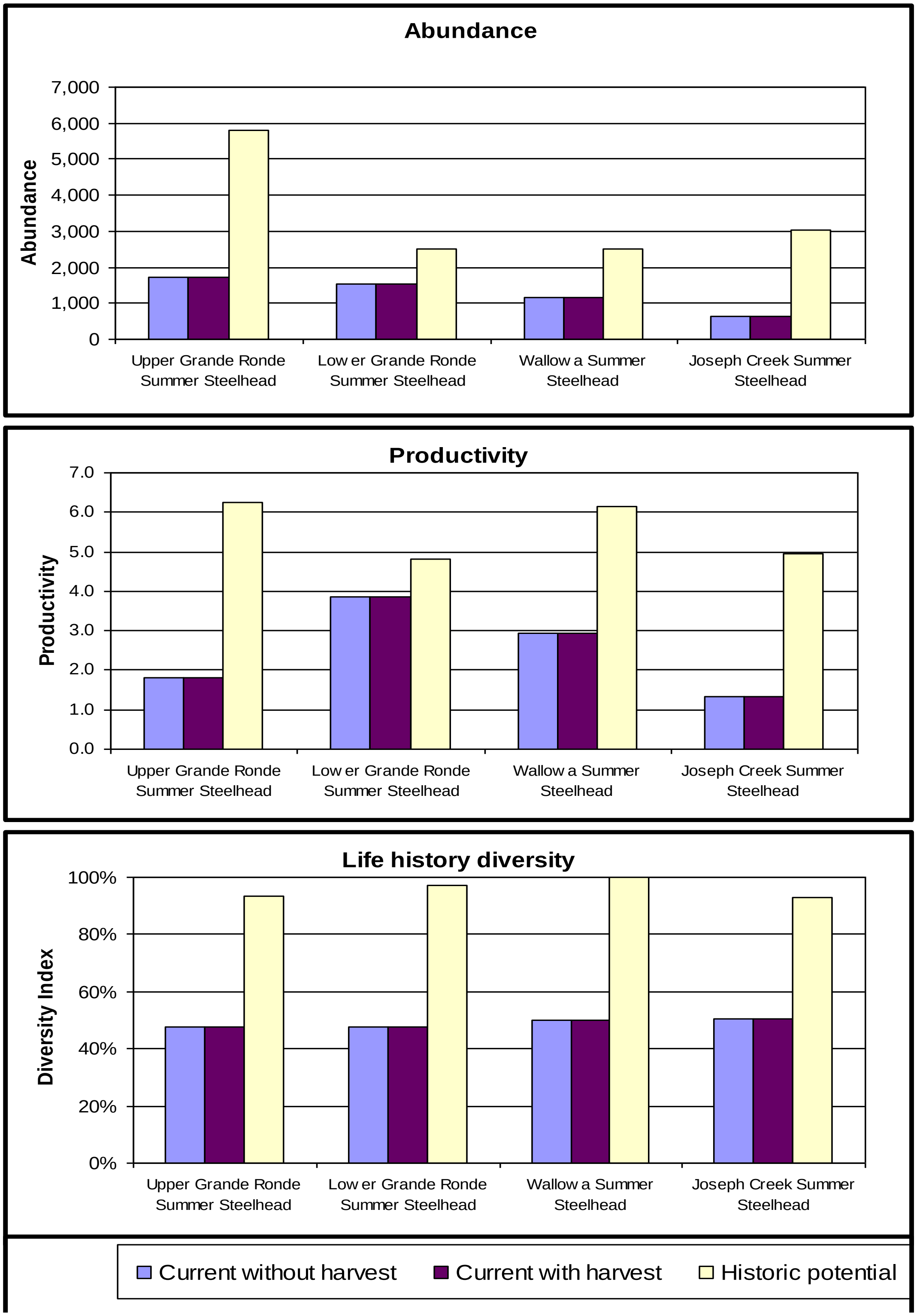


FIGURE 3 **EDT ESTIMATES OF ABUNDANCE, PRODUCTIVITY, AND LIFE HISTORY DIVERSITY COMPARED TO ESTIMATED HISTORIC POTENTIAL FOR GRANDE RONDE SUBBASIN SUMMER STEELHEAD (NPCC 2004A, FIGURE 22, PG. 72)**



Degradation of instream and riparian habitat in the Subbasin has been the dominant cause of salmon and steelhead decline (NPCC, 2004). The adverse effects of poorly managed logging, grazing, mining, dams, irrigation withdrawals, urbanization, exotic species introductions, and other human activities have been documented in all of Columbia River tributaries (ISG 1996). Riparian and instream habitat degradation has most severely impacted spring Chinook production potential in the Grande Ronde Subbasin (ODFW and CTUIR 1990, NPCC 2004a) and habitat loss and degradation has been widespread with the exception of road-less and wilderness areas (Anderson et al. 1992; CTUIR 1983; Henjum et al.1994; McIntosh et al. 1994).

Approximately 379 miles of degraded stream miles have been identified in the Subbasin (ODFW et al. 1990), with an estimated 80 percent of anadromous fish habitat in a degraded condition (Anderson et al. 1992). McIntosh (1994) documented a 70 percent loss of large pool habitat in the Upper Grande Ronde River since 1941. Riparian shade on low gradient streams was found to be less than 30 percent (Huntington, 1993). Stream channelization, diking, wetland drainage, and use of splash dams were common and widespread practices until the 1970's resulting in severe channel incision and degradation in some locations. The Oregon Department of Environmental Quality (ODEQ) listed over 60 stream reaches in the Subbasin on the State's list of water quality limited water bodies 303 (d). Of these stream segments, 24 are listed for habitat modification, 27 for sediment, and 49 for temperature. Table 3 illustrates priority areas for water quality treatment in the Subbasin (ODEQ, 2000).

TABLE 3 GEOGRAPHIC PRIORITY AREAS FOR WATER QUALITY TREATMENT IN THE UPPER GRANDE RONDE WATERSHED DEVELOPED THOURSOUGH TMDL PROCESS (H=HIGH, M=MEDIUM, L=LOW) (NPCC 2004A, TABLE 18, ODEQ, 2000)

Watershed	Temperature	Sediment	Flow
Lookingglass	L[1]	L	L
Lower Grande Ronde	L	L	L
Willow/Philips	H	H	H
Indian/Clark	M	M[2]	M
Catherine Creek	H	H	H
Beaver	M	M	L[3]
GRR Valley	H	H	H
Ladd Creek	H	H	H
Upper Grande Ronde	H	H	H[4]
Meadow Creek	H	H	H[4]
Spring/Five Pts.	H	M	M

Watershed analysis through the EDT (NPCC, 2004a and Mobrand, 2003) and synthesis through the Subbasin Plan Management Plan development process, identified instream habitat condition, high water temperature, sediment loads, and flow modification as primary limiting factors for Chinook and steelhead (pg. 11 NPCC 2004c, pg. 3 NPCC 2004d). Primary habitat degradation includes:

- **Channel Habitat Conditions** – Channel instability associated with removal of streamside cover and channelization has resulted in channel incision/down cutting, increased gradient, reduced channel length, elevated erosion, increased width-to-depth ratios, and loss of channel complexity. The quality of instream habitat has correspondingly been altered throughout much of the Subbasin.

- **Sediment** – Loss of upland and streamside vegetative cover has increased the rates of erosion. Soils lost from upland areas has overwhelmed hydraulic processes resulting in decreased availability of large pool habitat, spawning areas, riffle food production, and hiding cover.
- **Riparian Function** – Riparian habitat degradation is the most serious habitat problem in the subbasin for fish (McIntosh 1994, ICBEMP 2000). The loss of floodplain connectivity resulting from road/dike construction and channel incision, in addition to reduced habitat suitability for beaver, have altered dynamically stable floodplain environments and contributed to degradation and limited habitat recovery." This loss leads to secondary effects that are equally harmful and limiting, including increased water temperature, low summer flows, excessive winter runoff, and sedimentation.
- **Low Flow** – Water resources in many streams have been over-appropriated resulting in limited summer and fall base flow, development of fish passage barriers, and increased summer water temperatures.

Table 4 illustrates key habitat limiting factors by geographic priority area. The table has been edited from the Subbasin plan to depict only those geographic areas addressed under this proposal. These watersheds have been identified as the three highest priority areas to conduct habitat restoration with the greatest response in Chinook salmon and steelhead production potential (NPCC, 2004a, Supplement, Pgs. 49-50, Table 5-6).

TABLE 4 GRANDE RONDE SUBBASIN PRIORITY GEOGRAPHIC AREAS AND HABITAT LIMITING FACTORS (NPCC, 2004A)

Watershed	Fish Population(s)	EDT Priority Geographic Area(s) **highlighted** areas are priorities for multiple pops.	Habitat Limiting Factors
Wallowa River (including Lostine River)	Wallowa Steelhead Wallowa-Lostine Chinook Lostine/ Bear Cr Bull Trout	**Steelhead Priorities** Prairie Creek Upper Wallowa River –Wallowa Chinook Hurricane Cr , Whiskey Cr Lower Wallowa (1-3) -Minam Steelhead **Chinook Priorities** Lower Lostine – Wallowa Steelhead Mid-Wallowa – Wallowa Steelhead	➢ Key Habitat Quantity (reduced wetted widths) ➢ Habitat Diversity (reduced wood, riparian function) ➢ Sediment ➢ Temperature ➢ Flows
Upper Grande Ronde	Upper GR Steelhead Upper GR Chinook Upper GR Complex Bull Trout	Mid GR 4 (GR 37 - 44) - Chinook Mid GR Tribs 4 (Whiskey, Spring, Jordan, Bear, Beaver, Hoodoo…) Phillips Creek Upper GR Ronde 1 (45-48) - Chinook Mid GR 3 (GR – 34-36) Valley Sheep Cr, Fly Cr, Lower Meadow Cr – Chinook	➢ Sediment ➢ Flow ➢ Temperature ➢ Key Habitat Quantity (reduced wetted widths)
Catherine Creek/ Middle Grande Ronde	Upper GR Steelhead Catherine Cr Chinook Catherine Cr Bull Trout Indian Cr Bull Trout	Mid Catherine Creek (2-9) – UGR Steelhead SF, NF Catherine Creek Lower Grande Ronde R. 2	➢ Key Habitat Quantity (reduced wetted widths) ➢ Habitat Diversity (reduced wood, riparian function) ➢ Sediment ➢ Flow ➢ Temperature

Habitat protection and restoration needs in the Subbasin have been recognized in numerous reviews, planning processes, and reports (CTUIR, 1983), Noll and Boyce 1988, (ODFW, 1990), Wallowa-Whitman et.al. 1992, (Huntington, 1993) GRMWP (1994), (Mobrand, 2003), (NPCC, 2009), and (NPCCa, 2004). NPCC (2004a) Appendix 5 (pg 254) provides a relatively complete list of habitat protection and restoration strategies that can be applied to achieve goals and objectives. The NMFS proposed recovery plan for Snake River Chinook salmon recognized the importance of tributary habitat restoration and protection of habitat on both federal and private lands to Chinook and steelhead recovery (NMFS, 1997). NMFS has recently restarted the recovery planning effort for Chinook salmon and steelhead and tributary habitat restoration is expected to play a prominent role in the final NMFS recovery plan. NRC, (1996) has also noted the importance of protecting and rehabilitating freshwater habitat as part of salmon recovery. They specifically note the importance of riparian areas and recommend that habitat reclamation or enhancement should emphasize rehabilitation of ecological processes and function. The USFWS draft bull trout recovery plan recognized the importance of habitat protection and restoration as well (USFWS, 2002), specifically noting the need to improve water quality, reduce or eliminate fish passage barriers, and restoring impaired instream and riparian habitat.

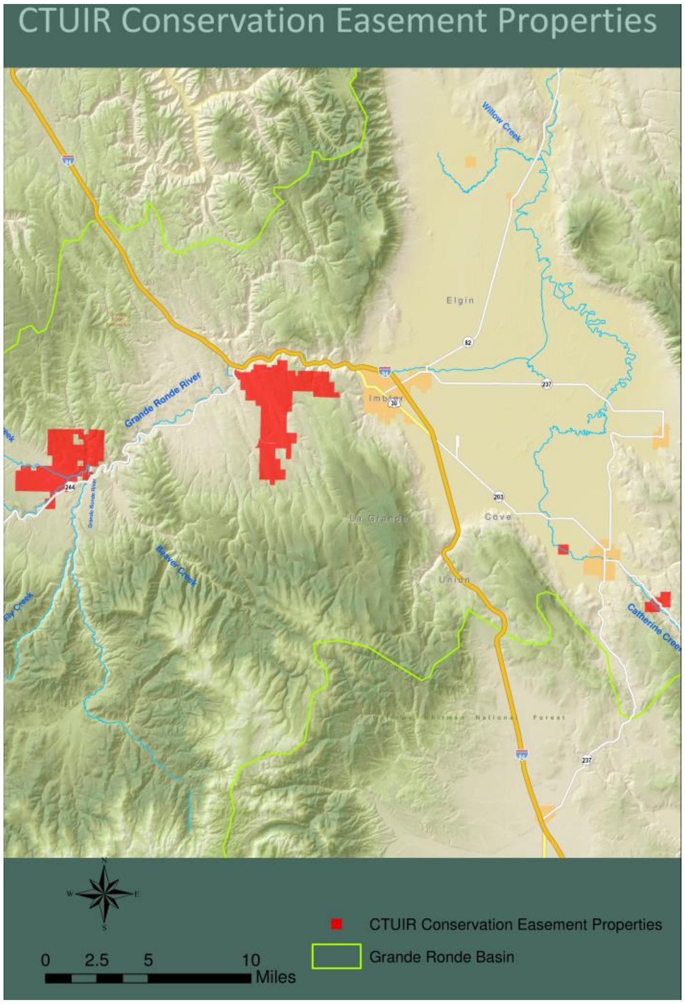
Noteworthy Accomplishments during FY2017

- Continued fish habitat enhancement activities, including maintenance, monitoring and adaptive management, on the Catherine Creek (CC 44) Southern Cross Phase III project, which permanently protects 1 mile mainstem and 64 acres of historic floodplain.
- Maintained and monitored conservation easements on Catherine Creek, Rock Creek, Meadow Creek and Dark Canyon Creek (Figure 4).
- Conducted baseline and post project morphological surveys along 2 miles of Catherine Creek.
- Initiated planning, field surveys, and design on projects planned for construction through 2018 including:
    - Planning and design on Winter Canyon Creek.
    - Completed Rock Creek Phase 3 Project Designs and Specifications.
    - Initiated planning and design on the 8 mile Middle Upper Grande Ronde River (MUGR) Reach.
    - Completed planning and design on Bird Track Springs Project in cooperation with the Bureau of Reclamation (BOR) and the U.S. Forest Service, covering over 4 miles of the mainstem Grande Ronde River and several side channel habitats.
- Completed construction of a riparian conservation easement fence (approximately 4,200 ft.) for the Kinsley property (CC44), protecting approximately 7.5 acres of riparian areas and approximately .5 miles of Catherine Creek.
- Completed construction of a permanent conservation easement fence (approximately 25,000 feet) on the Cunha ranch along Dark Canyon Creek and Meadow Creek.
- Project Leader participated on the Grande Ronde Model Watershed Board of Directors and Technical Implementation Team to review and develop projects.
- Project Leader and Assistant Biologist participated in the Technical Advisor Committee for the Atlas Process.
- Project Leader and Assistant Biologist participated in NRCS Local Working Group and Regional conservation Partnership Program planning.
- Assistant Biologist and Biologist completed the Portland State University River Restoration Environmental Professional Program.
- Project Staff attended relevant trainings and classes (River Restoration Northwest, CHAMPS snorkel training, BOR Project Management training).

- Staff conducted monitoring and evaluation activities on project areas, including expanded water temperature and groundwater monitoring efforts at restoration sites and application and monitoring of ungulate browse deterrent.
- CTUIR habitat staff supported other research and monitoring efforts at project sites including AEM and CTUIR physical habitat monitoring program.
- Project leader delivered presentations about the Catherine Creek Southern Cross Conservation Project to the NPPC ISRP in LaGrande, Oregon during spring 2017, American Water Resources Association Conference in Portland, Oregon, November 2017, and at the annual GRMW State of the Science Meeting in LaGrande, Oregon in April 2018.
- CTUIR staff hosted multiple tours on the Catherine Creek Southern Cross Conservation Project during 2016 and 2017, including the 2017 Union County Annual Crop Tour, the Oregon Water Resources Sponsored Place-Based Planning Group, Bureau of Reclamation and partners from the Idaho's Salmon River Basin and Idaho's Governors Salmon Program, as well as tours with other agencies and individuals.
- Pursued future restoration efforts by continuing discussions with federal land managers and private landowners about restoration opportunities along Catherine Creek, Grande Ronde River, Dry Creek, Whiskey Creek, Indian Creek, Rock Creek, and Winter Canyon Creek.
- Project staff coordinated with landowners, NRCS, and UCSWCD to provide technical assistance for restoration project enrollment in EQIP, CREP, and OWEB small grants. This work included:

    Rock Creek (For the Girls LLC)
    Bird Track Springs (Jordan Creek Ranch)
    Winter Canyon Creek

FIGURE 4 CTUIR CONSERVATION EASEMENT PROPERTIES MAP



Ongoing Work Elements

The following sections present work elements followed by discussion of accomplishments for the project during the contract period.

