

**THE UMATILLA RIVER ANADROMOUS  
FISH HABITAT PROJECT:**

**2011 ANNUAL REPORT**



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**Cover Image:** Time-lapse photograph image of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1, September 2012, image by CTUIR

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## ACRONYMS

BA	biological assessment
B&G	Bauer & Gustafson
BIA	Bureau of Indian Affairs
BMHRC	Blue Mountain Habitat Restoration Council
BPA	Bonneville Power Administration
cfs	cubic feet per second
COTR	Contracting Officer Technical Representative
CREP	Conservation Reserve Enhancement Program
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
cy	Cubic Yards
dbh	diameter at breast height
EPA	United States Environmental Protection Agency
ESA	Federal Endangered Species Act
ft	foot/feet
FY	fiscal year
gpm	gallons per minute
in	inch/inches
JPA	Joint Permit Application
km	kilometer/kilometers
LWD	large woody debris
m	meters
mi	mile/miles
MOA	Memorandum of Agreement
mph	miles per hour
NMFS	National Marine Fisheries Service
NPPC	Northwest Power Planning Council
NWPCC	Northwest Power and Conservation Council
NRCS	Natural Resource Conservation Service
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Department of State Lands
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
PCSRF	Pacific Coastal Salmon Recovery Fund
RM	river mile
SOW	Statement of Work
TMDL	total maximum daily load
UAFHP	Umatilla Anadromous Fisheries Habitat Project
UBNPME	Umatilla Basin Natural Production Monitoring and Evaluation Project
UBWC	Umatilla Basin Watershed Council
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UPR	Union Pacific Railroad
WHIP	Wildlife Habitat Incentive Program



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## EXECUTIVE SUMMARY

The Umatilla Anadromous Fish Habitat Project (UAFHP) is an ongoing effort to protect, enhance, and restore functional floodplain, channel, and watershed processes to provide sustainable and healthy habitat for aquatic species in the Umatilla River Basin, including Threatened Mid-Columbia summer steelhead. Flow quantity, water temperature, passage, and lack of in-stream channel complexity have been identified as the key limiting factors in the basin. During the 2011 fiscal year (FY) reporting period (February 1, 2011-January 31, 2012) primary project activities focused on improving in-stream and riparian habitat complexity and restoring natural channel morphology and floodplain function. Project activities in FY 2011 activities were mainly focused on the Meacham Creek Floodplain Restoration and In-Stream Enhancement Project (RM 6-7). Due to the size of this project, a vast amount of time was spent planning, coordinating, monitoring, overseeing and implementing the project. Additional planning/assessment tasks were accomplished on Meacham Creek, Wildhorse Creek, Birch Creek, West Birch Creek, McKay Creek, Iskúultpe Creek and the Umatilla River. Specific restoration actions included: (1) Completion of the Meacham Creek Floodplain Restoration and In-Stream Enhancement Project (RM 6-7) ; (2) 3.1 miles of cattle exclusion fencing on the headwaters of Iskúultpe Creek; (3) 1.4 miles of cattle exclusion fencing on Meacham Creek; (4) monitoring and maintenance of 23 conservation easements on 19 individual landowners properties; (5) controlled noxious weeds on 512 acres (109 riparian, 403 upland) within project areas and easements through hand and mechanical removal, biological control and chemical application; (6) completed planning, permitting, NEPA and ESA consultation, cultural resource clearance, design and implementation plan for the Birch Creek Taylor Dam Removal and Habitat Restoration Project. UAFHP participated in additional secondary projects as opportunities arose. Baseline and post-project monitoring and evaluation activities were also completed within the Umatilla River Basin. Habitat and aquatic assessment inventories were conducted at project sites prior to implementation. Effectiveness monitoring and monitoring plans will continue throughout the duration of each project to oversee progression and inspire timely managerial actions. Permitting applications for planned project activities and biological opinions were written and approved. Project activities were based on a variety of fisheries monitoring techniques and habitat assessments used to determine existing conditions and identify factors limiting anadromous salmonid abundance in accordance with the *Umatilla River Subbasin Salmon and Steelhead Production Plan* (NPPC 1990) and the *Final Umatilla Willow Subbasin Plan* (Umatilla/Willow Subbasin Planning Team 2005).

## INTRODUCTION

The ancestors of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) have hunted and gathered food and fished numerous rivers and streams of the Pacific Northwest for thousands of years. They depended upon anadromous fish for subsistence and trade. The indigenous people of the CTUIR still rely on natural resources from several watersheds located within areas of traditional use to provide them with a multitude of life essentials.

CTUIR's right to fish in its historical fishing places was acknowledged in the Treaty of 1855 that stated: "the exclusive right of taking fish in the streams running through and bordering said reservation is hereby secured to said Indians, and at all other usual and accustomed stations..." (Treaty of 1855, Articles of Agreement, Article 1, page 3). Decreased salmonid abundance has significantly impacted the livelihood of the Tribal community and altered their way of life.

Overfishing, sweeping changes to rivers and streams, and policies that changed the landscape have endangered salmon and created a "salmon crisis" (Montgomery 2003). It is the challenging duty of the CTUIR Umatilla Anadromous Fisheries Habitat Project (UAFHP) to restore and sustain healthy conditions of local watersheds to both assist in salmon recovery and ensure they provide adequate quantities of sustainable natural resources to satisfy the CTUIR's needs and preserve opportunities for traditional ways of life.

The Bonneville Power Administration (BPA) funds the CTUIR and other Pacific Northwest Tribes to restore salmonid habitat as part of its mitigation activities due to the harmful effects and loss of habitat caused by the massive Columbia River hydroelectric dams. The CTUIR UAFHP, #1987-100-01, funded by BPA through the Northwest Power Planning Council (NPPC) (renamed Northwest Power and Conservation Council in 2003 [NWPCC]) Fish and Wildlife Program, is an ongoing project initiated by CTUIR in 1987. The UAFHP is an ongoing effort to protect, enhance, and restore functional floodplain, channel, and watershed processes to provide sustainable and healthy habitat for aquatic species in the Umatilla River Basin. Project work further supports the CTUIR Department of Natural Resources ecological and First Foods mission statements to sustain production (Jones et al., 2008). Furthermore, CTUIR is guided in its habitat restoration activities by the *Five-Year Action Plan for the Development and Maintenance of Habitat Improvement Projects in the Umatilla Subbasin: 2006-2010 For BPA-Funded Fish Habitat Improvement Programs* sponsored by: Oregon Department of Fish and Wildlife (ODFW) and Confederated Tribes of the Umatilla Indian Reservation (CTUIR and ODFW 2006).

The goal of UAFHP is to protect, enhance, and restore salmonid habitat and abundance in the Umatilla River Basin. The project focuses on the mainstem Umatilla and tributaries that provide spawning, rearing, and migrational habitat for Middle Columbia River Basin Endangered Species Act (ESA) Listed summer steelhead and bull trout, as well as for spring chinook salmon, a preferred species of traditional importance to CTUIR. Habitat enhancement activities are designed to improve aquatic and riparian habitat resulting in an increase in viable populations of focal species and secondary species of fish and wildlife in the Umatilla River watershed. CTUIR is also engaged in activities to enhance habitat for bull trout, redband rainbow trout, Pacific lamprey, mountain whitefish, fall chinook and coho salmon.

During the 25-year project history, the CTUIR has helped administer and implement a number of fisheries habitat enhancement projects in the Umatilla River Basin. In FY 2011,

the CTUIR maintained 23 partnership habitat enhancement projects along Meacham Creek, Iskúultpe Creek, Birch Creek, Wildhorse Creek, West Birch Creek and the mainstem Umatilla River, among other sites. The CTUIR has developed effective interagency partnerships and is effectively working at the policy and project levels with various federal, state, and county agencies and private landowners.

The UAFHP is an integral component of the *Umatilla River Subbasin Salmon and Steelhead Production Plan* (NPPC 1990) and is well integrated into the framework of the *Umatilla Subbasin Plan* (Umatilla/Willow Subbasin Planning Team 2005) established by the NWPPC to better coordinate habitat restoration work in the Umatilla River Basin. The CTUIR, ODFW, Natural Resource Conservation Service (NRCS), Umatilla Basin Watershed Council (UBWC), and other participating agencies and organizations have made significant progress towards restoring and protecting vital salmonid habitat in the basin.