Manage and Administer Projects

This work element includes a suite of management actions required to administer the project, including preparation of annual operations and maintenance budgets, managing and preparing statements of work and budgets, and milestone and metrics reporting in Pisces, supervising and directing staff activities, conducting vehicle and equipment maintenance and management, payroll, purchasing, subcontracting for services, and administering/inspecting habitat enhancement activities. CTUIR staff administered the CC44 Southern Cross Project and assisted with the Catherine Creek CC44 Project, including construction subcontract solicitation, field stakeout, and observation and inspection. CTUIR administered all aspects of construction subcontracting, materials acquisition, and administration for the CC44 Southern Cross Project during 2016-2017.

The Project Leader supervised 4 permanent employees and a seasonal crew of 2 90-day e-hire employees to accomplish fish salvage and riparian planting project activities. Staff training included 2017 River Restoration Northwest Symposium (Project Leader, Biologists and lead Technician).

Environmental Compliance and Permits

Environmental compliance methods include development of appropriate documentation under various federal and state laws and regulations governing federally funded project work. Methods involve coordination with various federal and state agencies and development, oversight, and submittal of permit applications, biological assessments, cultural resource surveys, etc.

Primary accomplishments during the reporting period included coordination with BPA environmental compliance personnel to prepare supplemental documentation and reporting for ongoing and planned management actions.

Additionally, CTUIR staff continued EC compliance on projects planned for implementation beginning in 2017 including the Rock Creek Project Phase III and Bird Track Springs Project. Activities included preparation of maps illustrating the Area of Potential Effect (APE) to initiate cultural resource investigations and compilation of ESA species information for incorporation into ESA compliance documentation. EC compliance activities will be ongoing for the Rock Creek Project III in FY2018 with completion scheduled for late summer in preparation to construction initiation.

Coordination and Public Outreach/Education

Coordination and public education were undertaken to facilitate development of habitat restoration and enhancement on private lands, participate in Subbasin planning, ESA recovery planning, BiOp/Remand project development and selection processes, and assist with providing watershed restoration education. CTUIR technical staff coordinates through the GRMW on the Board of Directors and Technical Committee to help facilitate development of management policies and strategies, project development, project selection, and priorities for available funding resources.

The Project Biologist participates in multiple basin programs and processes associated with project prioritization and selection, funding, and technical review. Focus during FY2017 included work on the Catherine Creek Atlas process, initiation of the Upper Grande Ronde Atlas, and participation on the GRMW technical review team to evaluate and select projects for funding recommendations through the GRMW Step-Wise Process. Additionally, CTUIR staff continued working on look forward projects with close coordination between BPA and BOR to develop core project complexes and initiate concept planning in conjunction with CTUIR-BPA Accord land acquisition strategies.

CTUIR staff also participated in a several educational and public outreach activities which included a newspaper article about the CC44 Project for the Grande Ronde Model Watershed Ripples newsletter, a newspaper article about the Southern Cross Project for the East Oregonian, and several tours of the Southern Cross project with OWEB, BOR, CTUIR, and BPA staff.

Planting and Maintenance of Vegetation

The CTUIR habitat program annually participates and/or assumes the lead role in re-vegetation activities on individual habitat restoration and enhancement projects. Planting and seeding methods are developed to address site specific conditions and vegetation objectives. Natural colonization and manual techniques are utilized.

Staff efforts associated with planting during the reporting period included installation of approximately 10,000 containerized trees (Black Cottonwood, Hawthorne, Ponderosa Pine, Douglas Fir, Elderberry, Salmonberry, and Red-Osier Dogwood) and live willow whips on point bars, riffle margins, side channels, and floodplains of the CC44 Southern Cross Project. Disturbed areas were also seeded and mulched with a native grass seed mix consisting of Basin Wild Rye (33.06%), Rosanna Western Wheat Grass (19.07%), Snake River Wheat Grass (9.34%), Tufted Hairgrass (10.41%), Idaho Fescue (16.51%), and Big Blue Grass (9.94%). Plants were installed using hand-held augers, a mini-excavator, and a compact tracked loader with an auger attachment. Multiple applications and pre/post application monitoring of the animal repellant Plantskydd® within the Southern Cross RMZ and McCoy/Meadow Creek Project areas; (https://www.cbfish.org/Document.mvc/DocumentViewer/P160960/plantskydd-application-and-monitoring-plan.pdf)

Identify and Select Projects

Habitat protection, restoration and enhancement project opportunities were identified and developed during FY 2017. Activities included land and easement acquisition project identification and planning (Stevens Forest LLC Property, Tsiatsos Ranch Conservation Easement, Catherine Creek Boyd Property, and the Lookingglass Jennings Property), coordination and planning with State, Federal, local partners, and private landowners, and participation on Grande Ronde Model Watershed (GRMW) Board and Technical Committee to evaluate projects for BPA funding through the Step-Wise Process.

Project staff continued contact with landowners on 5 miles of Rock Creek (a contiguous section upstream of the current Rock Creek Project), and 1 mile of Winter Canyon Creek to discuss fish habitat restoration projects.

Operate and Maintain Habitat & Structures

Project maintenance includes conducting custodial responsibilities on individual projects to ensure that developments remain in functioning repair and habitat recovery is progressing towards meeting projects goals and objectives. Operations and maintenance of habitat and structures was supervised by biologists and carried out by two permanent technicians, two seasonal technicians (6 month hires), and multiple contractors. Activities included:

-layout and maintenance of an irrigation system (hand lines/pumps) within the Southern Cross Riparian Management Zone (RMZ);
-construction and maintenance of plant enclosures (panels/cages) within the Southern Cross RMZ, and the McCoy Meadows/Meadow Creek Project areas;
-construction and maintenance of water gaps/water access sites on Meadow Creek (Habberstad), Dark Canyon Creek, Rock Creek, and Catherine Creek Project areas (CC37, CC44);

-construction and repair of fences along Catherine Creek (CC37, CC44), McCoy Creek, Meadow Creek, Dark Canyon Creek, and Rock Creek Project areas;
-manual control of noxious weeds within the Southern Cross Conservation Property;
-regular stream/air temperature and groundwater well data collection on Catherine Creek, McCoy/Meadow Creek, Upper Grande Ronde River and tributary streams;
-collection of willow/cottonwood cuttings for swale channel roughness enhancement and bioengineered bank treatment within the Southern Cross RMZ;
-enhancement of swale channel roughness with willow/cottonwood cuttings (trenching/augering) within Southern Cross RMZ;
-construction of bioengineered bank treatment using straw bales, coir fabric, and willow cuttings on Southern Cross Conservation Property;
-spot re-seeding and mulching of swale complexes within the Southern Cross RMZ using riparian and wetland seed mixes;
-mechanical ripping of access roads and staging areas on the Southern Cross Conservation Property by project construction contractor and reseeding by Tri-County Cooperative Weed Management Area (CWMA);
-harvest and processing of 150-200 Lodgepole pine poles for post assisted wood structures; -construction of post assisted wood structures within swale channel complexes on Southern Cross Conservation Property utilizing hydraulic and pneumatic post pounders and woven willow cuttings/lodgepole slash;
-general maintenance of project vehicles (trucks/ATVs/trailers), power tools (pumps/chainsaws/augers/pounders), and miscellaneous hand tools;
-inspected contracted construction of riparian easement protection fences on CC44 (Southern Cross, Kinsley), and Dark Canyon-Cuhna) properties.
-Activities also include the treatment of noxious and invasive weeds through a cooperative agreement with the Tri-County Cooperative Weed Management Area (CWMA) on the Southern Cross Conservation Property, Lookingglass Creek Property, CC37 Project, and the Rock Creek Project (Figure 5).

FIGURE 5 CTUIR/TRI-COUNTY CWMA WEED TREATMENT MAP

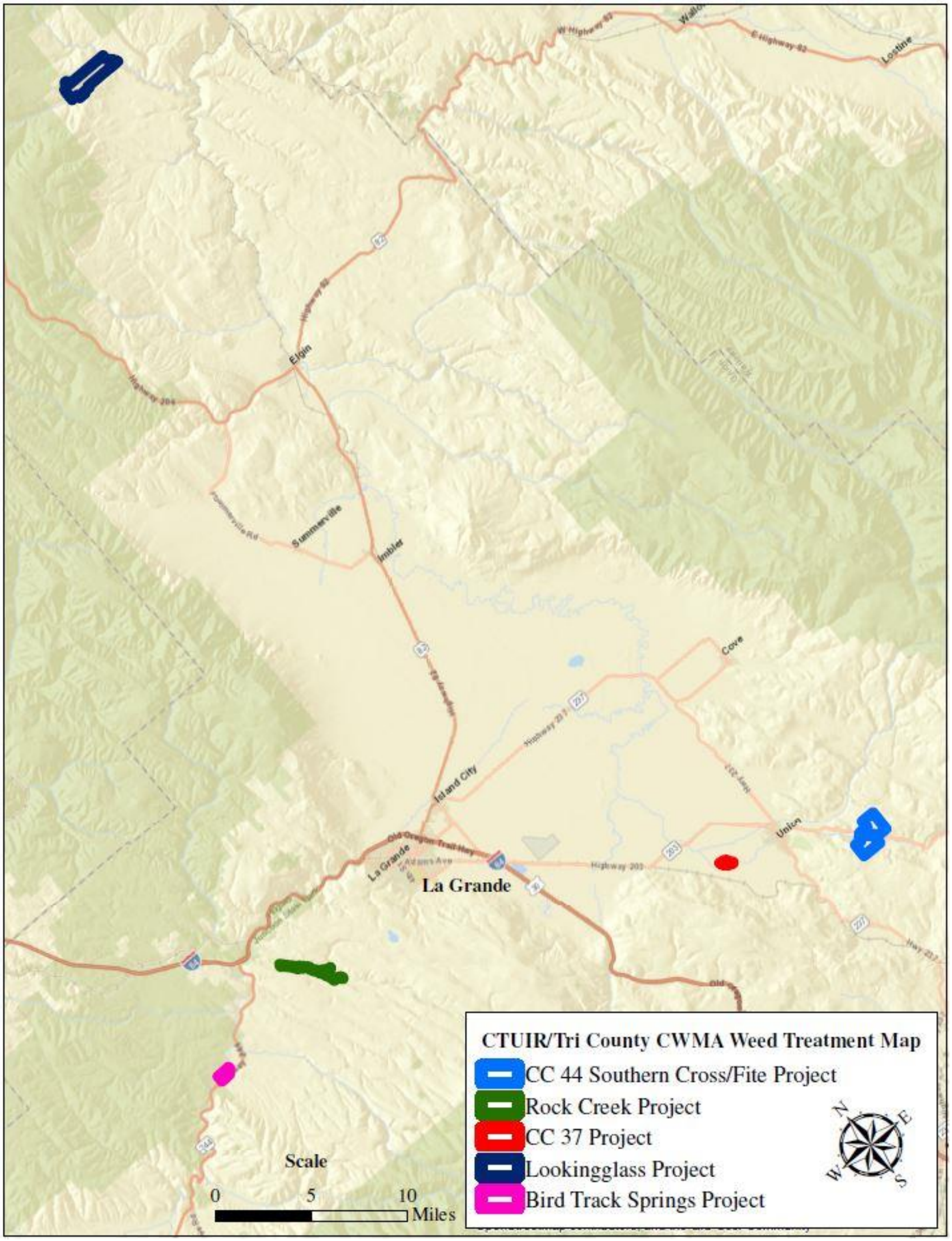


FIGURE 6 2017 TRI-COUNTY CWMA NOXIOUS WEED SUMMARY

Tri-County CWMA Noxious Weed Summary

Southern Cross

Class "A" Weeds

- Hoary Cress -White top

Class "B" Weeds

- Yellow Starthistle
- Canada Thistle
- Bull Thistle
- Scotch Thistle
- Russian Thistle
- Diffuse Knapweed
- Hounds tongue
- Catchweed Bedstraw

Nuisance Weeds

- Catchweed
- Field penny cress
- Annual bugloss
- Common mullein
- Tumble Mustard
- Curly Doc
- Shepherd's Purse
- Wild Mustard
- Fiddleneck
- Common Cocklebur
- Chamomile

Annual Grasses

- Medusahead Rye
- Cheat grass
- Ventanata

Chemicals

- Transline was used in Riparian areas
- Milestone was used on upland areas and hay pastures areas
- Round up was used on cheat grass in hay pasture
- Plateau was used on upland Medusahead as well as parts of the hay pasture

CC 37

Class "B" Weeds

- Canada Thistle
- Bull Thistle
- Scotch Thistle
- Catchweed Bedstraw

Nuisance Weeds

- Catchweed
- Field penny cress
- Common mullein
- Fiddleneck
- Sow thistle

Chemicals

Transline was the only chemical used in this project area.

Rock Creek

Class "A" Weeds

- Hoary Cress -White top

Class "B" Weeds

- Canada Thistle
- Bull Thistle
- Scotch Thistle
- Diffuse Knapweed
- Hounds tongue
- Sulphur, Cinquefoil

Nuisance Weeds

- Common mullein
- Fiddleneck
- Doc

Annual Grasses

- Medusahead Rye
- Cheat grass
- Ventanata

Chemicals

- Transline was used in Riparian areas
- Milestone was used on upland areas
- Milestone plus Escort was used on roads
- Plateau was used on roadside Medusahead

Monitoring & Evaluation

Monitoring and evaluation (M&E) of individual projects is conducted either independently by the CTUIR or jointly with project partners, Fish Habitat Enhancement Biological Effectiveness Monitoring 2016 Annual Progress Report (project #2009-014-00; BPA contract #71934) depending on the project. Monitoring and evaluation efforts include annual photo-points, installation of water and air temperature probes, stream channel cross sections and longitudinal profiles, pebble counts, juvenile fish population and habitat surveys, stocking/census surveys on re-vegetation efforts, and groundwater monitoring. Public tours, workshops, and presentations of individual projects will continue to be conducted. These activities provide for the discussion of various approaches, restoration techniques, successes, failures, and ultimately adaptive management.

Project staff conducted presence/absence snorkel surveys on side channels as part of the pre-project data collection efforts for the Bird-Track Springs Project.

Following are descriptions of the various M&E components of the project followed by project specific monitoring results.

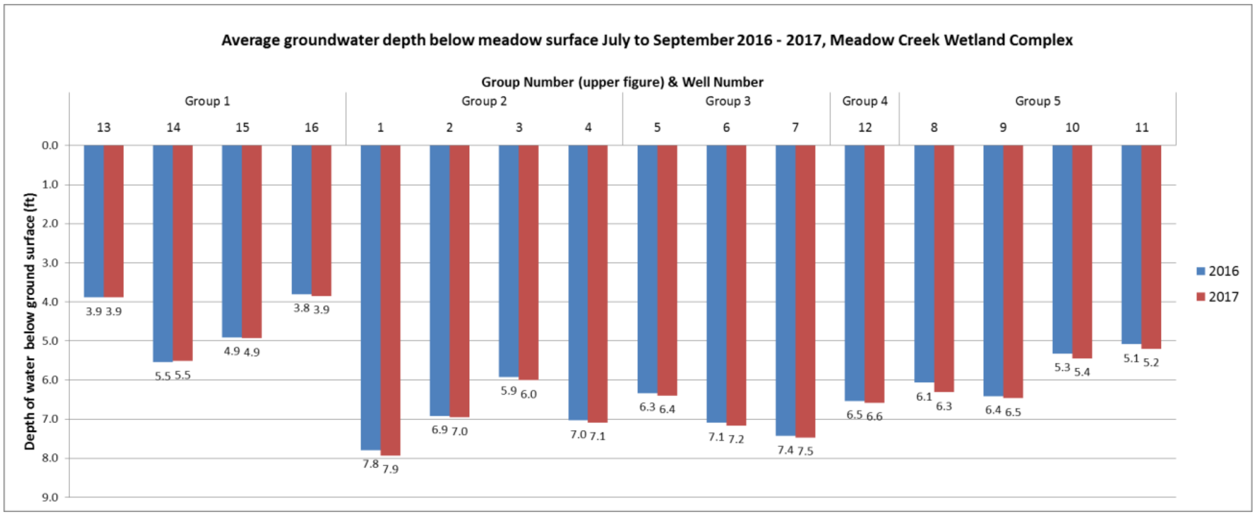
Groundwater Monitoring

Meadow Creek Groundwater

There were 16 shallow groundwater wells monitored in 2017 by CTUIR along the Meadow Creek Wetland complex on the McCoy Meadows Ranch. Surveys are conducted once every two weeks throughout the spring, summer, and fall. In 2017 there were 18 surveys, giving us a sample size of 288 individual groundwater measurements. Data is plotted in relation to the meadow surface elevations at each monitoring well site in order to evaluate seasonal and annual changes in groundwater depths. Wells are grouped for these plots into 5 units that represent their position within the meadow system, with Group 1 located at the most upstream portion of the project (wells 13 to 16) and Group 5 being the most downstream group (wells 8 to 11).

When comparing average groundwater elevations from depths measured in months July to September 2016 with records from July to September 2017 there appears to be little difference in the summer averages between these two years (Figure 7). 3 of the 16 wells measured in July through September 2017 had the same average summertime depth below meadow surface compared to their corresponding wells measured during the same months the previous year. The remaining 13 wells measured in summer 2017 each show a decrease in groundwater elevation of approximately 0.1 ft. compared to the previous year.

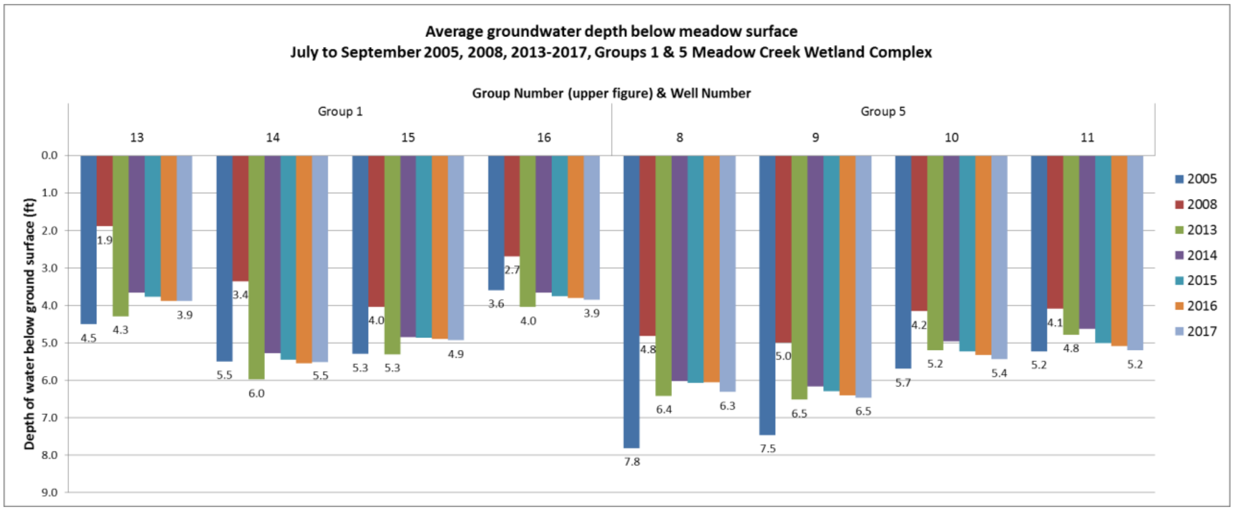
FIGURE 7 AVERAGE GROUNDWATER ELEVATIONS ALONG MEADOW CREEK WITHIN THE MCCOY MEADOWS RANCH.



Average summer groundwater depths within the Meadow Creek Wetland Complex from months July to September 2008, 2013- 2017 for the most upstream wells (Group 1) and most downstream wells (Group 5) were graphed (Figure 8). In addition, pre-project measurements taken in 2005 during the same months are also shown for comparison. There is a six-year trend in decreasing groundwater elevation from 2008 to 2013. Groundwater records from 2013 are the furthest below meadow surface since 2005 pre-project levels for nearly all wells, with the exception of wells 10 and 11 where 2017 groundwater measurements were furthest from the meadow surface since pre-project conditions. It is possible that sediment build up at the Meadow Wetland Intake prevented desired flows from main channel Meadow Creek to access the wetland channel and contributed to this drop in groundwater elevation. A possible down-cutting of Meadow Creek, and coinciding dropping of the water table, may also have been a factor in these groundwater differences. The lower than average snowpack during winter 2012/2013 could also have contributed to lower than average summer flows in the Meadow Creek drainage, resulting in a lowered water table.

Groundwater depth measurements taken in 2014 indicate a consistent increase in groundwater elevation when comparing to summer seasonal average depths recorded from 2013 for Group 1 and Group 5 wells. The average increase in groundwater elevation in 2014 for these eight well sites was +0.4 feet. A possible explanation for the increase in groundwater elevation could be that mainstream Meadow Creek flows were allowed more access to floodplain and side channels, or that high flow diversion from the main channel persisted longer in these areas. All but one of the 8 wells (well #16) from Groups 1 and 5 showed groundwater elevations higher than pre-project levels in 2014. The average increase in groundwater elevation in 2014 compared to 2005 pre-project levels was +0.7 feet, which could be the result from seasonal high flows accessing the constructed Meadow Creek Wetland side channel. From 2014 to 2017 there has been a slight, but consistent, decline in average summertime groundwater elevation. The combined average drop in groundwater elevation between 2014 and 2017 among all wells from Group 1 is 0.2 feet. For Group 5 wells the combined average decline in groundwater elevation is 0.4 feet. One well (well #16) had an average summer 2016 groundwater depth 0.3 feet below that of the 2005 pre-project level, and well #14 and #11 were measured in 2017 to be at the same groundwater elevation as pre-project records.

FIGURE 8 2005 (PRE-PROJECT), 2008, 2013 - 2017 AVERAGE GROUNDWATER ELEVATIONS ALONG MEADOW CREEK WITHIN THE MCCOY MEADOWS RANCH.



McCoy Creek Groundwater

Groundwater well data was collected once every two weeks beginning March 28, 2017 and ending November 22, 2017. A total of 18 surveys were conducted to measure the groundwater depth below meadow surface during these months. There were 34 groundwater wells monitored along the McCoy Creek restoration project in 2017. The percent of well measurements when wet versus when dry were recorded and plotted (Figure 9) and shows a trend in increased groundwater elevation within the project area from 2007 to 2011, a decrease from 2011 to 2012, and no significant change from 2012 through 2014. Records from 2015 show a 4% decrease in wet well measurements compared to the previous year, but measurements from 2016 show a 2% increase in wet wells versus dry. There were 3% fewer wet wells measurements taken in 2017 compared to the previous year, which puts the current Wet vs. Dry ratio (60-40) at the lowest since 2007 (58-42).

FIGURE 9 PLOT OF WET VERSUS DRY WELL MEASUREMENTS ALONG MCCOY CREEK 1997 TO 2016.

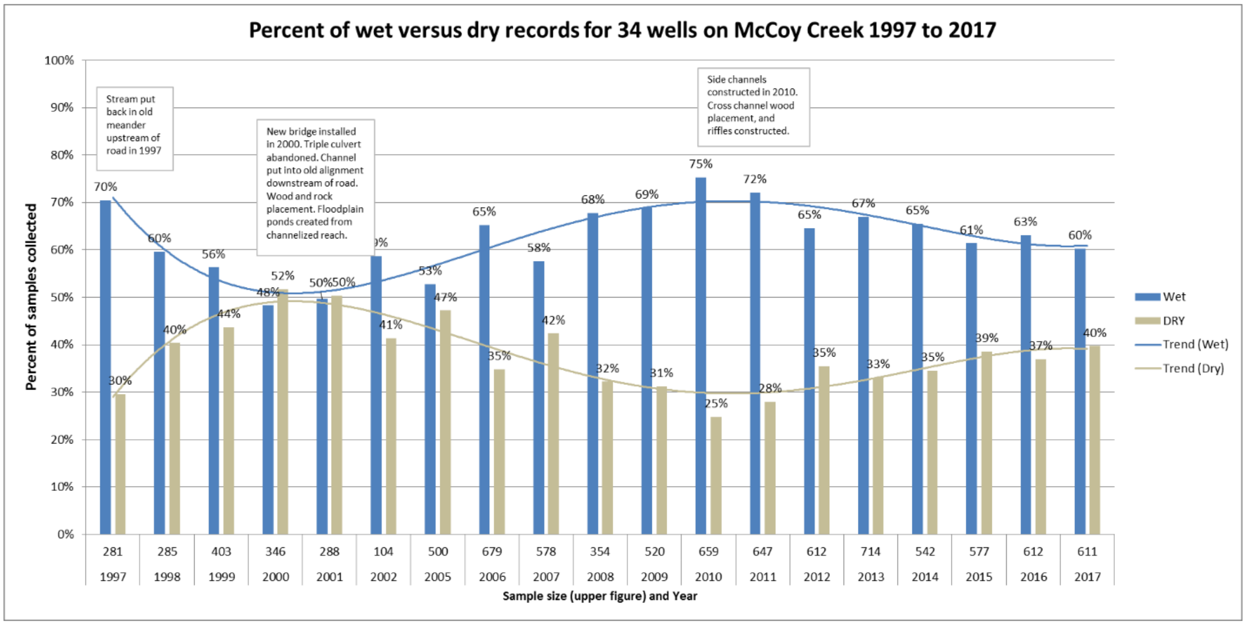


Figure 10 shows 16 wells that remained wet for at least 3 surveys during the summer months July through September for the last 10 years since 2008. Wells located where water table levels dropped below the bottom of the well during July through September were not considered for annual comparison. 9 of the 16 wells sampled for these years contained average summer groundwater at a level that never dropped below 3 feet of the meadow surface, and 7 of these wells did not get below the preferred max target depth of 2.5 feet below the meadow surface during the months July through September for the last 10 years. Only two of these wells measured in 2017 recorded an average summer groundwater depth of below 4 feet from the meadow surface. For most of these wells, a similar trend in average summer groundwater elevation change can be seen. The general pattern that exists is a rising of groundwater elevation toward the meadow surface beginning in 2008 and topping out around 2011, followed by a decline away from meadow surface elevation. Records collected in 2017 show that, in most cases, summer groundwater was the furthest away from the meadow surface since 2008. The most peculiar exception is seen in well 24 where average summer groundwater elevation declined from 2008 to 2010, and has been steadily rising towards the meadow surface since. Records from 2017 show that groundwater elevations at well 24 are the closest to the meadow surface than they have been since the early 2000’s (not shown on graph), which contrasts with the declining groundwater elevation trend seen in most other wells.

FIGURE 10 PLOT OF AVERAGE SUB-SURFACE WATER ELEVATIONS JULY TO SEPTEMBER 2008 - 2017 ALONG MCCOY CREEK.

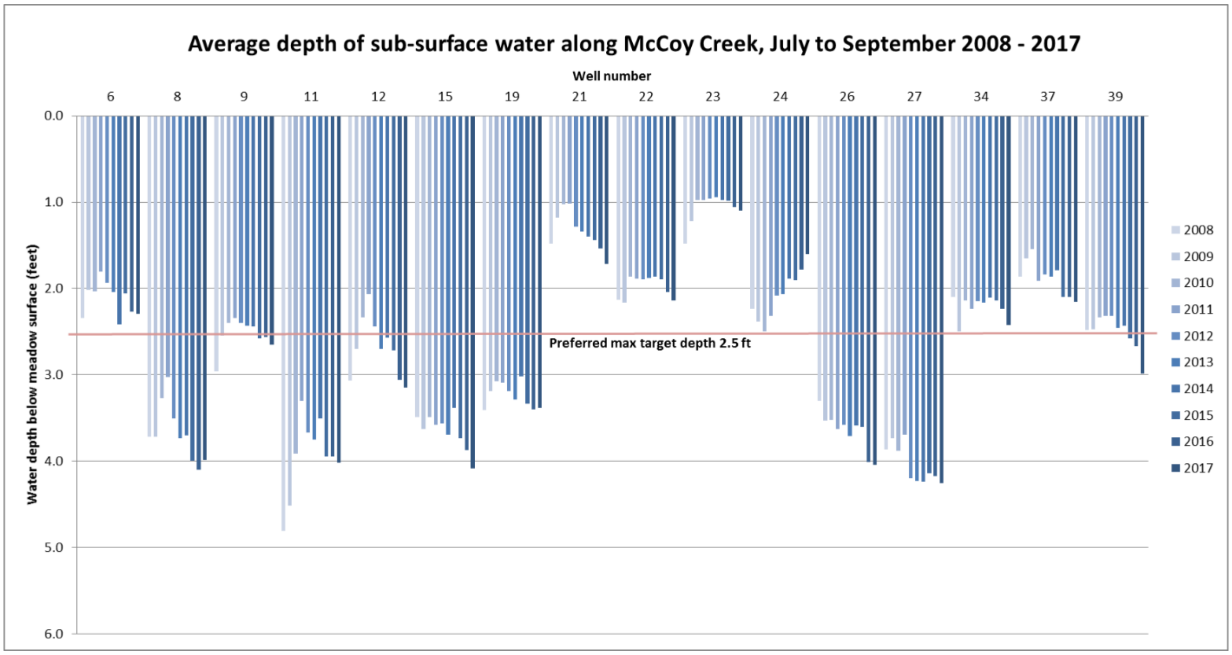
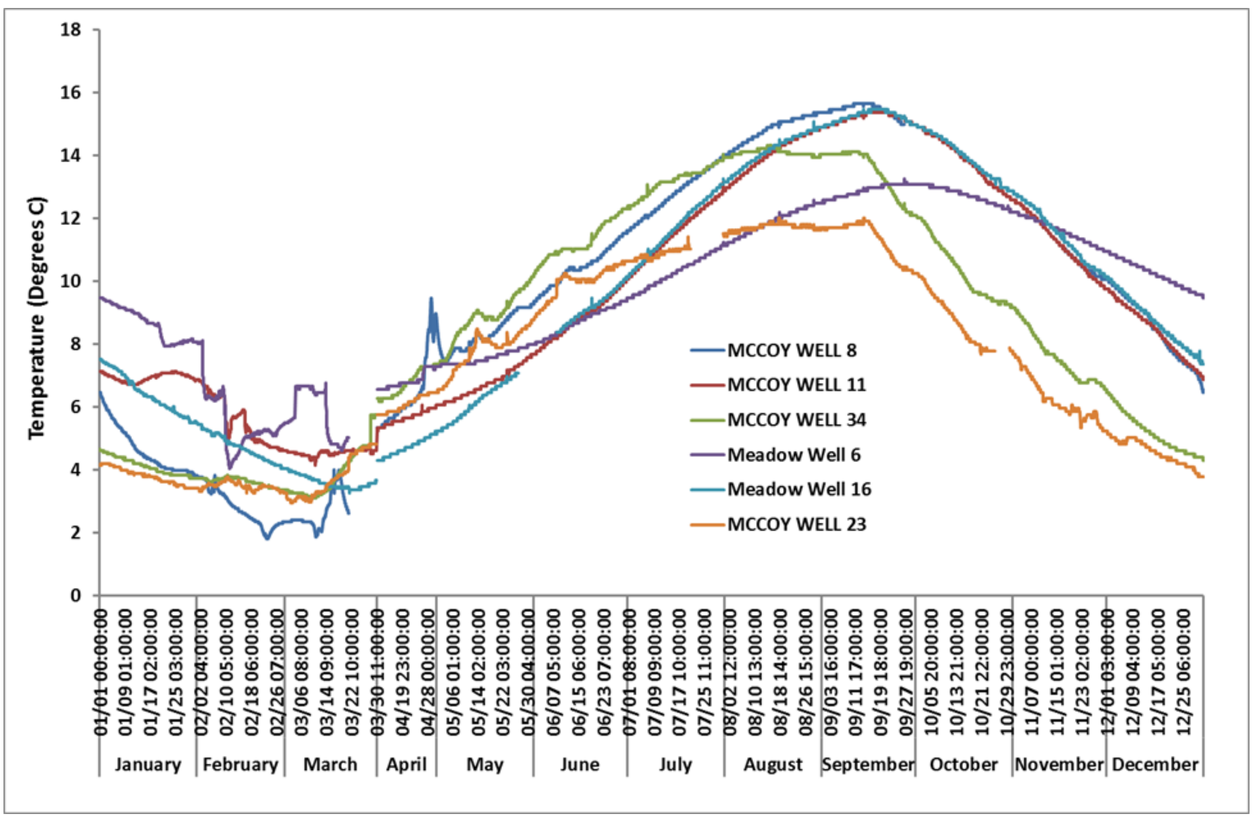


FIGURE 11 GROUNDWATER TEMPERATURE DATA FOR 6 OF THE 50 WELLS MONITORED IN 2017 IN MCCOY AND MEADOW CREEK.



Groundwater Summary

Following the restoration efforts there appears to be some increase in the average sub-surface water elevation within the project area. Increased groundwater elevations are most evident near the upstream log structure (above the McIntyre road bridge), but is also evident within all the wells. There is a widespread increase in sub-surface water and the rising trend seen after 2000 is continuing. This trend of a sudden increase in sub-surface water followed by a gradual 'settling' has also been recorded along Meadow Creek. It is anticipated that with the activation of the McCoy Creek side channels, greater floodplain access at high flows, and the backing up of water within proximity to the log and riffle structures the sub-surface water within the well network will continue to be at a level greater than the lows of 2000 and 2001.

In contrast to McCoy Creek the sub-surface water within the Meadow Creek Wetland Complex has continued to decrease and is further down from the meadow surface in 2013 than any year since the activation of the wetland channel network. This reduction has reached the pre-project levels seen in 2005 at wells 4, 5, 14, 15 and 16 and is within 2 – 3 tenths of a foot of those levels for 3 other wells when comparing summer groundwater depths July – September.

Groundwater temperatures were monitored in 6 of the 50 wells in 2017. Overall, trends show lower temperatures in the downstream wells on McCoy Creek (wells 23 & 34) compared to the two upstream wells (8 & 11; Figure 24). A similar trend is evident in Meadow Creek with the upstream well (16) and the downstream well (6; Figure 11).