#### **Noteworthy accomplishments for the CTUIR UAFHP during FY2011:**

- Completion of the Meacham Creek Floodplain Restoration and In-Stream Enhancement Project (RM 6-7.1) including levee removal and modification, channel and side-channel construction, installation of large wood and rock habitat features, and riparian plant restoration.
- Installing 1.4 miles of fencing to exclude trespass livestock (cattle, horses, and wildlife) on Meacham Creek, RM's 6-7 and 8.5.
- Installing 3.1 miles of fencing to exclude trespass livestock (cattle, horses, and wildlife) on Iskúultpe Creek headwaters.
- Maintaining 23 conservation easements on 19 individual landowner properties, and partnering with the NRCS Wildlife Habitat Incentives Program (WHIP) and Conservation Reserve Enhancement Program (CREP).
- Planting approximately 6,817 potted plants and 10,000 willow cuttings at the Meacham Creek Floodplain Restoration and In-Stream Enhancement Project (RM 6-7.1).
- Using hand and mechanical, biological and chemical controls to treat 512 acres (109 riparian, 403 upland) for noxious weeds.
- Conducting project maintenance activities at all sites.

Subbasin planning teams utilized information from a variety of resource assessment sources to classify existing habitat status, determine limiting factors, and identify priority areas for restoration activities. A combination of both passive and active restoration strategies were then developed to address habitat deficiencies. Collection of aquatic habitat, geomorphology, water quality, and fish abundance data is ongoing and utilized for optimizing adaptive restoration plans at project areas.

Although many project areas are in an early stage of recovery, establishment of conservation easements, construction of riparian exclusion fencing, development of off-channel water sources for livestock, re-vegetation efforts, and in-stream work, such as passage barrier rectification, channel reconstruction, large wood additions, and floodplain reconnection have resulted in improving trends including:

- Improved stream channel stability with early succession dimension, pattern and profile
- Increased accessibility to suitable habitat conditions in headwater streams via passage rectification

- Decreased channel width-depth ratios, gradient, and entrenchment and increased channel sinuosity, length, floodplain connection, enhanced pool habitat, increased stream shade and undercut banks
- Increased availability of in-stream habitat, including backwater and off-channel rearing areas
- Improved condition of riparian and wetland plant communities for fish and wildlife species
- Increased in-stream habitat complexity and diversity resulting in improved pool-riffle sequences associated with dynamically stable channel morphology

During the 2006 NWPCC project solicitation, the CTUIR developed a schedule of planned actions for FY2007-2009 in cooperation with the ODFW. Most project activities scheduled for work under the 2006 NWPCC project solicitation have been completed. CTUIR continues to update project lists in priority geographic areas within the Umatilla River Subbasin for restoration. CTUIR secured funding for habitat improvements from a variety of sources in FY 2011 in addition to the BPA, including Blue Mountain Habitat Restoration Council (BMHRC), Bureau of Indian Affairs (BIA), Environmental Protection Agency (EPA), NRCS, Oregon Watershed Enhancement Board (OWEB), Oregon Water Resources Department (OWRD), Pacific Coastal Salmon Recovery Fund (PCSRF), UBWC and U.S. Forest Service.

Project results are reported in various BPA formats including Pisces status reports, project completion reports, and annual reports. The CTUIR maintains a complete database on project planning, proposals, permitting, implementation, and results through the completion of required project deliverables. For a complete list of reports submitted by the CTUIR's UAFHP since 1989, please consult the following website at URL: <http://www.efw.bpa.gov/integratedfwp/reportcenter.aspx> and search **publications**, typing 1987-100-01 in the project number box provided.

## **PROJECT AREA**

### **Umatilla River Subbasin**

The Umatilla River Subbasin is located in the northwest portion of the Blue Mountain Ecological Province in northeast Oregon. The Umatilla River Subbasin comprises 1,465,600 acres of the 6,400,000 acres of ceded CTUIR land (CTUIR 1995) as identified by the Treaty of 1855. Figure 1 illustrates the vicinity of the Umatilla River Basin within the Blue Mountain Province. The Umatilla River drains an area of approximately 2,540 square miles (mi.<sup>2</sup>) (6,579 square kilometers [km<sup>2</sup>]) and flows approximately 89 mi. (143 km) from its mouth to where it divides into the north and south forks of the Umatilla River. Each fork adds another approximately 10 mi. (16 km) of length. Major tributaries in addition to the north and south forks include Meacham Creek, Birch Creek, McKay Creek, Butter Creek, and Wildhorse Creek. The Umatilla River originates at elevations up to 4,228 feet (ft.; 1,289 m) and flows to an elevation of about 269 ft. (82 m) at its confluence with the Columbia River (USFWS 2002).

## *Geology and Vegetation*

The Umatilla River Basin can be roughly divided near the city of Pendleton, Oregon (OR) (RM 53) into two physiographic regions. The lower river, west of Pendleton, has cut a low valley into a broad upland plain called the Deschutes-Umatilla Plateau. Parent geologic materials of the plain are dominated by multiple layers of middle Miocene basalt flows, specifically, the Wanapum and Grand Ronde Basalts, originating 14 to 17 million years ago. Pleistocene and Holocene loess, alluvial, and glaciofluvial deposits are located on top of the Miocene basalts (Walker and MacLeod 1991; USGS 2008). Currently, vegetation on the broad Deschutes-Umatilla Plateau is primarily comprised of dry land crops and sagebrush-grass communities.

The region east of Pendleton is dominated by the Blue Mountain foot hills and the Blue Mountains. The Blue Mountains are accreted terrains that underwent lifting, faulting and folding of volcanic, sedimentary and metamorphic rock from 15-6 million years ago (Alt and Hyndman 1995). The middle Miocene basalts of the lower river are also the dominant parent materials in the headwaters. The river and streams have cut steep-sided canyons into the layers of rock that form the higher elevations of the Blue Mountains. Exposed basalt outcrops fracture into blocks and plates while the unexposed layers remain fairly impervious to water (Walker and MacLeod 1991). The combination of steep canyon walls and impervious bedrock lends to poor ground water recharge (NPPC 1990). Vegetation distribution patterns upstream of Pendleton are typical for the Blue Mountains. Grasses and small shrubs dominate the drier, south facing slopes. Conifers dominate the north facing slopes, higher elevations, and moderately wet areas.

Historically throughout the Umatilla Basin, deciduous trees were abundant in riparian areas on the valley floor. In 1812, Robert Stuart described the Umatilla River near the location of present day Pendleton with “bottoms well covered with cottonwood pofsefs (a good) many Swamps and Ponds in which reside a great multitude of beaver” (Rollins 1935, as cited by USFWS 2002, Chapter 10). During this same time period, “[M]any of the pioneers traveling through the area noted the cottonwoods along the river (Nagle 1998, as cited by USFWS 2002, Chapter 10).”

Riparian habitat and vegetation on the mainstem Umatilla River and many tributaries are in poor condition. Land use practices over the last hundred years have cleared most of the riparian vegetation along the rivers and streams for irrigated agricultural, livestock, and urban uses. In the lower Subbasin, losses of riparian vegetation are particularly high; one study estimated those losses at greater than 95% as compared to pre-pioneer settlement conditions (c. 1850; Umatilla/Willow Subbasin Planning Team 2004)

The mid-Umatilla River Subbasin is a highly utilized broad valley with degraded fisheries habitat conditions, including a disconnected floodplain, poor width-to-depth ratios, streambank erosion, channel incision, noxious weeds, and lack of adequate stream shading due to the narrow riparian belt width comprised of secondary growth and located a significant distance from the wetted channel. Three-quarters of the Umatilla River has been constrained by levees, and consequently, approximately 70% of 422 miles of inventoried river and streams are in need of improvement (Umatilla/Willow Subbasin Planning Team 2004).