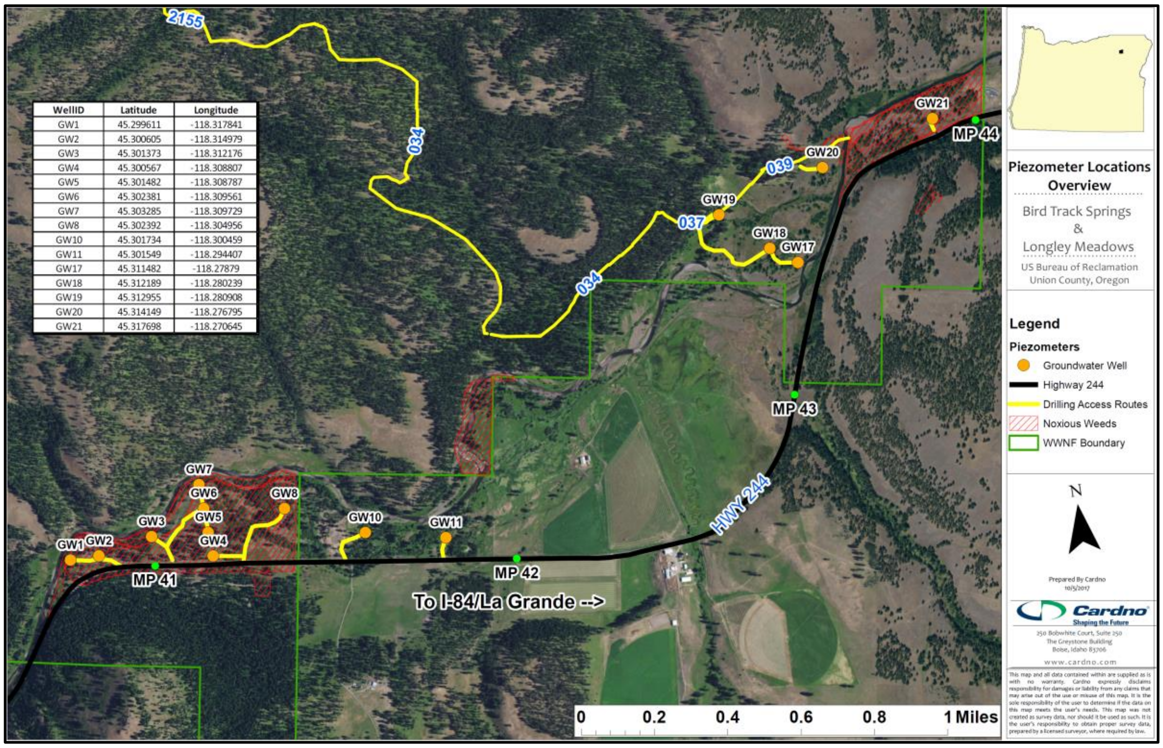
Bird Track Springs/Longley Meadows Pizeometer Installation

Groundwater monitoring wells (Pizeometers) were installed within the proposed Bird Track Springs and the Longley Meadows Project areas. The objective of this procedure was to install permanent, small-diameter groundwater monitoring wells that can be used to conduct hydrologic analysis and temperature measurements of groundwater and hyporheic exchange. A total of 10 pizeometers were installed within the Bird Track Springs Project area and 5 were installed within the Longley Meadows Project area (Figure 12).

Each well hole was approximately 2 inches in diameter and were advanced by a drill rig which was approximately the size of a personally operated vehicle (Figure 13).The work area for well installation was approximately 20 feet long by 10 feet wide for each hole. Spill prevention included absorbent mats and booms maintained onsite to collect any potential leakage/spillage that would occur due to the unlikely chance of a spill, hydraulic line failure or refueling accident. Wells were installed in the floodplain both to the north and south of the existing channel alignment and were installed using a drill auguring method in which core samples were collected. The locations were placed outside of the anticipated channel realignment to allow for pre and post project implementation monitoring.

All drill holes were completed using bentonite from the total depth of the drill hole to just below the ground surface. Soil was used to backfill drill holes from about 0 to 1 foot below the ground surface. Bentonite was hydrated (water added) to form a surface seal as required by most state and federal well completion regulations. An example of a geo-probe monitoring well data (well #17) typical for what is being utilized is shown in Figure 14.

FIGURE 12 BIRD TRACK SPRINGS/LONGLEY MEADOWS PIZEOMETER LOCATIONS



WellID	Latitude	Longitude
GW1	45.299611	-118.317841
GW2	45.300605	-118.314979
GW3	45.301373	-118.312176
GW4	45.300567	-118.308807
GW5	45.301482	-118.308787
GW6	45.302381	-118.309561
GW7	45.303285	-118.309729
GW8	45.302392	-118.304956
GW10	45.301734	-118.300459
GW11	45.301549	-118.294407
GW17	45.311482	-118.27879
GW18	45.312189	-118.280239
GW19	45.312955	-118.280908
GW20	45.314149	-118.276795
GW21	45.317698	-118.270645

FIGURE 13 INSTALLATION OF GROUNDWATER WELL #21

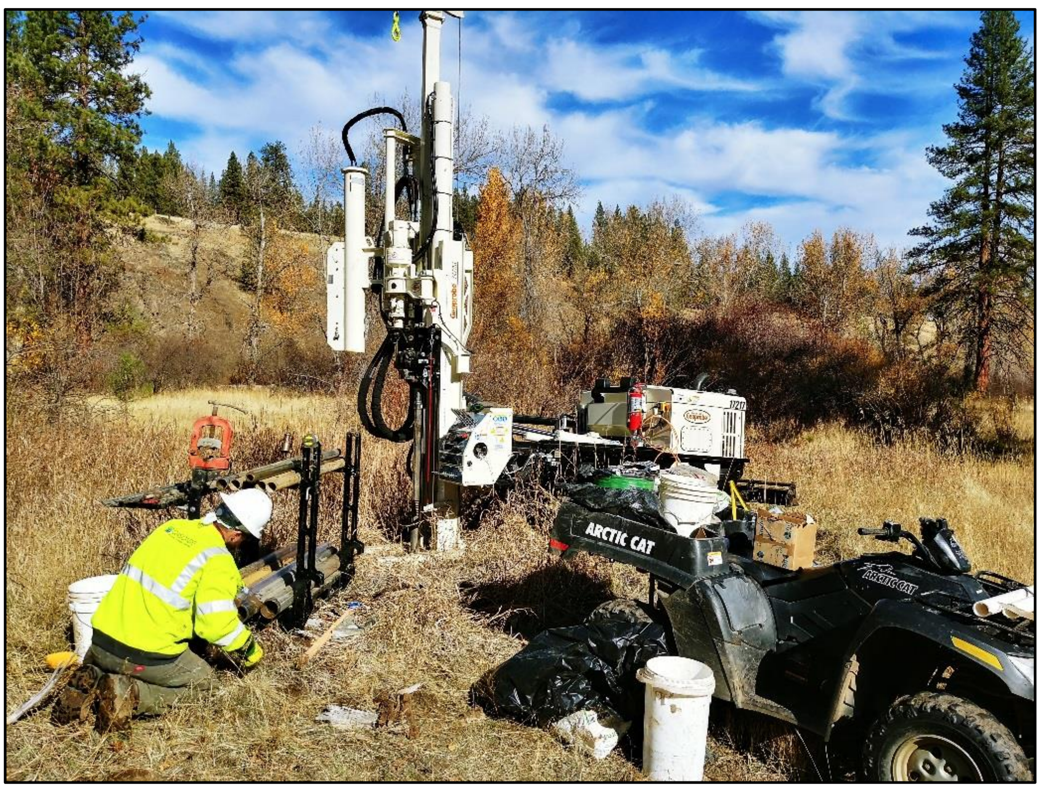


FIGURE 14 EXAMPLE OF BIRD TRACK SPRINGS WELL #17 TEMPERATURE AND WATER DEPTH

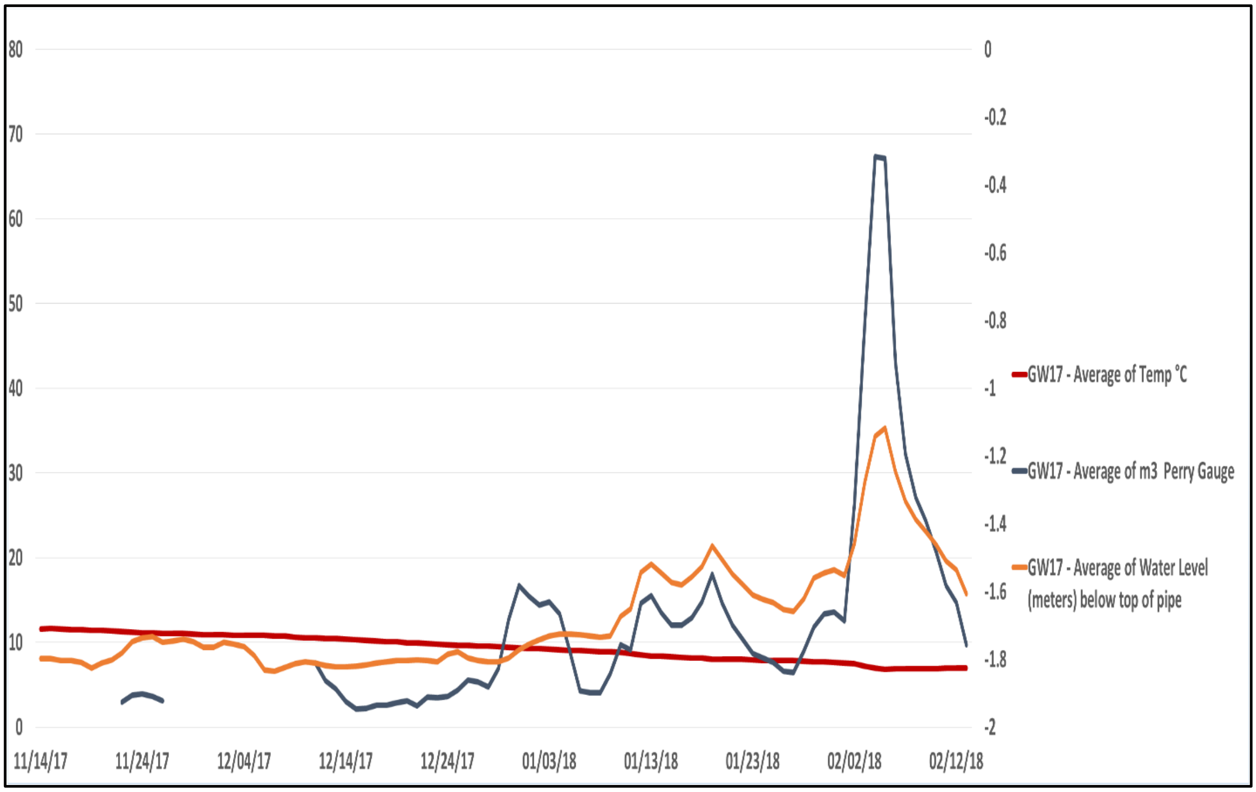


Photo Point Monitoring

Photo points are an effective monitoring method used to document morphological changes on restoration projects. Representative photos are taken at intervals throughout each project, the number being determined by the project size and complexity. A master photo point notebook is used to align each subsequent year's photo with the image taken the previous year. Ideally, images are captured in the exact location as the earlier image, with landmarks (trees, hillsides, etc.) used to align the photo. Images are taken during midday for optimal lighting conditions with a Nikon D3100 camera and jpeg images are saved into a master photo point file. Aerial photos are also taken at varying intervals along several project locations.

During 2016 photo points were taken at 4 separate projects. A total of 76 photos were taken, and GPS coordinates were recorded at each photo point site. Each photo point site is marked with a green T-133 post or a 1 foot rebar stake. Photo points are located at sites along project reaches with good visibility of stream-bank vegetation and areas where morphological changes are likely to occur. Photo points are typically taken every year; however, some project photo points are taken every other year. 16 photo points were taken at CC 44 Southern Cross, McCoy Creek, Meadow Creek, and McCoy/Meadow Creek enclosures. Representative samples are provided in figure 27. Of particular note are stark differences in recruitment of riparian vegetation between enclosed and exposed areas in the McCoy Creek/Meadow Creek complex. This project is subject to intense browsing pressure from wild ungulates resulting in extremely limited release of riparian vegetation in untreated areas. This contrast is readily seen when comparing photo points of protected and unprotected areas of the project (Figures 15 and 16).

FIGURE 15 UNPROTECTED REACH ON MCCOY CREEK, JULY 2017.

FIGURE 16 PROTECTED ELK ENCLOSURE ON MCCOY CREEK, JULY 2017.

FIGURE 17 PRE AND POST PROJECT PHOTO POINTS.

Southern Cross Pre Project 2015 **Southern Cross Post Project 2017**

Southern Cross Pre Project 2015 | **Southern Cross Post Project 2017**

McCoy Meadows Pre Project 2011 | **McCoy Meadows Post Project 2017**

2017 Water Temperature Monitoring

Water Temperature 2017 Summary

During 2017, sixty two temperature probes were deployed within the Grande Ronde Basin, all recording at 1-hour intervals. Eleven of these loggers were new deployments for 2017 within the Upper Grande Ronde River and at the Bird Track Springs planned project area. The primary objectives of monitoring stream temperatures are to track changes at existing or proposed habitat restoration projects before and after work are completed.

Summary statistics were calculated for each probe that included the number of records when temperatures were at or exceeded the DEQ lethal limit of 25ºC, the number of records when temperatures were at or exceeded 20ºC, and when temperatures were within a range of 10ºC to 15.6ºC (the preferred temperature range of juvenile Chinook salmon – as cited by Yanke et. al. 2003). The number of days when the mean temperature was at or exceeded the DEQ standard of 17.8ºC was also calculated. Diurnal fluctuations in water temperature were also plotted.

Temperature probes deployed are Onset HOBO© Pendant 64k or TidbiTv2 loggers set to record at 1-hour intervals. Pendant 64K probes are housed in a metal tube that is anchored to the streambed and cabled to a post or tree on the bank, while Tidbit v2 probes can be installed in the aforementioned manner or housed in a PVC bushing and cap and installed with underwater epoxy (Isaak, Horan, & Wollrab, 2013). Probe locations have been consistent from 2009 to 2016 and when possible, the same probes are deployed at each site during this period. Each year prior to deployment probes are tested in an ice bath and verified with an NIST certified thermometer.

The following summary of water temperature data will be broken down into an overview of each sub-watershed area which includes: the Upper Grande Ronde River, Meadow Creek, McCoy Creek, Dark Canyon Creek, Rock Creek, and Catherine Creek. A summary of temperature metrics for the Upper Grande Ronde and sub-watersheds can be seen in Table 9.

Grande Ronde Watershed

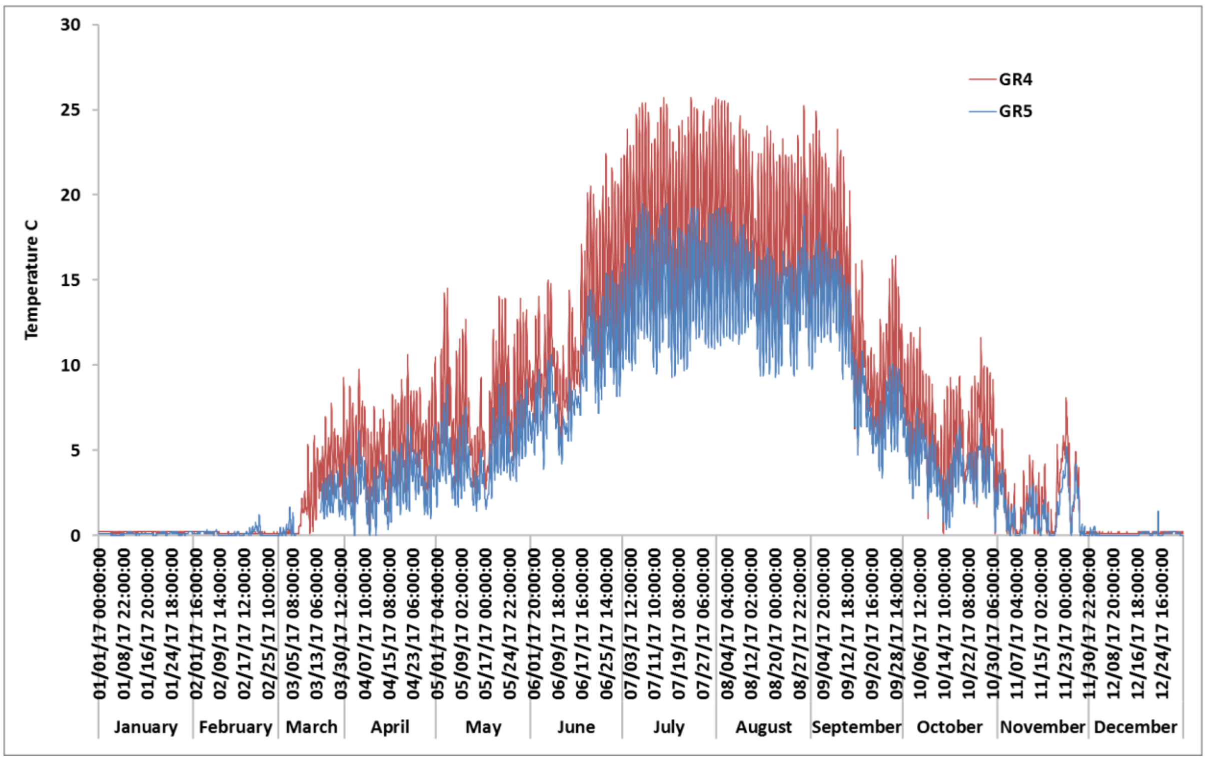
Twenty five probes were deployed along the Upper Grande Ronde River from Hilgard State Park to the mine tailings upstream of Vey Meadows. During 2017 these probes recorded data for 66-364 days (between 1/1/2017 and 12/31/2017). There were 6,323 records removed from the dataset due to either a probe being out of the water or similar reported problems, leaving 123,082 hours logged for analysis. During 2017 there were 34 records at the lower site below Vey Meadows (GR4) for temperatures >= 25°C. There were 684 records of temperatures >= 20°C at the same site.

The probe below the Vey Ranch (GR4) had 34 hours of lethal limits recorded compared to 0 at the probe above the acclimation facility (GR5). There were 684 records of temperatures >=20°C at GR4 and 0 records at GR5. Approximately 14.5% of the deployment period at GR4 site was in 10-15.6 °C range compared to 17.0% at GR5, and GR4 had 43 days recorded with a mean >= 17.8 °C compared to 0 at GR5.

- Comparisons with other years show:

1. GR4 had the fourth highest number of lethal limit and temperature >=25ºC since 2009 (highest was in 2013). GR4 had the lowest percent of time in the 10-15.6ºC range (highest was in 2011). There were 43 days with a mean daily temperature >=17.8ºC since 2009 which is the second highest in the range since data collection began.
2. GR5 had 0 hours with temperatures >=20ºC in 2017 compared to 60 hours in 2015 and 0-14 in other years. The percentage of time in the 10-15.6ºC range was the lowest in 2017 than all other years since records began in 2009.

FIGURE 18 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ALONG THE GRANDE RONDE RIVER DURING 2017.



Meadow Creek Watershed

The CTUIR Fish Habitat Project had 11 probes deployed in 2017 within the Meadow Creek Watershed covering 4 streams – Battle Creek, Meadow Creek, McCoy Creek, and Dark Canyon Creek. The probe data was then grouped by project for this report. The projects were:

- Dark Canyon (landowner Joe Cunha), with 2 probes – DC1 and 2 at river miles 0.06 and 2.0 respectively.
- McCoy Meadows Ranch (landowner Mark and Lorna Tipperman) McCoy Creek, with 3 probes – MCCOY1, 6, 7 at river miles 2.7, 1.5, and 0.1 respectively.
- McCoy Meadows Ranch (landowner Mark and Lorna Tipperman) Meadow Creek and the Wetland Complex, with 2 probes – MEADOW1 and 2 on mainstem Meadow Cr at river mile 2.9 and 1.5 respectively.

- Meadow Creek Habberstad (landowner John Habberstad), with 3 probes – MEADOW5 and 6 at river mile 7.53 and 6.77 respectively and BATTLE1 on Battle Creek at river mile 0.04.

Dark Canyon Creek - Summary of CTUIR stream monitoring within the lower 2 miles of 2009 to 2017

In late July 2010, fish habitat enhancements were implemented by CTUIR along 1.9 miles of Dark Canyon Creek and 1 mile of Meadow Creek within the boundaries of the Cunha Ranch. The project area is located near Starkey, Oregon in the Upper Grande Ronde Subbasin. The project legal description is Township 3 South, Range 35 East, portions of Sections 24, 25, and 36, Willamette Meridian, Union County Tax Lot 500. Approximately 150 pieces of large wood were added to Dark Canyon Creek and Meadow Creek in existing pools, or placed in a manner to create pool habitat and provide in-stream habitat complexity. The objective of the large wood additions was to contribute to floodplain formation and stability by increasing roughness, slowing water velocities, and trapping sediment. Furthermore, large wood was used in order to increase pool habitat quality and quantity and to provide thermal and predatory refuge for aquatic species including the aforementioned ESA listed fish species.

In 2012 CTUIR, in cooperation with the landowner and NRCS, developed four off-channel springs for livestock watering, and constructed 3.6 miles of pasture fence. Additional riparian corridor fencing was completed in 2017 along Dark Canyon Creek and Meadow Creek to exclude livestock and protect riparian habitat. The 3,000 acre ranch, along with 2 miles of Dark Canyon Creek and 1 mile of Meadow Creek was protected under a permanent conservation easement in 2015 under the CTUIR-BPA Accord in cooperation with Blue Mountain Land Trust.

Since August 2009, the CTUIR Grande Ronde Fish Habitat program has monitored water temperature at two locations within Dark Canyon Creek – an upper probe site (DC2) at river mile 2.0 and a lower probe site (DC1) at river mile 0.06. Temperatures at these two sites with the exception of 2009 were monitored from April to October each year and starting in 2016 temperatures will be monitored throughout the year.

Diurnal fluctuations in water temperature are less in 2017 than those recorded in 2010, (pre-project, during construction and immediately following construction) at the lower probe site (river mile 0.06), but are similar at the upper probe site (river mile 1.9). This may indicate a possible cooling effect through the project area seen in 2017 that is not present in 2010 (Figure 29 & 30).

A possible cooling trend is also evident when exploring summary values for stream temperatures in Table 8. In 2010 the 308 records of temperatures >=20°C were recorded with similar distribution of values at both upper and lower sites with 52.6% of those records recorded at the upper site compared to 47.4% at the lower. This similarity is not present by 2017 where the upper site records 100 % of the 380 >=20°C records.

From the temperature data collected since 2009, it is evident that water entering the project area has been increasing in the number of >=20°C records (see Figure 31). However, it is beyond the scope of this monitoring effort and these data to explain why this is occurring. The scope of inference for these data is restricted to the project area (the lower 1.9 miles of Dark Canyon

Creek), but within that scope it can be demonstrated that following fish habitat restoration actions there is a cooling trend through the project area.

FIGURE 19 PLOT OF DIURNAL FLUCTUATIONS IN WATER TEMPERATURE AT THE UPPER PROBE SITE (RIVER MILE 1.9) FOR 2010 AND 2017. ALTHOUGH THERE IS A SLIGHT SKEW IN TIMING OF PEAK TEMPERATURES THE DIURNAL FLUCTUATION ARE VERY SIMILAR FOR THESE TWO YEARS.

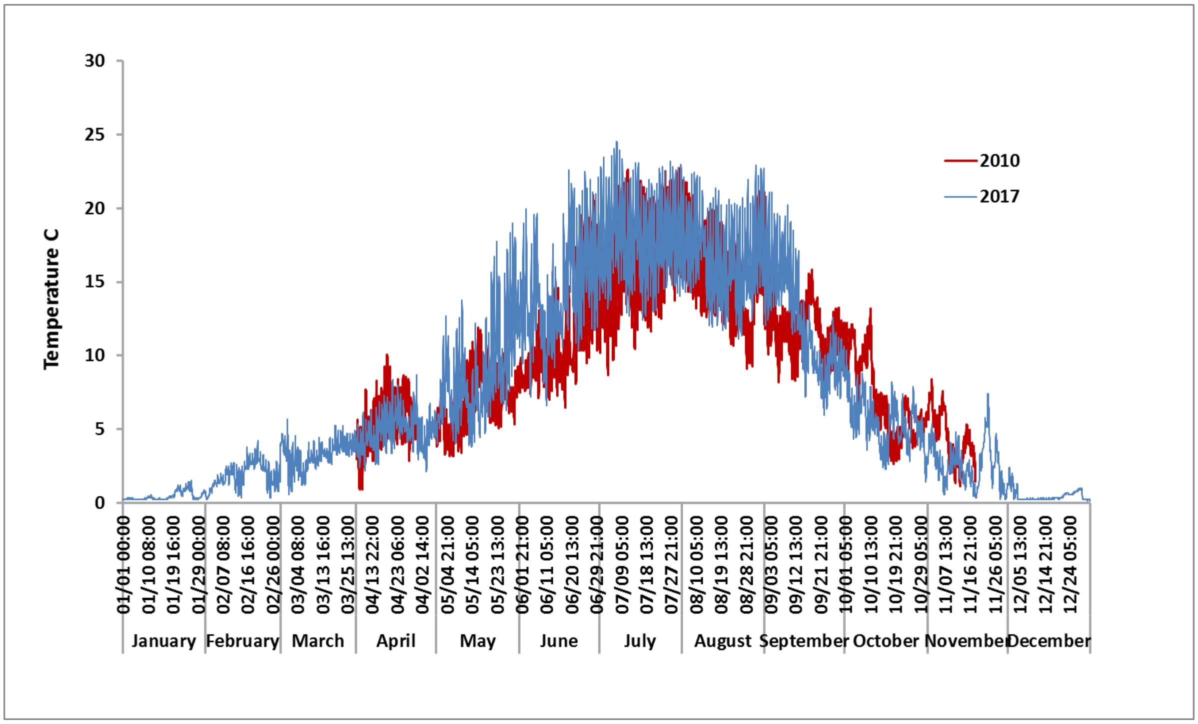


FIGURE 20 PLOT OF THE DIURNAL FLUCTUATION IN WATER TEMPERATURE AT THE LOWER PROJECT SITE (RIVER MILE 0.06) FOR 2010 AND 2017. PLOT SHOWS THE REDUCTION IN DIURNAL FLUCTUATIONS OF WATER TEMPERATURE RECORDED AT THIS SITE IN 2017 COMPARED TO THE PRE-PROJECT/ DATA OF 2010.

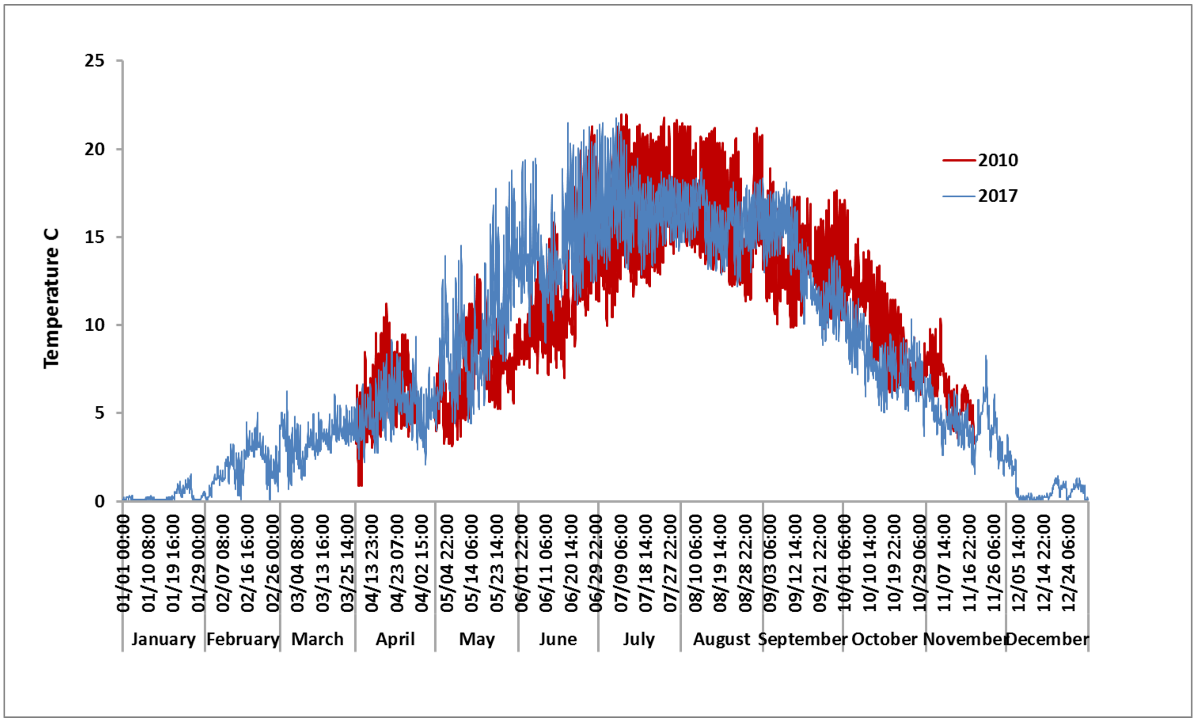


TABLE 5 SUMMARY TABLE FOR WATER TEMPERATURE PROBES AT TWO SITES ALONG DARK CANYON CREEK FROM 2010 TO 2017. SHADED AREA IS THE LOWER PROJECT SITE.

Stream	Location Name	River mile	Year	# of Days Deployed	# of Hours for Analysis	Max Temperature (° C)	Hours >=25 ° C	Hours >=20 ° C	Hrs. at 10 - 15.6 ° C	% at 10 - 15.6 ° C	Mean daily >=17.8 ° C (# days)	% of deployment when Mean daily >=17.8 ° C
Dark Canyon Creek	DC1	0.06	2009	106	2544	23.1	0	93	874	34.4	1	0.9
Dark Canyon Creek	DC1	0.06	2010	226	5398	22	0	146	2156	39.9	0	0.0
Dark Canyon Creek	DC1	0.06	2011	145	3480	20.9	0	36	2120	60.9	0	0.0
Dark Canyon Creek	DC1	0.06	2012	191	4536	24.2	0	75	2204	48.6	2	1.0
Dark Canyon Creek	DC1	0.06	2013	215	5161	24.4	0	154	1988	38.5	5	2.3
Dark Canyon Creek	DC1	0.06	2014	217	5184	20.3	0	11	2345	45.2	3	1.4
Dark Canyon Creek	DC1	0.06	2015	166	3984	20.8	0	22	1969	49.4	3	1.8
Dark Canyon Creek	DC1	0.06	2016	276	6612	18.4	0	0	3033	45.9	0	0.0
Dark Canyon Creek	DC1	0.06	2017	364	8698	21.8	0	0	1916	22.0	1	0.3
Dark Canyon Creek	DC2	1.9	2009	106	2544	22.3	0	43	789	31.0	2	1.9
Dark Canyon Creek	DC2	1.9	2010	226	5399	22.7	0	162	1761	32.6	6	2.7
Dark Canyon Creek	DC2	1.9	2011	145	3480	22.0	0	85	1618	46.5	4	2.8
Dark Canyon Creek	DC2	1.9	2012	191	4535	23.8	0	227	1702	37.5	20	10.5
Dark Canyon Creek	DC2	1.9	2013	215	5161	24.9	0	257	1632	31.6	17	7.9
Dark Canyon Creek	DC2	1.9	2014	217	5184	24.7	0	307	1704	32.9	29	13.4
Dark Canyon Creek	DC2	1.9	2015	166	3984	24.4	0	180	1460	36.6	14	8.4
Dark Canyon Creek	DC2	1.9	2016	276	6611	23.4	0	175	2087	31.6	11	4.0
Dark Canyon Creek	DC2	2	2017	364	8699	24.5	0	380	1459	16.8	27	7.4

FIGURE 21 **PLOT OF THE NUMBER OF WATER TEMPERATURES >=20°C ON DARK CANYON CREEK. PLOTTED TREND LINE DEMONSTRATES THAT OVERALL WARMER WATERS ARE ENTERING THE PROJECT AREA EACH YEAR (RED BARS), BUT THIS WATER IS COOLING AS IT MOVES THROUGH THE PROJECT AREA TO THE LOWER PROBE SITE (BLUE BARS).**

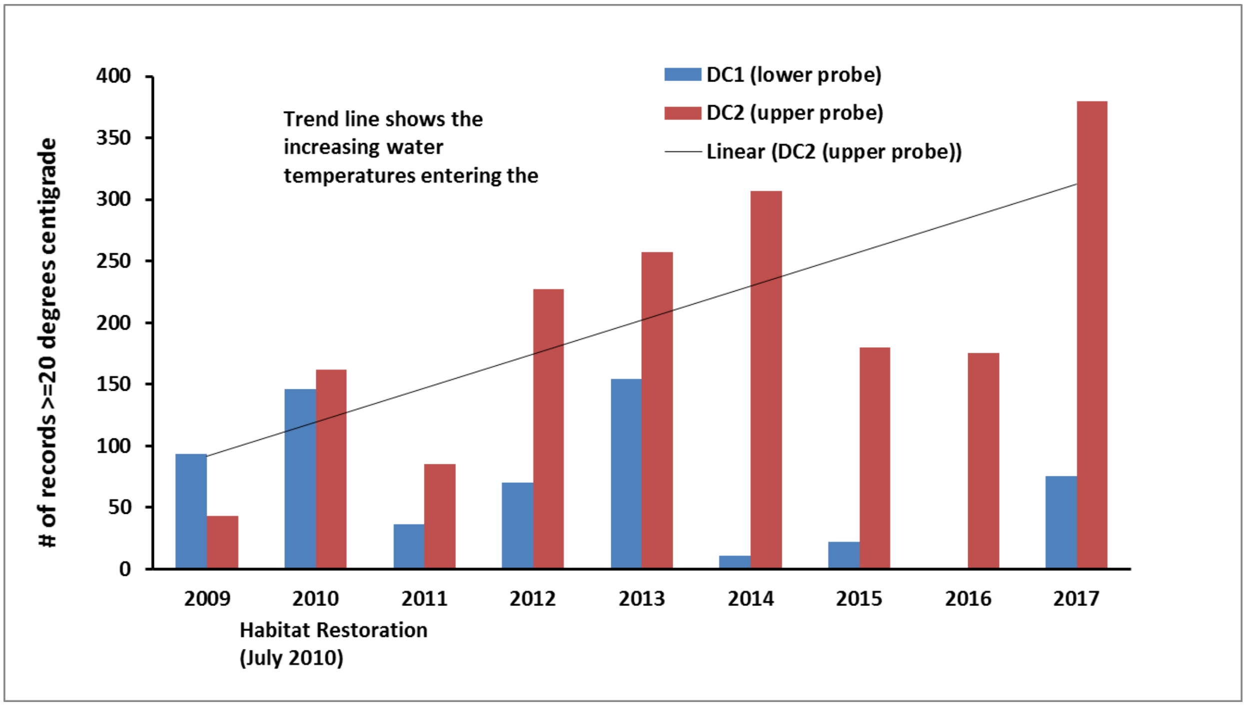
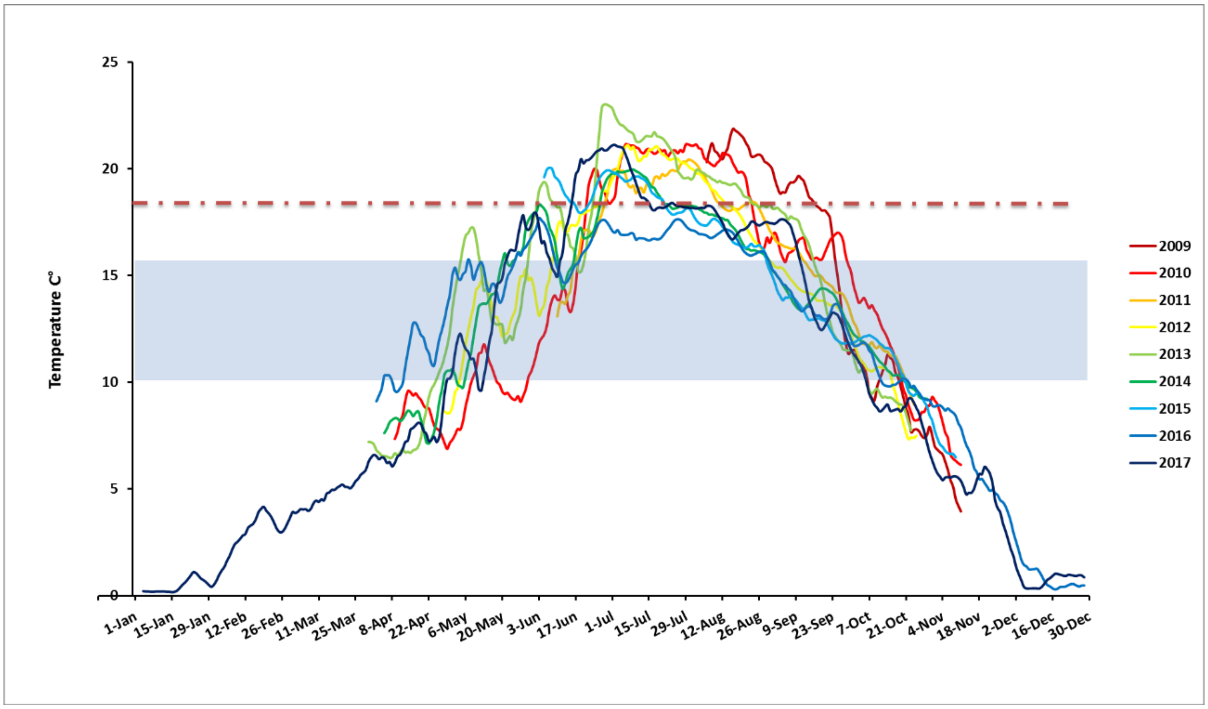