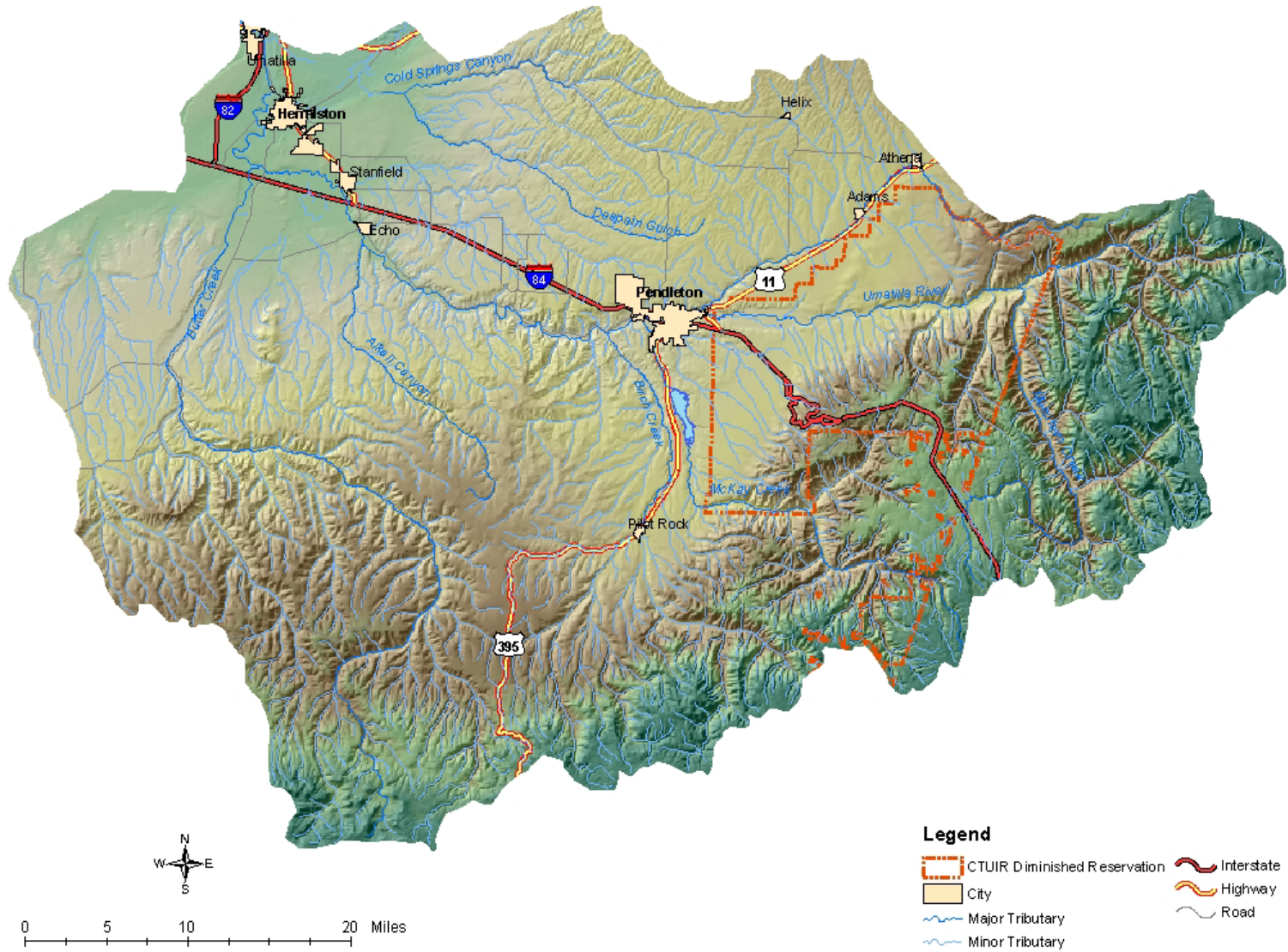
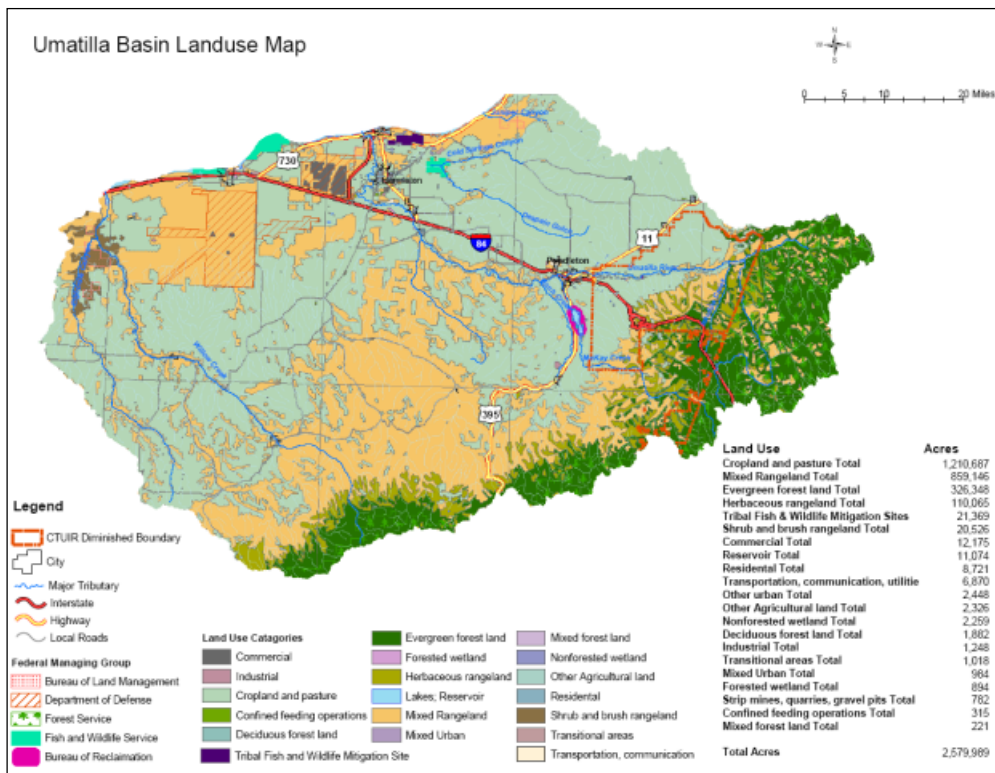


Figure 1. Umatilla River Subbasin

## Land Use

Agriculture, both cropland and pasture, dominate the use of the Umatilla River Subbasin at the present time and total one million plus acres (Figure 2). Mixed rangeland accounts for one third of the remaining acres. Several land uses have adverse impacts on the Umatilla Subbasin and its fisheries habitat including: (1) agriculture (cropland and pasture, irrigated and dry land), (2) livestock grazing in both forested lands and land not designated for crops, (3) streamside roads, (4) railroads, (5) timber harvest, (6) recreational and municipal water development, (7) housing development and urbanization within the floodplain, (8) irrigation and water withdrawals, (9) recreational use of riparian areas, (10) livestock water developments, and (11) channel modification, such as dams and levees, for flood control projects (USFWS 2002).

When large numbers of livestock have full access to streams, the following impacts may occur: reduction of riparian vegetation, bank erosion, channel incision, reduced stream depths, and reduction of overall water quality. Generally, salmonid abundance is limited in reaches inhabited by unmanaged livestock due to an overall reduction of habitat quality and quantity.



**Figure 2. Land Use within the Umatilla Basin**

## Hydrology

Annual precipitation averages 10 inches/year (in/yr) near the confluence with the Columbia River to 50 in/yr in the headwaters (Taylor 1993). From 1928 to 1999, annual discharge at the gauging station near Umatilla, Oregon (RM 1.9) averaged 345,700 acre-feet (80.7 million

cubic meters [m<sup>3</sup>]). Average annual discharge of the Umatilla River Basin for calendar years 1995 to 1999 was 531,486 acre-feet (124 million m<sup>3</sup>) (USFWS 2002).

U.S. Geological Service (USGS) flow data from 1995-2008 at Gibbon, OR (RM 78.5) and the West Reservation Boundary, Umatilla River (RM 56.1) show unstable, flashy hydrograph patterns and extreme low and high flow episodes.<sup>1</sup> The Umatilla River hydrographs exhibit tall peaks indicative of high flows during high rain, snowmelt, and runoff events in the spring and early winter, but severe drops in flow during the semi-arid summer months, when it is not uncommon to have reaches of major tributaries devoid of flows for months at a time. This phenomenon results from the regional geological characteristics and arid climate, but is also influenced by the poor health of the Umatilla River and its tributaries.