FIGURE 22 7 DAY AVERAGE DAILY MAXIMUM TEMPERATURES (7DADM) FOR DARK CANYON (LOWER), YEARS 2009 TO 2017. COLOR GRADIENT INDICATES PRE-PROJECT (2009-2010; RED) TO POST PROJECT CONDITIONS (2010-2017; BLUE). BLUE BOX IS IDEAL TEMPERATURES FOR JUVENILE CHINOOK (10-15.6°C) AND RED DASHED LINE IS UPPER LIMIT FOR JUVENILE REARING AND MIGRATION (18°C).



McCoy Creek

There were a total of 23,946 hours of data from 3 probes for the analysis collected between 41/1/2017 and 12/31/2017. Combining the data for the probes gave a total of 3,440 hours when water temperature was between 10ºC and 15.6ºC (an average of 14.3% of the data).

- A total of 466 hours logged when temperatures reached 25ºC or higher.
  - The middle and lower sites on McCoy Creek in 2017 had the highest maximum temperature (28.5 ºC), while the lowest site had the greatest number of records at lethal limits (260 hrs), and the greatest number of records where temperatures were >=20 °C (1061 hrs) and the greatest percent time in 10-15.6 °C range compared to the other 2 sites (15.0%).
  - The upper site was in the middle of the range for maximum temperature since 2010, while the middle site had the second highest maximum and the lower site was in the middle of the range for maximum since 2010
  - The most downstream site had the second highest number of temperature records >=20ºC and the highest >=25ºC since 2010.
  - The mid property site had the lowest percent time in 10-15.6ºC range compared to records from that site since 2010, although it should be noted that this was the first year since records covered the entire calendar year.

- The upper middle sites had the highest number of days with a daily mean >=17.8ºC, while the lower site had the second highest number of days with a daily mean >=17.8°C since 2010

- There were a total of 2,853 records of temperatures >= 20°C,
    - MCCOY1 recording 809 hours,
    - MCCOY6 recording 983 hours,
    - MCCOY7 recording 1061 hours.
- Mean daily temperatures were >=17.8ºC on a maximum of 75 days at river mile 0.1 (see Table 9).

FIGURE 23 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ALONG MCCOY CREEK DURING 2017.

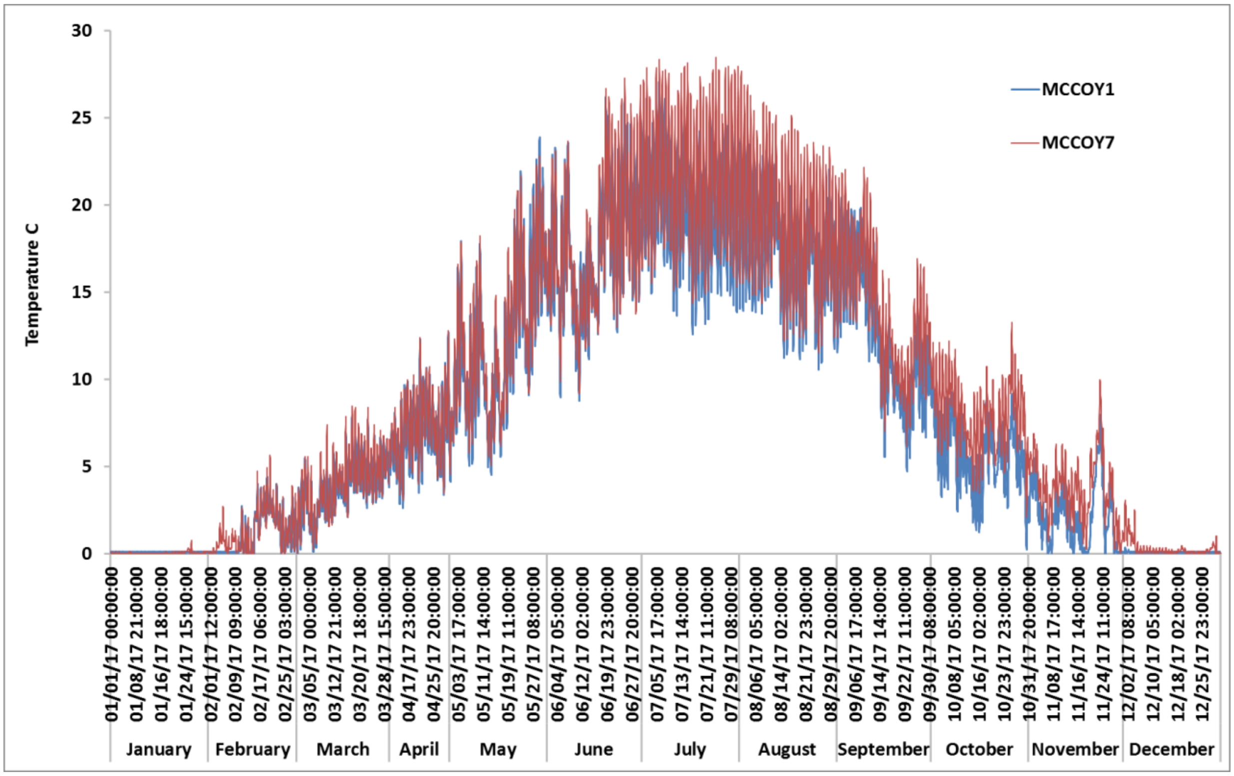
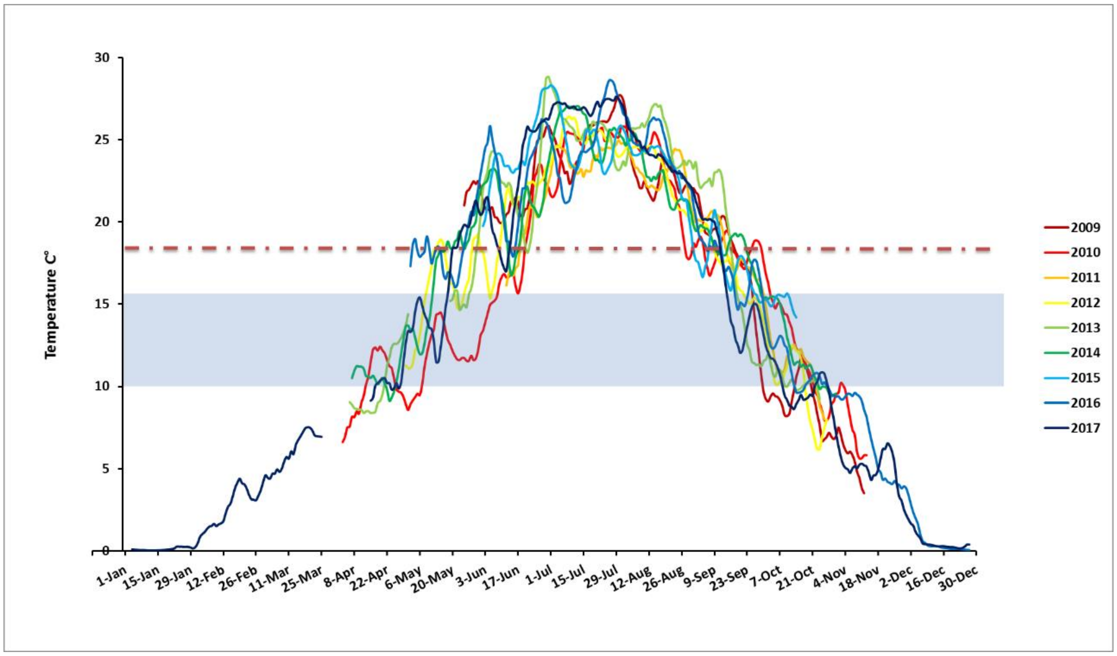


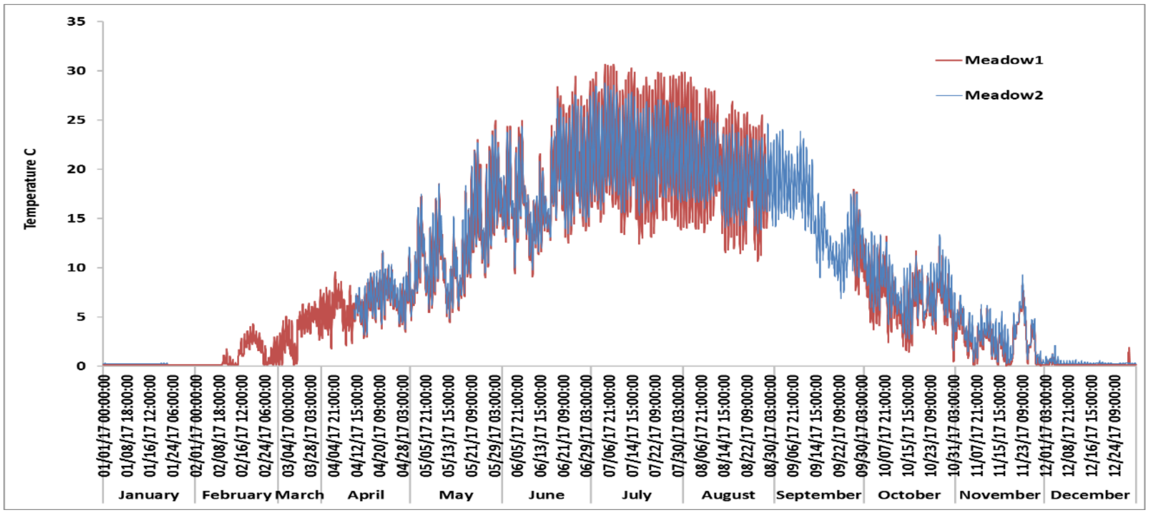
FIGURE 24 7 DAY AVERAGE DAILY MAXIMUM TEMPERATURES (7DADM) FOR MCCOY CREEK (RIVER MILE 0.1), YEARS 2009 TO 2016.. COLOR GRADIENT INDICATES PRE-PROJECT (2009-2010; RED) TO POST PROJECT CONDITIONS (2010-2017; BLUE). BLUE BOX IS IDEAL TEMPERATURES FOR JUVENILE CHINOOK (10-15.6°C) AND RED DASHED LINE IS UPPER LIMIT FOR JUVENILE REARING AND MIGRATION.



Meadow Creek

The probe at river mile 2.9 (MEADOW1) was deployed for 365 days between 1/1/2017 and 12/31/2017 and the probe at river mile 1.5 (MEADOW2) was deployed for 365 days between 1/1/2017 and 12/31/2017. They recorded a total 14,529 hours of data for the analysis.

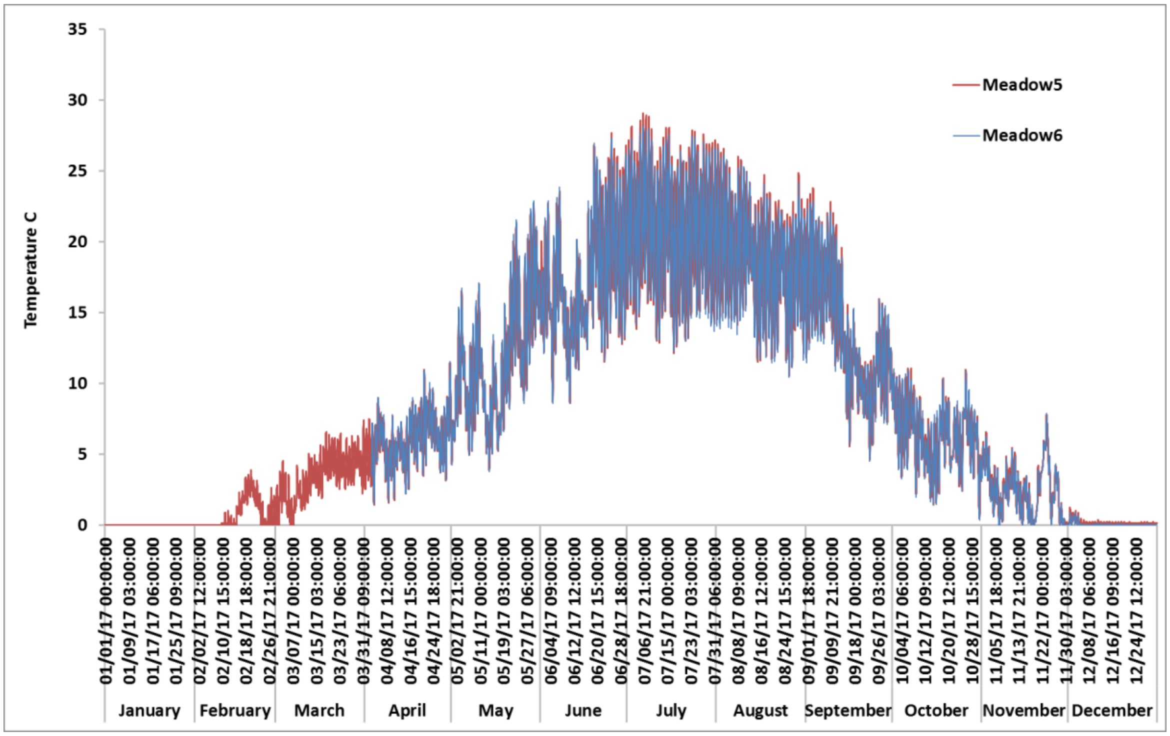
FIGURE 25 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ALONG MEADOW CREEK DURING 2017.



Meadow Creek Habberstad Property

Two probes were deployed on Meadow Creek within the Habberstad restoration project. These probes were at river mile 7.5 (MEADOW5), and 6.8 (MEADOW6) and were deployed for 365 and 277 days respectively from 1/1/2017 to 12/31/2017 for a total of 15,301 hours for analysis.

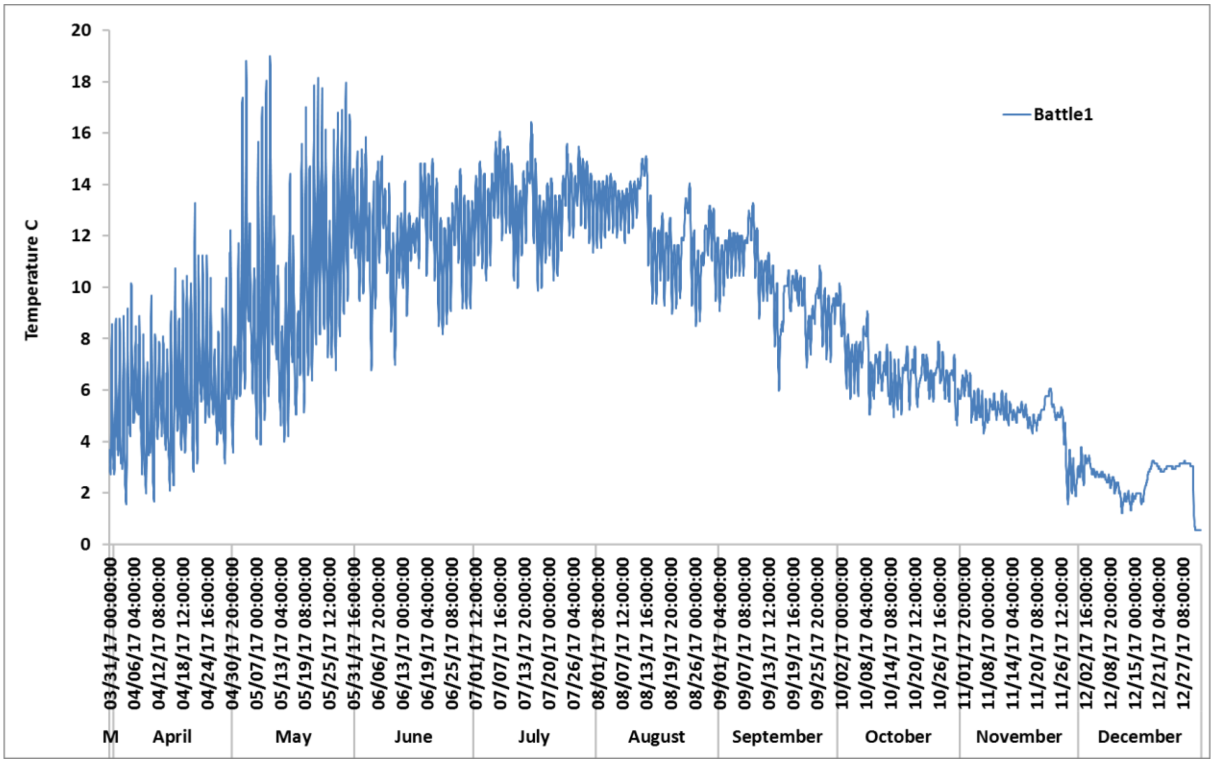
FIGURE 26 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE AT TWO LOCATIONS ON MEADOW CREEK DURING 2017 WITHIN THE HABBERSTAD PROJECT AREA.



Battle Creek - Habberstad

There was one probe deployed on Battle Creek during 2017 at river mile 0.04 between 3/30/2017 and 12/31/2017 for a total of 6,624 hours for analysis.

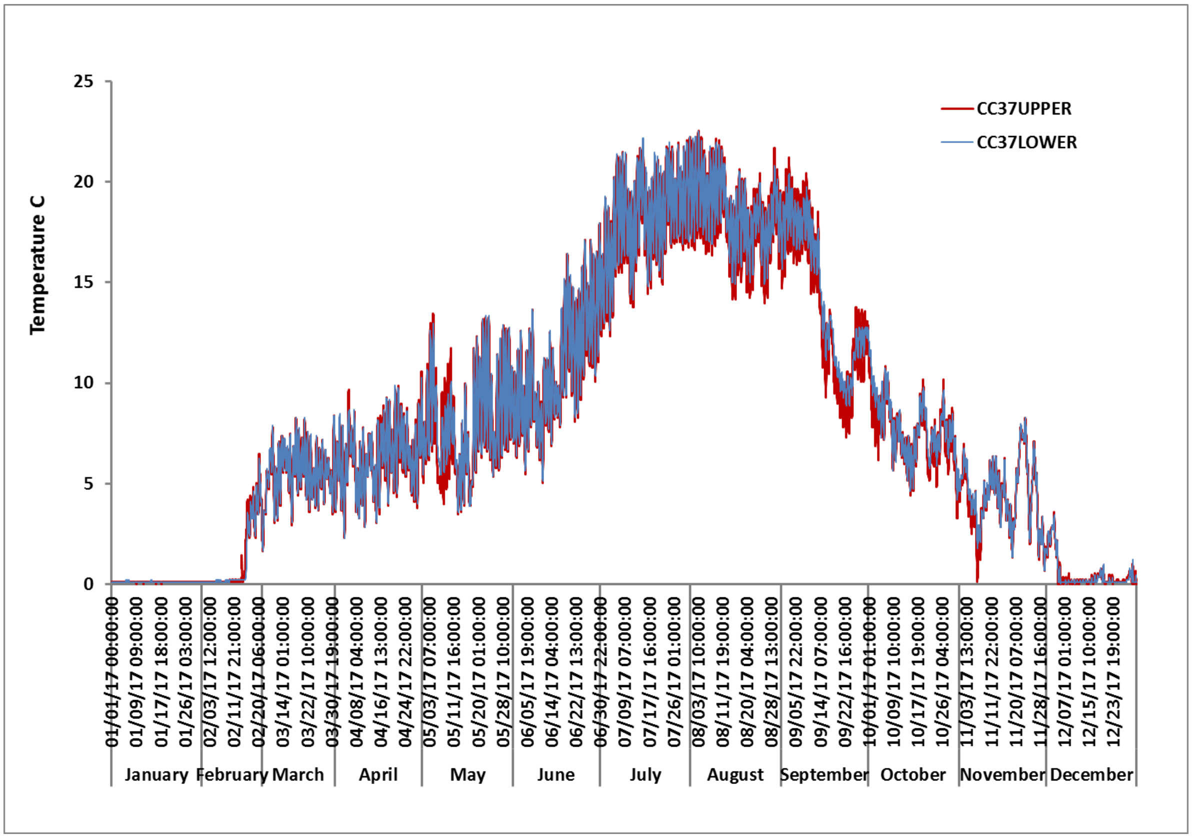
FIGURE 27 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ON BATTLE CREEK DURING 2017 WITHIN THE HABBERSTAD PROJECT AREA.



Catherine Creek 37

Two probes were deployed within the boundaries of the Catherine Creek (RM37) project in order to monitor the CC37 Fish Habitat Enhancement Project, constructed July-August, 2012. The upper probe at river mile 37 had 8,449 hours for analysis compared to the lower probe at river mile 36 (8,430 hours). Lethal limits were recorded for 0hours at the upper and lower probes.

FIGURE 28 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ON CATHERINE CREEK (CC37) DURING 2017.



Catherine Creek 44

To monitor water quality (temperature) within the Catherine Creek River Mile 44 (CC44) Project area, CTUIR deployed 20 Hobo Pendant temperature probes within the boundaries of several property owners. The probes were deployed from 1/1/2017 to 12/31/2017 with a range of 43-365 days and a total of 139,054 hours recorded for analysis. There were 503 lethal hours recorded in 2017.

FIGURE 29 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ON CATHERINE CREEK (CC44) DURING 2017.

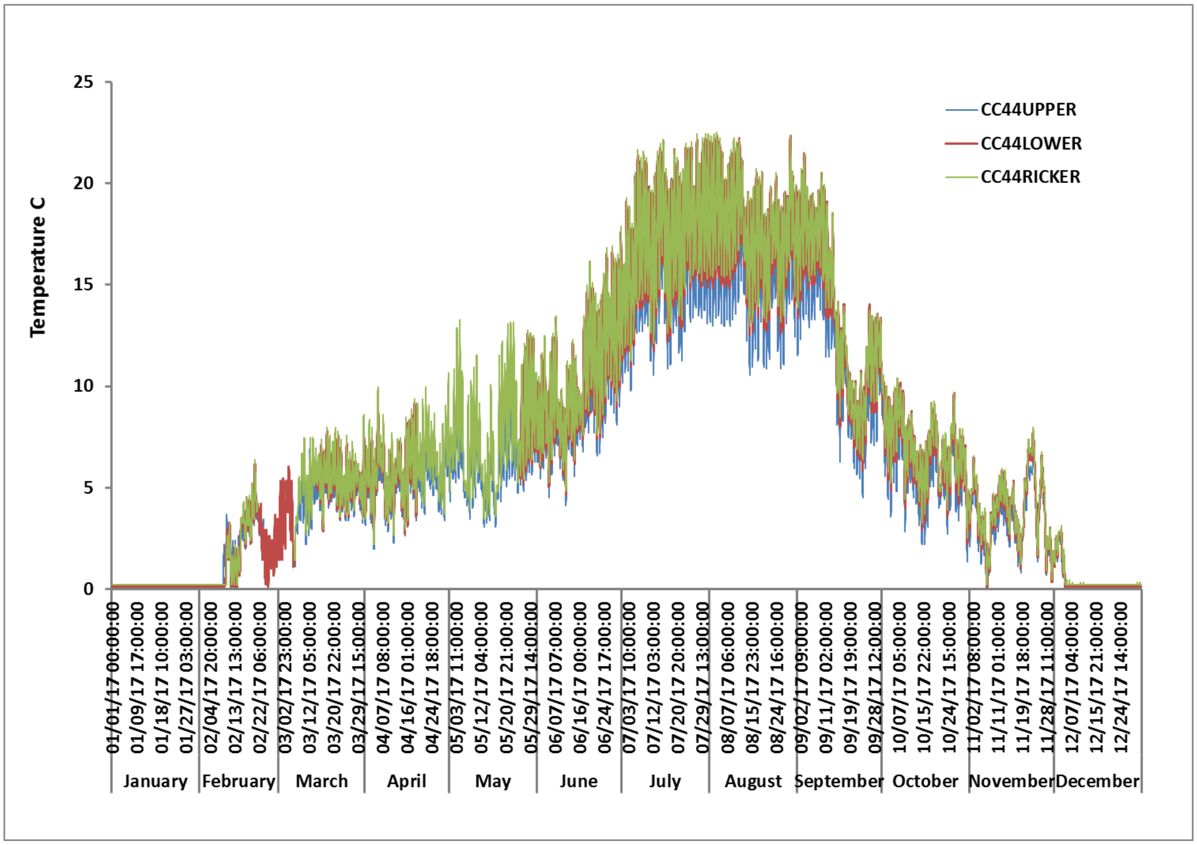


FIGURE 30 7 DAY AVERAGE DAILY MAXIMUM STREAM TEMPERATURE IN CATHERINE CREEK MAINSTEM (RED) AND FLOODPLAIN FEATURES (BLUE) IN TWO YEARS FOLLOWING PROJECT COMPLETION. NOTE STREAM TEMPERATURE ATTENUATION IN FLOODPLAIN FEATURES DURING SUMMER PEAK TEMPERATURES AND WARMER TEMPERATURES DURING WINTER. . BLUE BOX IS IDEAL TEMPERATURES FOR JUVENILE CHINOOK (10-15.6°C) AND RED DASHED LINE IS UPPER LIMIT FOR JUVENILE REARING AND MIGRATION.

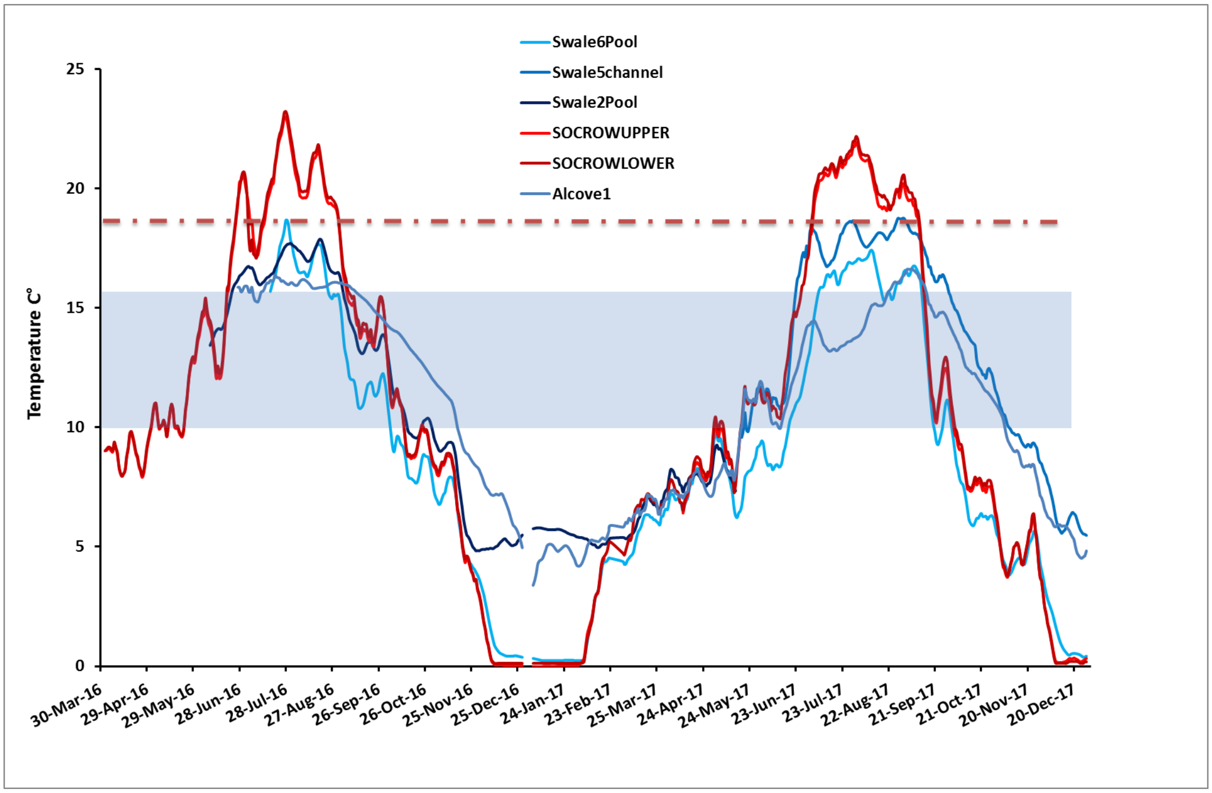


TABLE 6 WATER TEMPERATURE PROBE METRICS FOR 61 SITES IN THE UPPER GRANDE RONDE, MAINSTEM GRANDE RONDE, ROCK CREEK, MEADOW CREEK, DARK CANYON CREEK, MCCOY CREEK, AND CATHERINE CREEK SUB-WATERSHEDS DURING 2017.

Stream	Location Name	River mile	Year	Start date	End date	# of Days Deployed	# Hours in Deployment Period	# of Hours for Analysis	Max Temperature (° C)	Hours >=25 ° C	Hours >=20 ° C	Hrs. at 10 - 15.6 ° C	% at 10 - 15.6 ° C	Mean daily >=17.8 ° C (# days)
Battle Creek	BATTLE1	0.0	2017	3/30/2017	12/31/2017	277	6636	6624	19.0	0	0	2704	40.8	0.0
Catherine Creek	CC37LOWER	36.0	2017	1/1/2017	12/31/2017	365	8759	8430	22.5	0	341	1015	12.0	14.8
Catherine Creek	CC37UPPER	37.0	2017	1/1/2017	12/31/2017	365	8759	8449	22.5	0	348	1073	12.7	13.6
Catherine Creek	CC44LOWER	40.0	2017	1/1/2017	12/31/2017	365	8759	7681	22.3	0	296	1064	13.9	8.7
Catherine Creek	CC44RICKER1	38.0	2017	1/1/2017	12/31/2017	365	8759	8439	22.5	0	324	1124	13.3	10.5
Catherine Creek	CC44UPPER	44.0	2017	1/1/2017	12/31/2017	365	8759	8488	22.1	0	156	1342	15.8	0.0
Catherine Creek	LowerNewChannel	41.0	2017	1/1/2017	12/31/2017	365	8759	8560	22.3	0	280	1216	14.2	6.4
Catherine Creek	SCMID	41.2	2017	1/1/2017	12/31/2017	365	8759	8271	22.3	0	268	1227	14.8	6.7
Catherine Creek	SCPool#1	41.3	2017	1/1/2017	12/31/2017	365	8759	8574	22.2	0	242	1224	14.3	6.4
Catherine Creek	SCPool#2	40.9	2017	1/1/2017	12/31/2017	365	8759	6162	22.3	0	243	832	13.5	7.8
Catherine Creek	Side_Channel1	41.0	2017	1/1/2017	12/31/2017	365	8759	8559	23.0	0	205	1154	13.5	6.4
Catherine Creek	SOCROWLOWER	40.9	2017	1/1/2017	12/31/2017	365	8759	8560	22.3	0	270	1206	14.1	6.4
Catherine Creek	SOCROWUPPER	41.6	2017	1/1/2017	12/31/2017	365	8759	9947	22.0	0	460	1837	18.5	3.6

Stream	Location Name	River mile	Year	Start date	End date	# of Days Deployed	# Hours in Deployment Period	# of Hours for Analysis	Max Temperature (° C)	Hours >=25 ° C	Hours >=20 ° C	Hrs. at 10 - 15.6 ° C	% at 10 - 15.6 ° C	Mean daily >=17.8 ° C (# days)
Catherine Creek	Swale2Pool	41.4	2017	1/1/2017	12/31/2017	365	8759	3135	10.6	0	0	11	0.4	0.0
Catherine Creek	Swale6Pool	41.0	2017	1/1/2017	12/31/2017	365	8759	8582	18.1	0	0	1244	14.5	0.3
Catherine Creek	UpperNewChannel	41.4	2017	3/15/2017	12/31/2017	292	7007	7008	22.0	0	227	1235	17.6	5.1
Catherine Creek	Swale1Channel	n/a	2017	5/11/2017	12/31/2017	235	5639	4089	23.5	0	57	1008	24.7	1.8
Catherine Creek	Swale4channel	n/a	2017	5/12/2017	12/31/2017	234	5615	5232	25.3	333	333	998	19.1	13.8
Catherine Creek	Swale5channel	n/a	2017	5/16/2017	12/31/2017	230	5519	5405	19.1	0	0	1711	31.7	0.0
Catherine Creek	Swale6channel	n/a	2017	5/12/2017	12/31/2017	234	5615	5483	29.3	170	590	1099	20.0	25.4
Dark Canyon Creek	DC1	0.1	2017	1/1/2017	12/31/2017	364	8736	8698	21.8	0	0	1916	22.0	0.3
Dark Canyon Creek	DC2	1.9	2017	1/1/2017	12/31/2017	364	8736	8699	24.5	0	380	1459	16.8	7.4
Grande Ronde River	Alcove_Tsiatsos	152.9	2017	8/11/2017	12/31/2017	142	3408	3432	16.9	0	0	2142	62.4	0.0
Grande Ronde River	BTS1	144.5	2017	6/30/2017	12/31/2017	184	4416	4440	28.5	276	948	501	11.3	40.0
Grande Ronde River	BTS2	144.4	2017	6/30/2017	9/12/2017	75	1789	1790	28.8	227	976	39	2.2	99.2
Grande Ronde River	BTS3	144.2	2017	1/1/2017	9/12/2017	255	6110	6054	27.9	85	609	1019	16.8	19.0