This hydrologic effect is less pronounced in the relatively pristine North Fork Umatilla Wilderness Area, apparently because of minimal human disturbance, higher elevations, developed soils, and expansive riparian areas featuring large woody debris and climax plant communities. It is generally perceived as a “reference” reach.

#### *Anthropogenic Effects on Salmonid Habitat*

The Umatilla River 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*), steelhead-rainbow trout (*O. mykiss sp.*), and mountain whitefish (*Prosopium williamsoni*). Human-caused alterations have negatively impacted the watershed and caused significant reductions of endemic salmonid populations. Beginning in the late 1800s, fish populations started to decline due to habitat degradation; sockeye and coho were extirpated in the early 1900s. Irrigation and agricultural development throughout the basin in the early 1900s is believed to be the primary cause of the decline of steelhead and the extinction of salmon. Since the completion of the Treaty of 1855, aquatic and riparian habitats have been degraded through irrigation diversions, water extractions, channelization, livestock grazing, logging, agriculture and urban development (Umatilla/Willow Subbasin Planning Team 2004). Subsequently, the abundance of Chinook, steelhead, bull trout, and other fish species has also been dramatically reduced. With declining fish populations, Tribal governments, federal, state and international agencies were obligated to eliminate or significantly reduce subsistence and sport fisheries by the mid-1970s. The Federal government listed Columbia River spring Chinook salmon, summer steelhead, and bull trout as threatened species under the ESA in 1973, 1992, 1997, and 1998, respectively.

The following species listed under the ESA currently occur in the Umatilla River Basin: Columbia River bull trout Critical Habitat (designated), Columbia River bull trout (threatened), and Mid-Columbia River steelhead (threatened). In the mid-1980s, a successful, hatchery-based salmonid reintroduction effort for the Umatilla River was instituted using neighboring strains of various salmonid species. Although hatchery programs currently support subsistence and restricted sport fishing opportunities for steelhead

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<sup>1</sup> US Geological Survey Water Data can be found at the following URL, as accessed November 19, 2008:

[http://waterdata.usgs.gov/nwis/uv/?site\\_no=14020850&agency\\_cd=USGS](http://waterdata.usgs.gov/nwis/uv/?site_no=14020850&agency_cd=USGS)  
[http://waterdata.usgs.gov/nwis/uv/?site\\_no=14020300&agency\\_cd=USGS](http://waterdata.usgs.gov/nwis/uv/?site_no=14020300&agency_cd=USGS)

and Chinook salmon, there remains significant need to re-build viable, harvestable, and sustainable fish stocks throughout the basin.

Modern human activities have loaded the Umatilla River with agricultural fertilizers, sewage, pesticides, and suspended sediments, as well as urban and industrial pollution (CTUIR 2008). The Oregon Department of Environmental Quality (ODEQ) listed the Umatilla River Subbasin on the State's list of water quality limited water bodies' 303(d) list (Please see the ODEQ website at URL <http://www.deq.state.or.us/wq/assessment/rpt0406/results.asp> for details). A Total Maximum Daily Load (TMDL) was also written for waters within reservation boundaries (CTUIR 2005) that, in combination with CTUIR's habitat enhancement work, should lead to water quality improvements over the long term (Please see <http://yosemite.epa.gov/R10/WATER.NSF/TMDLs/Approved+TMDLs#OR>, select "Oregon", and navigate to "Umatilla Tribal TMDL" for a copy of this report.).

Throughout much of the Subbasin, maximum water temperatures exceed lethal limits for bull trout and approach lethal limits for Chinook salmon and rainbow/steelhead trout. The high stream temperatures potentially limit carrying capacity, adversely affect fish fitness, and should be considered as a primary factor limiting salmonid production in the Subbasin. CTUIR's UAFHP is currently taking steps to address water quality issues through its habitat restoration activities.

#### *Habitat Protection/Restoration Activities*

Habitat protection and restoration needs in the Subbasin have been recognized in numerous reviews, planning processes, and reports (CTUIR 1993; CTUIR 2000; Umatilla/Willow Subbasin Planning Team 2004; 2005). The National Marine Fisheries Service (NMFS) has recently restarted the recovery planning effort for Chinook salmon and steelhead and tributary habitat restoration. The National Research Council (1996) notes the importance of protecting and rehabilitating freshwater habitat as part of salmon recovery and specifically notes the importance of riparian areas. This body recommended that habitat reclamation or enhancement should emphasize rehabilitation of ecological processes and function (NRC 1996). The United States Fish and Wildlife Service (USFWS) draft bull trout recovery plan (USFWS 2002) also recognized the importance of habitat protection and restoration and specifically noted the need to improve water quality, reduce or eliminate fish passage barriers, and restore impaired in-stream and riparian habitat. Pre-project implementation aquatic habitat inventory surveys conducted by CTUIR revealed that habitat quality ranked poor in 85% of areas surveyed and fair in 15% in the Umatilla River. Flow quantity, water quality, passage, and in-stream channel complexity were identified as key limiting factors.

The *Final Umatilla Willow Subbasin Plan* (Umatilla/Willow Subbasin Planning Team 2005) determined that the limiting factors could be addressed through habitat restoration and implementation ("Phase III") of the Umatilla Basin Project. Three restoration scenarios were proposed based on the results of the Ecosystem Diagnostic Treatment model: (1) Habitat restoration of the top priority geographic areas singly plus the implementation of Phase III of the Umatilla Basin Project; (2) Habitat restoration of the top 19 geographic areas plus implementation of Phase III; and (3) Habitat restoration of the top 19 geographic areas with no implementation of Phase III.

Not surprisingly, these results suggested that the greatest amount of action (restoring the 19 geographic areas and implementing Phase III flow increases) has the greatest impact on steelhead and Chinook salmon productivity and abundance. The *Final Umatilla Willow*

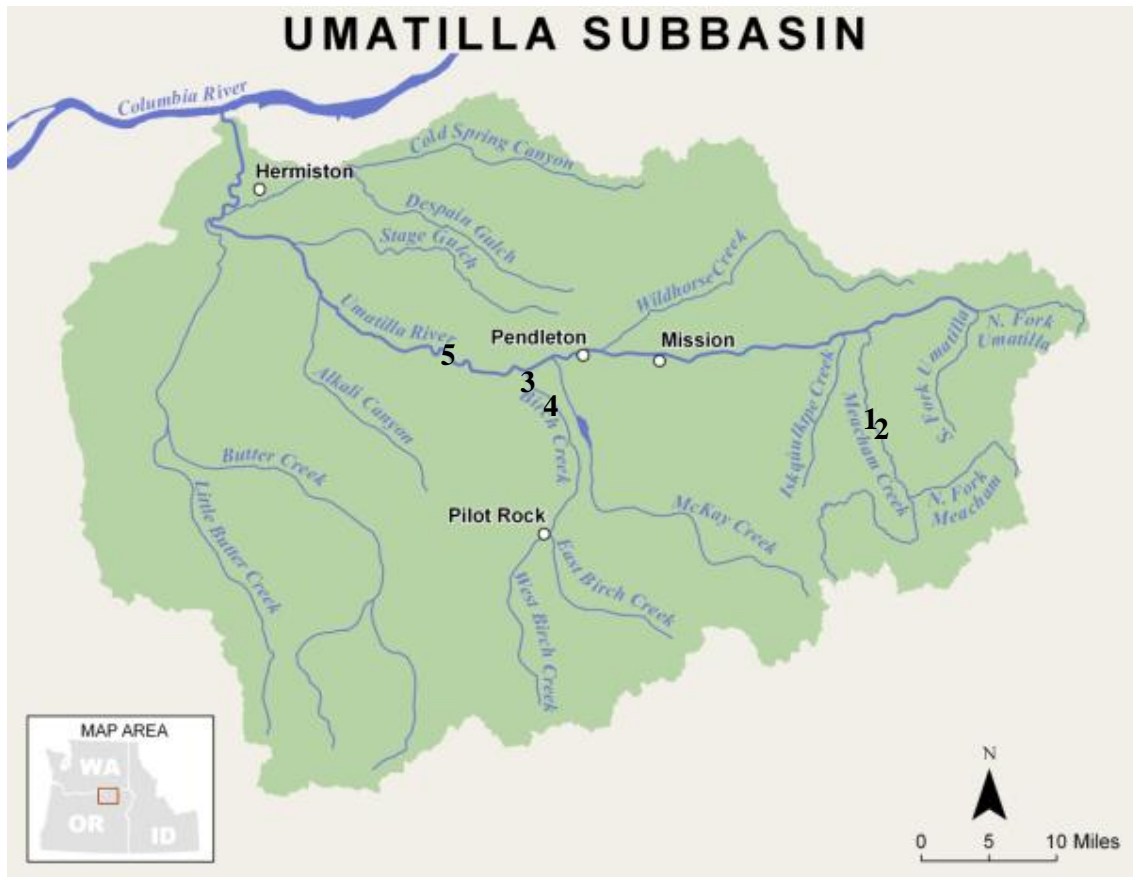
*Subbasin Plan* (2005) models recommended that a scenario with habitat restoration coupled with increased flows would be the most effective means of rehabilitating diminished (from historic levels) runs of Chinook and steelhead. Implementation of Phase III will involve increased in-stream flows in the Umatilla River mainstem from Thornhollow (RM 73.5) to the mouth. Priority management strategies are being conducted in accordance with the *Final Umatilla Willow Subbasin Plan* (Umatilla/Willow Subbasin Planning Team 2005). These include:

- Increase water conservation and irrigation efficiency
- Large Wood/Boulder Structure Placement
- Fence/Plant Riparian Zones
- Modify Channel Floodplain Function
- Construct Pool/Riffle – In-stream Modification
- Modify Detrimental Land use Activities
- Restore Upstream/Headwater Attributes to Improve Downstream Conditions
- Increase Passage Efficiency

In accordance with the 2006 NPCC solicitation outline, the FY2011 CTUIR UAFHP focused its restoration activities primarily on the Meacham and Birch Creek watersheds. The Meacham Creek Watershed has long been a primary focal point of the CTUIR effort to improve habitat conditions in the Umatilla Basin because of its location, size, historical significance, and recovery potential. CTUIR has initiated restoration activities to address existing habitat deficiencies as part of a long-term watershed restoration plan.

CTUIR and ODFW work together to co-manage and improve habitat in target areas in the Umatilla River Basin. Priority target geographical areas were established in the *Five Year Action Plan for the Development and Maintenance of Habitat Improvement Projects in the Umatilla Subbasin* (CTUIR and ODFW 2006). The Meacham and Birch Creek watersheds were identified by CTUIR and ODFW in the Five-Year Action Plan as priority areas for fish habitat restoration activities. An analysis of habitat conditions in the Umatilla Subbasin was conducted by CTUIR and ODFW. In addition to the historical relevance of these watersheds, fisheries data collected over the last two decades illustrated the importance of the Subbasin to anadromous and resident salmonids. These watersheds are a primary focal point of the CTUIR effort to improve habitat conditions in the Umatilla Subbasin because of the current habitat status, historical significance and recovery potential. CTUIR initiated restoration activities to address existing habitat deficiencies as part of long-term watershed restoration plan. CTUIR is the lead entity responsible to address habitat deficiencies in the following high priority target areas: (1) Birch Creek: RM 2.0 to Hoeft Road (RM 10.5); (2) East Birch Creek: Mouth to Humphrey Bridge (RM 4.0) and Westgate Canyon Ranch (Baker Property); (3) West Birch Creek: Mouth to Bear Creek (RM 5.0); (4) Meacham Creek: Mouth to Forks, RM 15.3 (including tributaries); and (5) Upper Umatilla River: Mission Bridge (RM 59.5) to Meacham Creek (RM 78.8). In 2005, Birch Creek shifted from being solely managed by ODFW to being co-managed with CTUIR.

Our primary area of focus for restoration work in FY 2011 was Meacham Creek, Birch Creek and mainstem Umatilla River (Figure 3). However, project restoration activities occur in other areas of the Subbasin where floodplain and riverine processes are treated with outcomes that are beneficial to ecological processes, water quality and fish production. The following section describes specific areas where projects were implemented by CTUIR's UAFHP in FY2011.



**Figure 3. Umatilla River Basin FY2011 UAFHP Project Sites**

**1: Meacham Creek, RM 6-7;**  
**2011 Floodplain Restoration and**  
**In-stream Enhancement.**  
 Removal and Modification of  
 Levee and Spur Dikes.

**2: Meacham Creek, RM 6.0-**  
**8.5; 2011 Installed 1.3 Miles and**  
**Disposed of 0.8 Miles of**  
**Livestock Exclusion Fencing.**

**3: Birch Creek, RM 0-1.0; 2011 Fish**  
**Passage & Stream Connectivity**  
**Restoration Project Design**  
**Development – Taylor Property.**

**4: Birch Creek, RM 2.8-2.9;**  
**2011 Seeding and Plantings as**  
**Part of the 2010 Bank**  
**Stabilization and In-stream**  
**Wood Habitat Enhancement**  
**Project.**

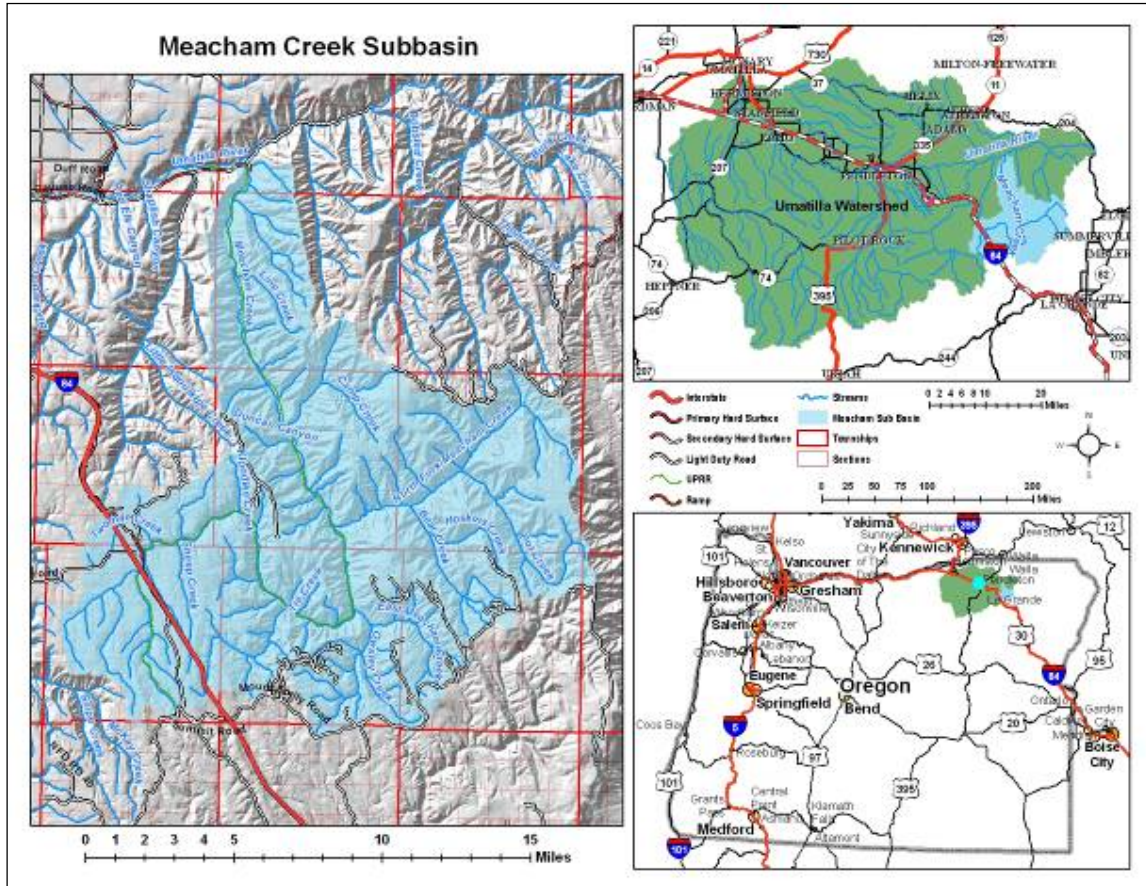
**5: Umatilla River, B&G**  
**Property; 2009-2010 Riparian**  
**Plantings and Maintenance on**  
**NRCS CREP Tarps.**

### Description of Creeks in Project Area

#### Meacham Creek

The 114,000 acre Meacham Creek Watershed (Figure 4) is located in northeast OR, on the west slope of the Blue Mountains, 23 miles east of the city of Pendleton, OR. The headwaters originate near the towns of Meacham and Kamela, OR, near Salmon Back Ridge. Meacham Creek is a 37-mile long major tributary of the Umatilla River that enters near RM

79. Although intermittent in several reaches, it contributes slightly more than half of the summer flow to the mainstem Umatilla River at the confluence of Meacham Creek and the mainstem Umatilla River confluence. Data from CTUIR shows that Meacham Creek runs 2-3 °C warmer (16 °C [60.8 °F] vs. 13.5 °C [56.3 °F]) during the summer than the Umatilla River at this location.