Stream	Location Name	River mile	Year	Start date	End date	# of Days Deployed	# Hours in Deployment Period	# of Hours for Analysis	Max Temperature (° C)	Hours >=25 ° C	Hours >=20 ° C	Hrs. at 10 - 15.6 ° C	% at 10 - 15.6 ° C	Mean daily >=17.8 ° C (# days)
Grande Ronde River	BTS4	144.0	2017	1/1/2017	9/12/2017	255	6110	6054	27.6	84	752	1079	17.8	19.8
Grande Ronde River	BTS5	143.9	2017	1/1/2017	9/12/2017	255	6110	6054	28.7	137	351	805	13.3	31.7
Grande Ronde River	BTS6	0.1	2017	1/1/2017	9/12/2017	255	6110	5575	26.7	0	0	2072	37.2	1.7
Grande Ronde River	FS_coldwater	156.2	2017	8/11/2017	12/31/2017	142	3408	3426	17.8	0	0	1384	40.4	0.0
Grande Ronde River	GR1	145.6	2017	1/1/2017	12/31/2017	364	8736	6957	28.8	242	838	723	10.4	22.4
Grande Ronde River	GR10	169.6	2017	1/1/2017	12/31/2017	364	8736	8753	29.1	292	1213	1233	14.1	23.6
Grande Ronde River	GR11	156.2	2017	1/1/2017	12/31/2017	364	8736	5931	26.9	28	372	840	14.2	11.7
Grande Ronde River	GR12	186.0	2017	1/1/2017	12/31/2017	364	8736	8721	26.0	31	650	1273	14.6	14.0
Grande Ronde River	GR3	143.3	2017	1/1/2017	11/13/2017	316	7584	7602	28.5	271	1091	1229	16.2	26.2
Grande Ronde River	GR4	194.2	2017	1/1/2017	12/31/2017	364	8736	8536	25.7	34	684	1237	14.5	12.1
Grande Ronde River	GR5	199.7	2017	1/1/2017	12/31/2017	364	8736	8344	19.5	0	0	1416	17.0	0.0

Stream	Location Name	River mile	Year	Start date	End date	# of Days Deployed	# Hours in Deployment Period	# of Hours for Analysis	Max Temperature (° C)	Hours >=25 ° C	Hours >=20 ° C	Hrs. at 10 - 15.6 ° C	% at 10 - 15.6 ° C	Mean daily >=17.8 ° C (# days)
Grande Ronde River	GR9	152.1	2017	1/1/2017	12/31/2017	364	8736	8531	27.7	168	829	1293	15.2	19.4
Grande Ronde River	Gun_Club	142.2	2017	8/15/2017	12/31/2017	138	3312	2957	23.7	0	90	890	30.1	0.8
Grande Ronde River	Jordan Cr. Ranch	144.9	2017	9/8/2017	12/31/2017	114	2736	2760	17.8	0	0	480	17.4	0.0
Grande Ronde River	Jordan Cr_hwy	n/a	2017	10/26/2017	12/31/2017	66	1584	1608	11.3	0	0	256	15.9	0.0
Grande Ronde River	LM_OX1	n/a	2017	10/26/2017	12/31/2017	66	1584	1608	7.5	0	0	0	0.0	0.0
Grande Ronde River	LM_SC3	143.3	2017	10/26/2017	12/31/2017	66	1584	1603	9.8	0	0	0	0.0	0.0
Grande Ronde River	Longley 1	143.4	2017	8/15/2017	12/31/2017	138	3312	3336	16.0	0	0	1047	31.4	0.0
Grande Ronde River	Longley 2	143.1	2017	8/15/2017	12/31/2017	138	3312	3180	18.7	0	0	474	14.9	1.5
Grande Ronde River	Longley 3	143.2	2017	8/15/2017	12/31/2017	138	3312	3334	15.5	0	0	1697	50.9	0.0
Grande Ronde River	Longley Air	n/a	2017	9/19/2017	12/31/2017	103	2472	2496	29.8	n/a	n/a	n/a	n/a	n/a
Graves Creek	GRAVES1	0.5	2017	1/1/2017	12/31/2017	364	8736	8630	19.9	0	0	2516	29.2	0.3
McCoy Creek	MCCOY1	2.7	2017	1/1/2017	12/31/2017	364	8736	8461	27.1	63	809	1207	14.3	18.2

Stream	Location Name	River mile	Year	Start date	End date	# of Days Deployed	# Hours in Deployment Period	# of Hours for Analysis	Max Temperature (° C)	Hours >=25 ° C	Hours >=20 ° C	Hrs. at 10 - 15.6 ° C	% at 10 - 15.6 ° C	Mean daily >=17.8 ° C (# days)
McCoy Creek	MCCOY6	1.5	2017	1/1/2017	12/31/2017	364	8736	7026	28.5	143	983	965	13.7	26.0
McCoy Creek	MCCOY7	0.1	2017	1/1/2017	12/31/2017	364	8736	8459	28.5	260	1061	1268	15.0	21.3
McCoy Creek	MCCOYAIR	2.1	2017	1/1/2017	12/31/2017	364	8736	6433	42.3	977	1330	865	13.4	24.6
Meadow Creek	MEADOW1	2.9	2017	1/1/2017	12/31/2017	365	8748	7671	30.7	390	992	937	12.2	23.2
Meadow Creek	MEADOW2	1.5	2017	1/1/2017	12/31/2017	365	8748	6858	28.8	246	1164	1104	16.1	32.2
Meadow Creek Wetland	MEADOW5	7.5	2017	1/1/2017	12/31/2017	365	8748	8759	29.1	224	974	1271	14.5	19.2
Meadow Creek Wetland	MEADOW6	6.8	2017	3/30/2017	12/31/2017	277	6636	6542	28.2	194	1019	1254	19.2	26.0
Rock Creek	ROCK1	0.2	2017	1/1/2017	12/31/2017	364	8736	8760	31.6	195	597	1510	17.2	12.3
Rock Creek	ROCK2	1.7	2017	3/17/2017	12/31/2017	289	6936	3828	25.1	1	147	716	18.7	5.0
Rock Creek	ROCK3	3.0	2017	3/23/2017	12/31/2017	283	6792	3830	26.4	14	154	812	21.2	6.3
Rock Creek	ROCK4	4.5	2017	1/1/2017	12/31/2017	364	8736	8230	24.6	0	198	1481	18.0	2.9
Rock Creek	RockAllen	7.0	2017	6/20/2017	12/31/2017	194	4656	4680	29.4	67	404	1197	25.6	11.8

Lessons Learned/Adaptive Management

The Grande Ronde Subbasin is one example of efforts to learn and adapt management programs through time. Historically, basin partners developed projects in an opportunistic approach. Projects were largely identified and developed with willing landowners based on course scale planning established through the Grande Ronde Subbasin plan completed in 2004. In 2013, basin partners initiated a strategic planning process (ATLAS) for Catherine Creek and the upper Grande Ronde watershed based on salmon and steelhead life history requirements to stratify the watersheds by biological significant reaches, assign relative importance of limiting factors, define key actions to address limiting factors, and develop a ranking and prioritization system to clearly identify geographic and reach priorities and both short and long term strategies to focus watershed restoration actions in areas with the most biological need and the highest probability of benefit. The process engaged multiple basin partners and leveraged the best available science and local expertise available to develop a road map that all partners can utilize to identify, develop, and implement strategic watershed and fish habitat restoration and enhancement projects. Transitioning opportunistic to strategic planning may be one of the most important adaptive management changes employed in the basin for prioritizing and strategizing work in Catherine Creek and the Grande Ronde river to address survival gaps for Snake River Spring-Summer Chinook and Summer Steelhead populations in the Grande Ronde Subbasin.

Additionally, the CTUIR Grande Ronde Fish Habitat Project continues to monitor and evaluate performance of projects and conservation measures developed to improve watershed and fishery resources in the Grande Ronde Subbasin. Post project construction and monitoring data, along with staff experience and collaboration with basin partners, collectively informs and helps improve our understanding of how different techniques and approaches to watershed and habitat restoration respond as well as develop new and innovative approaches to addressing habitat limiting factors for salmon and steelhead populations.

Literature Cited

Anderson, J.W., and others. 1992. Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration, and Monitoring Plan. USFS, PNWFRS, ODFW, CRITFC, CTUIR, NPT, OSU.

CBFWA. 1990. Columbia Basin Fish and Wildlife Authority. Integrated System Plan for Salmon and Steelhead Production in the Columbia River Basin.

CHaMP Scientific protocol for salmonid habitat surveys within the Columbia Habitat Monitoring Program. [Report]. - [s.l.] : Columbia Habitat Monitoring Program., 2015.

CRITFC. 1995. Wykan Ush Me Wa Kush, Spirit of the Salmon. Columbia River Basin Salmon Policy. Columbia River Inter-Tribal Fish Commission. Columbia Basin Salmon Policy, 1995.

CTUIR. 1983. Confederated Tribes of the Umatilla Indian Reservation. Summary Report: Salmon and steelhead habitat improvement initiatives--John Day, Umatilla, Grande Ronde and Imnaha drainages.

Grande Ronde Model Watershed Program, et., al. 2004. Grande Ronde Subbasin Plan. Northwest Power Planning Council Fish and Wildlife Program.

Henjum, M. G., J.R. Karr, D. L. Bottom, D. A. Perry, J. C. Bennarz, S. G. Wright, S. A. Beckwitt and E. Beckwitt. 1994 Interim Protection for Late-Successional Forest, Fisheries, and Watersheds: National Forest East of the Cascade Crest, Oregon and Washington.

Huntington, C. H. 1993. Clearwater BioStudies. Final Report. Stream and Riparian Conditions in the Grande Ronde Basin. Grand Ronde Model Watershed Operations-Action Plan, Appendix A and B.

Independent Scientific Group. 1996. Return to the River: Restoration of Salmonid fishes in the Columbia River Ecosystem. September 1996.

Issak, D. J., Horan, D.L and S.P.Wollrab. 2013. A simple protocol using underwater epoxy to install annual temperature monitoring sites in rivers and streams. Gen. Tech. Rep. RMRS-GTR-314. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 21 p.

Johnson D H [et al.] Salmonid Field Protocols [Journal] // American Fisheries Society. - 2007. - pp. 325-340.

Costi K, Shippentower, G and A. Wildbill. 2016. Fish Habitat Enhancement Biological Effectiveness Monitoring 2016 Annual Report. Confederated Tribes of the Umatilla Indian Reservation. Project # 2009-014-00; BPA contract# 71934.

McCullough, D. A. 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to Chinook salmon. Environmental Protection Agency 910-R-99-010.

McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wismar, S.E. Clarke, G.H. Reeves, and L.A. Brown. 1994. Management history of eastside ecosystems: Changes in fish habitat over 50 years, 1935-1992. General Technical Report, PNW-GTR-321, Report. USDA, Forest Service

Mobrand, L. and L. Lestelle. 1997. Application of the ecosystem diagnosis and treatment method to the Grande Ronde Model Watershed Project. BPA Task Order Number 95AT61148.

Mobrand, L. 2003. Application of the Ecosystem Diagnosis and Treatment Method to the Grande Ronde Subbasin.

Huntington, C. (1993). Stream and Riparian Conditions in the Grande Ronde Basin. Grande Ronde Model Watershed.

Jones K L [et al.] Physical Habitat Monitoring Strategy (PHAMS) for reach-scale restoration effectiveness monitoring [Report] = PHAMS : Open-File Report 2015-1069 / U.S. Department of the Interior. - Reston, Virginia : U.S. Geological Survey, 2013.

Jones, K. L. (2008). Umatilla River Vision. CTUIR, Department of Natural Resources, Pendleton.

Mobrand, L. (2003). Application of the Ecosystem Diagnosis and Treatment Method to the Grande Ronde Subbasin. .

Newbury, R., & Gasboury, M. (1994). Stream analysis and fish habitat design: A field manual. Gibson: Newbury Hydraulics LTD.

Newbury, R., Gaboury, M., & Bates, D. (1997). Restoring habitats in channelized or uniform streams using riffle and pool sequencies. Canadian Ministry of Environment, Lands and Parks. Vancouver: Watershed Restoration Program.

NMFS. (1997). Snake River Salmon Recovery Plan (8/97 draft),. National Marine Fisheries Service.

NRC. (1996). Upstream. Salmon and society in the Pacific Northwest. Washington D. C.: National Research Council.

NMFS. 1997. National Marine Fisheries Service. Snake River Salmon Recovery Plan (8/97 draft), Chap.4, pg. 61, 1997.

NMFS. 1995. National Marine Fisheries Service. Snake River Salmon Recovery Plan.

Noll, W., Williams, S., and R. Boycce. 1988. Grande Ronde river basin fish habitat improvement implementation plan. Oregon Department of Fish and Wildlife.

Nehlsen, W., J. E. Williams, and J. A. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho, and Washington. Fisheries Bulletin, American Fisheries Society, Bethesda, Maryland.

NPCC. 1994. Columbia River Basin Fish and Wildlife Program. Northwest Power Conservation Council.

NPPC. 2001. Grande Ronde River Subbasin Summary. Northwest Power Conservation Council.

NPCC. 2004a. Grande Ronde Subbasin Plan. Prepared for Northwest Power and Conservation Council by Grande Ronde Model Watershed Program. Pgs. 491. Available from www.nwcouncil.org/fw/subbasinplanning/granderonde/plan/

NPCC. 2004b. Imnaha Subbasin Plan. Prepared for Northwest Power and Conservation Council by Wallowa County Natural Resources Advisory Committee. Paged by section. Available from www.nwcouncil.org/fw/subbasinplanning/imnaha/plan/

NPCC. 2004c. Grande Ronde Subbasin Plan Supplement. Prepared for Northwest Power and Conservation Council by Grande Ronde Model Watershed Program. Pgs. 51. Available from www.nwcouncil.org/fw/subbasinplanning/granderonde/plan/

NPCC. 2004d. Imnaha Subbasin Plan Supplement. Prepared for Northwest Power and Conservation Council by Wallowa County Natural Resources Advisory Committee. Pgs. 20. Available from www.nwcouncil.org/fw/subbasinplanning/imnaha/plan/

NPPC. 2000. Columbia River Basin Fish and Wildlife Program. Portland, OR. Available from www.nwcouncil.org/library/2000/2000-19/Default.htm

NRC. 1996. Upstream. Salmon and society in the Pacific Northwest. National Research Council, Washington D.C. 452 pp.

ODEQ. 1999. Grande Ronde Section 319 National Monitoring Program Project. Temperature Monitoring Summary Report, 1993-1998. Oregon Department of Environmental Quality.

ODFW. (1990). Past and present abundance of Snake River sockeye, Snake River Chinook, and lower Columbia River coho salmon. A report prepared for Senator Mark Hatfield, U. S. Senate. Oregon Department of Fish and Wildlife.

ODFW, 1990. Oregon Department of Fish and Wildlife and four other agencies. 1990. Grande Ronde River Subbasin, salmon and steelhead production plan. Northwest Power Planning Council, Portland, Oregon.

ODFW, 1996. Oregon Department of Fish and Wildlife. 1996. Grande Ronde Basin Fish Habitat Enhancement Project. 1996 Annual Report.

Rosgen, D., 1996 Applied river morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Rosgen, D.L. 1998. The reference reach – a blueprint for natural channel design. Presented at the ASCE, Denver, Co

Stillwater Sciences Biological effectiveness monitoring and evaluation plan for fisheries [Report]. - Portland, Oregon : Stillwater Sciences, 2012.

Thurow, R.F. 1994. Underwater Methods for Study of Salmonids in the Intermountain West. General Technical Report. Ogden, UT: US Department of Agriculture, Forest Service, Intermountain Research Station.

USFS et., al. 1992. Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration, and Monitoring Plan, USFS, PNFRES, ODFW, CRITFC, CTUIR, NPT, OSU.

USFWS. 2002. Bull Trout Draft Recovery Plan. U. S. Fish and Wildlife Service. Paged by section. Available from http://ecos.fws.gov/docs/recovery_plans/2002/021129.pdf

White, S., C. Justice, and D. McCullough. 2011. Protocol for Snorkel Surveys of Fish Densities. A component of Monitoring Recovery Trends in Key Spring Chinook Habitat Variables and Validation of Population Viability Indicators. Columbia River Inter-Tribal Fish Commission, Portland, OR.

Yanke, J. A., B. C. Jonasson, F. R. Monzyk, S. M. Nesbit, A. G. Reischauer, E. S. Van Dyke, R. W. Carmichael. 2004. Investigations into the Early Life History of Naturally Produced Spring Chinook Salmon and Summer Steelhead in the Grande Ronde River Subbasin. 2003 annual report. On file with Oregon Department of Fish and Wildlife, La Grande, Oregon