**Figure 4. Meacham Creek Subbasin, tributary to the Umatilla Basin.**

### *Topography*

The topography of the Meacham Watershed is typical of the Blue Mountain foothills, with broad flat ridges bisected by moderately steep, constraining canyons with a variety of aspects. The valley floor is generally comprised of multiple terraces alternating with moderately steep hill slopes located adjacent to the creek. Elevations range from approximately 1,850 feet above sea level near the mouth of the creek to approximately 2,850 feet at the headwaters. In the lower half of the subbasin, it is characterized by having a broad valley floor averaging 10.7 times as wide as the active channel. The upper half consists of much steeper and closely orientated hill slopes that encroach upon the channel and contribute increasing proportions of bedrock into the channel and bank composition.

The typical channel morphology is most representative of a Rosgen "C" type classification (e.g., slightly entrenched, meandering, alluvial channels that occur on gentle gradients in broad valleys, as defined in Rosgen 1996) in the lower half of the watershed; in the upper

watershed, the channel becomes increasingly constrained due to natural and human-made conditions.

### *Hydrology*

The USGS maintains a gauging station operated in cooperation with the CTUIR at Gibbon, OR (RM 78.5). The drainage area covered is 176 mi<sup>2</sup>. Maximum flows peak at 8,800 cubic feet per second (cfs), while minimums of 7 cfs constitute summer base flows. Several vast dry channel reaches are located intermittently throughout Meacham Creek in the summer months. It has been theorized that substantial fish displacement, stranding, and mortality occurs in the system due to these hydrological conditions.

### *Plant Communities*

Plant communities in the Meacham Watershed exhibit a grass-timber mosaic characteristic, typical in the Blue Mountains. North-facing slopes and the riparian corridor support second growth timber. Grasslands are more common on south-facing slopes. In the riparian areas, cottonwoods and conifers (12-20 in diameter breast height [dbh]) are dominant, various shrubs comprise the second-story growth, and tertiary growth consists of grasses. Riparian shrub communities generally consist of black hawthorn, Himalayan blackberry, willow, and to a lesser extent, ocean-spray, various rose species, elderberry, and common snowberry. Other habitat types include upland shrub, predominantly mallow ninebark/common snowberry and common snowberry/rose plant associations, located in stream or draw bottoms.

### *Anthropogenic Impacts*

The Meacham Watershed is of historical significance to Native American people of the area because of its traditional hunting, fishing and gathering opportunities. There are various ancient sites of cultural significance located adjacent to the Meacham waterways. The primary impacts to Meacham Creek are associated with the adjacent UPR railway, built in the early 1900s at close proximity to the mainstem of Meacham Creek for the majority of its 37 river miles. Extensive diking, channel relocation or highly constrained, and alteration of the vegetative component are impacts associated with construction and maintenance of railway operations. Many of the large trees in the Meacham watershed were likely removed to fuel steam locomotives during the early days of railroad and to supply the needs of a sawmill formerly located near RM 2 of the North Fork of Meacham Creek (Andrus and Middel 2003). A significant secondary impact to Meacham Creek is the presence of livestock in the riparian area and stream zone, where moderate to heavy grazing pressure occurs.

The current property ownership profile of Meacham Creek and watershed shows a mixture of public, private, and Tribal ownership. Management of the resources in the watershed is controlled by various Tribal, Federal, private, and corporate interests. Much effort is devoted to planning and promoting cooperative participation in the restoration process by the various entities. Project scoping and educational outreach continues to be an important tool in regard to forging mutually beneficial relationships and coordinating restoration efforts among all land managers in the Subbasin.

In limited areas, hunting and fishing opportunities are available to tribal and non-tribal participants, but much of the watershed is somewhat restricted to users due to the presence of locked gates at both ends. The UPR installed the gates within the last decade as a means of

reducing traffic for railway safety and fire control in an effort to ensure that operations are uninterrupted. The restricted access aids recruitment of numerous fish and wildlife species. This benefit is diluted to some degree by disturbance and mortality associated with the infrastructure of the UPR and its daily operations.

### *Anadromous Salmonids*

The Meacham Creek Watershed produces an anadromous salmonid component which contributes to the harvest of both the recreational and commercial fisheries trades located in the Columbia River and Pacific Ocean as well as the traditional and subsistence uses by Native Americans from the Umatilla Subbasin. To illustrate the significance of Meacham Creek as a salmonid producer, there are more than twice as many salmonids estimated in the lower 15 miles of Meacham Creek than in the lower 81.8 miles of the Umatilla River, despite having less water volume than the Umatilla River. Currently, the Meacham watershed is a primary producer of steelhead-rainbow trout and is of secondary importance for Chinook salmon and bull trout.

Much of the Meacham Creek Watershed is not in compliance with salmonid temperature requirements and corresponding state and federal water quality standards. Thermal guidelines for bull trout state that water temperatures above 15° C (59° F) limit distribution. This benchmark is consistently exceeded in the majority of the Meacham Watershed. Physical habitat survey data is ranked as poor overall and is summarized in *Umatilla Basin Natural Production Monitoring and Evaluation Annual Report 1992-1993* (CTUIR 1994).

Meacham Creek's suitability for salmonids is currently classified as marginal, but the restoration potential is good despite limitations imposed by the fixed presence of the UPR. Currently, high stream temperatures, lack of summer flow, limited quantity of pools, lack of overall habitat complexity and shortages of large woody debris are considered as factors limiting salmonid carrying capacity and production in Meacham Creek.

### **Isquulktp Creek**

Isquulktp Creek is a tributary of moderate size that enters the mainstem of Umatilla River at RM 76.7. Isquulktp Creek contributes roughly 5% of the Umatilla River's summer flow and is a known destination for significant numbers of adult steelhead spawning. It is dominated by constraining terraces and predominantly single, Rosgen "C" channel morphology (low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well-defined floodplains, as defined in Rosgen 1996). Isquulktp Creek ranked as moderate habitat quality overall for salmonids, primarily due to relative light disturbance and hydrologic stability. Isquulktp Creek receives very little fishing pressure. Hunting opportunities attract the most recreational users.

An intensive Aquatic Habitat and Fish Inventory survey was conducted by CTUIR in 1994 on Isquulktp Creek (RM 0-10). Specific results for individual habitat metrics and fish populations can be found in *Umatilla Basin Natural Production Monitoring and Evaluation Annual Report 1993-1994* (CTUIR 1995). In 1994, the number of juvenile salmonids estimated in the lower 10 miles was 37,611, 97.1% of which were steelhead-rainbow trout; 2.9% were juvenile spring Chinook salmon. An Aquatic Habitat Inventory and Fish Survey were conducted in the summer of 2008 as part of FY2008 activities (Hoverson et al. 2009). Results indicated an increase in undercut banks from 3.8% to 13.2%, an increase in the quantity of pieces of wood by 250 (220 added by CTUIR via helicopter in 2006) resulting in

an increased wood rating for fish benefit from 1.3 to 1.6, and channel shade increased from 5% to 40-45%.

Low numbers of bull trout have been documented in Isquulktp Creek. It is conceivable to foresee the potential of Isquulktp Creek as a rearing area for juvenile bull trout and staging area for adults. Historically, Isquulktp Creek would have theoretically supported moderate abundance of bull trout. The potential for a moderate number of juveniles and low numbers of small adults exists. Poor connectivity between existing populations in other areas of the basin appears to be limiting distribution due to undesirable conditions within the migratory corridor.

### **McKay Creek**

McKay Creek is a moderate-sized tributary that enters the Umatilla River near RM 50.6, just west of Pendleton, OR. It is approximately 36 miles long and its headwaters are in the Blue Mountains near the Umatilla/Union County line. The lower six miles of McKay Creek's hydrology is heavily influenced by the McKay Creek Reservoir and the earthen dam (RM 6) creates a complete passage barrier for migrating fish. The upper 30 miles is inaccessible to migrating fishes but is inhabited by abundant numbers of resident rainbow trout. Historically, it was a preferred destination for anadromous spawning activity (Chinook salmon and steelhead-rainbow trout). Habitat conditions still exist to support spawning and rearing for anadromous fish populations about McKay Creek Reservoir and earthen dam. The lower creek is encroached upon by residential housing developments and agriculture adjacent to both sides of the creek. The upper reach does have alternating agricultural land use (e.g., crops and grazing). The predominant crop is wheat and alfalfa but the encroachment of hill slopes prevents expansive crop fields.

### **West Fork Spring Hollow Creek**

West Fork Spring Hollow Creek is a small tributary to the Wildhorse Creek. It flows in a northwesterly direction from the foothills of Wildhorse Mountain and enters Wildhorse Creek at RM 13.8. West Fork Spring Hollow Creek is predominantly a non salmonid stream, but there are documented accounts of steelhead-rainbow trout presence.

### **Birch Creek and West Birch Creek**

Birch Creek is a major tributary that enters the Umatilla River near RM 48.5, five miles west of Pendleton, OR. Birch Creek extends 16 miles before meeting West Birch Creek in the City of Pilot Rock, OR. West Birch Creek is of moderate size and measures 10 miles in length. The Birch Creek Watershed headwaters are characterized by elevations up to 4,000 ft. above sea level.

#### *Birch Creek*

The topography of the Birch Creek Watershed is typical of the Blue Mountain foothills, with broad flat ridges bisected by moderately steep, constraining canyons with a variety of aspects across a broad valley floor. The valley floor is comprised of low and high terraces with much incidence of actively eroding banks with an overall lack of in-stream cover. Thin riparian transects contain sparse tree growth. Water temperatures and habitat conditions throughout Birch Creek are classified as marginal for salmonids. Several passage issues in the lower basin are in the process of being evaluated by the UAFHP and ODFW and are quite

problematic for migrating salmonids seeking more desirable conditions in the upstream areas of the watershed. The upper reaches consist of moderately-steep, closely orientated hill slopes that cradle the channel and support substantial tree growth, and cooler waters.

Diking and straightening practices have generally concentrated flows into one predominant channel. Therefore, secondary channels account for a small portion of the overall stream length. Much of the large wood in the Birch Creek Watershed was likely removed to clear lands for agriculture or for timber harvest reasons. The poor health of the banks is primarily attributed to land use practices, such as clearing, overgrazing, and channelization and flashy hydrographs. Due to the relatively high composition of fine substrate and eroding banks, turbidity levels can become relatively high during heavy rainfall events. Summer flows are very low and the surface flow deficiency is magnified due to irrigation withdrawals. Open sky exposure to the wetted channel is at generally undesirable and at excessive levels.

Mid to lower portions of mainstem Birch Creek are very entrenched and provide poor juvenile rearing habitat for salmonids. Many of these channels have lost connection with their historic floodplain. Their degree of entrenchment is extremely erosive and unstable and produces excessive sediments that fill in pools, embed spawning substrates and accelerate horizontal channel migration.

In addition to poor physical habitat features such as lack of in-stream cover, several water quality issues have been identified as limiting factors of salmonid-rearing production in the Birch Creek Watershed during the summer months. Excessive water temperature, bacteria and sediment loads were identified and listed by the Umatilla Basin TMDL committee. Birch Creek is listed as water quality limited for temperature, habitat modification, and iron concentrations on Oregon's 1998 303(d) list. Extremely low summer flows are very common and magnify the issues with the categorical TMDL and 303d listings.

Despite severe human impacts and limiting factors, the Birch Creek Watershed is the migratory corridor to some of the most important summer steelhead spawning tributaries in the Umatilla River Basin. Its tributaries continue to provide primary spawning areas for adult steelhead and it is a significant producer of steelhead juveniles.

### *West Birch Creek*

West Birch Creek land use is primarily rural-residential in the lower reach, crop production and grazing in the middle reach, and timber production in the headwaters. The typical vegetative portrait of the lower two-thirds of West Birch Creek is comprised of crop lands or grasses whereas the upper tributaries present a mosaic of diverse, multi-level grass/shrub/tree growth. West Birch Creek has been heavily impacted by agricultural developments along the majority of its length. There are significant quantities of water withdrawals (up to 100%) for agricultural uses, diked and straightened channels, areas of severe livestock grazing, and crop fields in close proximity to the stream channel.

The majority of fish that inhabit lower West Birch Creek in the summer are from the family *Cyprinidae*. CTUIR studies have shown that ratios of non-salmonids (dace, suckers, shiners) to salmonids were approximately 1,000:1 in lower West Birch Creek during the summer.

West Birch Creek has vast, extensive areas of favorable substrate and desirable slope characteristics. These features give the sub-watershed a favorable spawning potential, but numerous passage issues in the mainstem of Birch Creek hinder the overall potential of this

system. If passage and other habitat deficiencies are addressed, the projected potential of steelhead production in the Birch Creek Watershed could be quite impressive.

### **Umatilla River**

The Umatilla River originates on the west slope of the Blue Mountains, east of Pendleton, OR and flows 115 miles in a northwesterly direction to the Columbia River at RM 289. The basin has a drainage area of 2,540 mi<sup>2</sup> (6,579 km<sup>2</sup>). The basin's hydrologic unit number is 17070103. Many reports describing the Umatilla River are available on the following BPA website at URL: <http://www.efw.bpa.gov/integratedfwp/reportcenter.aspx>.

The Mid-Umatilla River has been highly altered by human development. Stream channel morphology and flows have been significantly altered by irrigation structures and withdrawals, channelization, development, and clearing of the riparian area and adjacent uplands (CTUIR 2008). Stream temperatures between RM 35 and 49 are positively influenced by cold water releases from McKay Reservoir and provide suitable rearing temperatures for salmonids. These releases elevate flows from 45 cfs to between 250 and 325 cfs (Yoakum, OR flow gage) and decrease water temperatures (CTUIR 2008). The gradient in this reach is relatively constant, and the increased flows provide abundant fast water habitat types (CTUIR 2008). Umatilla River stream temperatures in the 14 miles below the McKay Reservoir are comparable to those found in upper reaches near the headwaters (RM 80-90).

## **DESCRIPTION OF ESA LISTED AND SENSITIVE SPECIES IN THE UMATILLA RIVER BASIN PROJECT AREAS**

### **Bull Trout – Umatilla River Watershed**

Bull trout (*Salvelinus confluentus*) are a sensitive species in regard to habitat requirements in that they need complex conditions in addition to high quality cold water. Bull trout numbers have declined dramatically from historical levels in the Umatilla Subbasin due to degraded habitat conditions and the species is classified as “threatened.” Adult bull trout population estimates for the entire Umatilla Subbasin number approximately 500 individuals. The North Fork of the Umatilla River holds approximately 85% of the basin's bull trout, three fourths of which are located between RM 3-6. The low numbers and concentrated distribution pattern of bull trout in the Meacham Creek Watershed categorizes the population as “increasing threat” and “high risk” of extinction. Not surprisingly a report on the status of Oregon's bull trout (Buchanan and Gregory 1997) classified the small bull trout population in Meacham Creek as “high risk”.

It is currently believed that adult bull trout in the Umatilla Subbasin move downstream in late fall to over-winter in the mainstream Umatilla River where seasonal growing conditions are more suitable. In the springtime, as water temperature begins to increase, adults migrate back into cooler headwater areas. Most bull trout in the Umatilla Subbasin are residential, showing only limited migratory patterns. The limited movement appears to be an evolutionary adaptation due to the vast detrimental impacts to habitat quality and quantity.

## **Bull Trout – Meacham Creek Watershed**

Meacham Creek is classified as critical habitat for bull trout due to its historical importance, knowledge of inhabitance, and potential for connectivity with the core population located in the North Fork Umatilla River. Bull trout numbers in the Meacham Watershed are highest in the headwater tributaries, and considerably lower in the mainstem (Andrus and Middel 2003). An estimated 15 bull trout inhabit the lower 15.3 miles of Meacham Creek during the summer months. It is suspected that bull trout staging in lower Meacham Creek during this time have migrated in from the upper Umatilla River or North Fork Meacham Creek. Population levels of sexually mature bull trout in the entire Meacham drainage is estimated at less than 50 individuals, most of which are located in the North Fork Meacham Creek, which joins the mainstem Meacham Creek at RM 15.5.

Bull trout have never been documented in Camp Creek. Year-round hospitable habitat is found in only a minority of the Meacham Watershed, generally near cold water inflows or relatively deep pools with additional desirable qualities such as shade and cover. Therefore a migratory life stage component would appear beneficial to Meacham's bull trout population. Two sub adult bull trout were observed in Meacham Creek, RM 6-7, during July fish salvage operations as part of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project described later in this document.

The habitat conditions for bull trout in the mainstem of Meacham Creek are severely limited and currently classified as marginal at best. Meacham Creek currently lacks both the quantity of complex habitat, and water quality essentials associated with systems that have strong populations of bull trout.

Current bull trout management strategy concentrates on protective measures such as fishing restrictions and preventive monitoring of actions that may cause "take." Population estimate trends show moderate increases since 1998. The combination of education, protection and recovery efforts along with habitat enhancement and closed fishing seasons are probable explanations for the positive response.

Protecting the Meacham sub-population is important to preserve the genetic integrity of the species as well as to enhance the migratory corridor from a connectivity standpoint with the primary core population located in the North Fork Umatilla River. The potential for connectivity improves the odds of species preservation over time, especially during catastrophic events and diversifies evolutionary genetic exchange between populations when conditions dictate the necessity for such. Proposed UAFHP restoration activities are intended to improve the status of bull trout in the Meacham Creek watershed by accommodating the specific needs of the species in an effort to increase numbers of this fragile sub-population over time.

## **Steelhead Trout – Birch Creek Watershed and Meacham Creek Watershed**

NMFS listed summer Middle Columbia River Steelhead as an Ecologically Significant Unit in 1999. In the Umatilla Subbasin, the wild steelhead run is supplemented with hatchery stock. Many of the returning hatchery fish reproduce naturally. A portion of wild adults are trapped upon their return from the ocean and spawned artificially at hatchery facilities.

## **Birch Creek Watershed**

The Birch Creek Watershed was historically, and continues to be, a major producer of summer steelhead trout, but the current population of this ESA-Listed species is at a fraction of historic levels due to detrimental anthropogenic impacts. However, the watershed is considered a primary destination for summer steelhead spawning in the Umatilla Subbasin. Steelhead-rainbow trout have proven to be best suited for conditions in the Birch Creek Watershed and are the most abundant salmonid species. The dominance of this species can be attributed to the beneficial timing of life cycle characteristics and the resilient adaptation to changing conditions in the basin, which has given the species a competitive advantage over other salmonids.

## **Meacham Creek Watershed**

From 1993-2008, CTUIR established several fish sampling sites throughout the Meacham Creek Watershed. The sites were sampled for fish several times annually, usually during the spring, summer and fall periods. Results showed that densities of captured salmonids were highly variable during different times of year, indicating strong migratory patterns and turnover. Rainbow/steelhead trout are the most abundant salmonid species in the Meacham Creek Watershed throughout the year.

## **Unlisted, Sensitive Species of Significance to Tribal Culture: Middle Columbia Spring Chinook Salmon**

Spring Chinook salmon were extirpated from the system in the early 1900s due to seasonal passage issues in the lower Umatilla River caused by irrigating dams and dewatering. A neighboring strain of spring Chinook salmon has been successfully reintroduced in the Umatilla River using hatchery supplementation techniques. A plethora of management strategies have been successfully exercised in effort to reestablish the species. The abundance of naturally produced juveniles has substantially increased in recent years, and adults now return to the Subbasin annually. Meacham Creek supports all age classes of spring Chinook salmon which shows an increasing trend of abundance. However, there is little evidence of use by juvenile or adult spring Chinook salmon in Birch Creek.

## **METHODS, RESULTS, AND DISCUSSION OF 2011 STATEMENT OF WORK DELIVERABLES**

This section describes methods and results, and discusses completed work elements in an outline similar to our statement of work in Pisces. Each work element with associated identifier code and milestone are listed, followed by a comprehensive summary of completed work under each work element.

### **Work Element A: 185. Produce Pisces Status Report** **Work Element Title: Periodic Status Reports for BPA** **Milestone Deliverable: Complete Periodic Pisces Status Reports**

CTUIR reported to BPA periodically during the contract period on the status of each statement of work element, and milestones and deliverables using the computer program Pisces:

- February-March (2/1/2011-3/31/2011)
- April-June 2011 (4/1/2011 - 6/30/2011)
- July-September 2011 (7/1/2011 - 9/30/2011)
- October-December 2011 (10/1/2011 - 12/31/2011)
- Final January 2012 (1/1/2012 - 1/31/2012)

The BPA Contracting Officer Technical Representative (COTR) reviewed the Pisces status reports, recommended changes as necessary and accepted them electronically upon approval. Additionally, upon completion of each deliverable milestone, we provided metrics and final project location (latitude and longitude) when required. These Pisces status reports provide a tool for the BPA COTR and administrative staff to track project progress in meeting contract requirements.

### **Work Element B: 119. Manage and Administer Projects** **Work Element Title: Manage and Administer Project** **Milestone Deliverable: Upload Statement of Work, Budget, Property Inventory for Upcoming Contract Period to Pisces**

- A. Per COTR, revise/finalize the new contract package (statement of work, environmental compliance documentation, budget, and property inventory).
- B. Accrual – submit September estimate to BPA.
- C. Funding package – conduct internal review (e.g., supervisor or interagency).

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 property inventory to the assigned BPA COTR for the following contract period. The project leader reports quarterly or as necessary on milestones and metrics to BPA using the BPA Pisces Program, supervises, trains, and directs staff activities, conducts vehicle and equipment maintenance and management, performs payroll, purchasing, subcontracting for services, and administers habitat enhancement activities.

### **Work Element C: 165. Produce Environmental Compliance Documentation** **Work Element Title: Produce Environmental Compliance Documentation** **Milestone Deliverable: Receipt of Environmental Compliance Clearance from BPA**

The following milestones were contracted for FY2011 projects:

- A. Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1 environmental compliance package.
- B. Meacham Creek Natural Channel Design and Levee Modification Project RM 2.4-4.4 environmental compliance package.
- C. Meacham Creek Natural Channel Design and Levee Modification Project RM 7.1-8.5 environmental compliance package.
- D. Meacham Creek Fence Construction and Maintenance Project environmental compliance.
- E. Birch Creek Peterson Dam Removal Project environmental compliance.
- F. Birch Creek Broun (Garton) Dam Removal Project environmental compliance.
- G. Birch Creek Taylor Dam Removal and Habitat Restoration Project environmental compliance package.
- H. Herbicide use proposals and application summaries for project.
- I. Isquilktppe Watershed South Boundary Fence Construction Project environmental compliance.

CTUIR successfully submitted all applicable and required documents to the appropriate federal, tribal, state, county entities for select implementation projects in a timely manner required under work elements related to producing environmental compliance documentation in FY2011. Secondary environmental compliance accomplishments during the reporting period included coordination with various compliance personnel to prepare supplemental documentation and reporting for ongoing and planned management actions. Environmental compliance methods include development of appropriate documentation under various federal, Tribal, state and county laws and regulations governing federally funded project work. Methods involve coordination with various federal and state entities agencies and development and submittal of permit applications, cultural clearances, biological assessments, National Environmental Policy Act checklists, etc., as necessary. Part of the environmental compliance work element includes planning and developing site-specific proposals tailored to accomplish fisheries goals and meet compliance standards. The details concerning the implementation of treatments and preparations for putting efforts on the ground, including preparations for subcontracting, and specifics in regarding the safeguarding of ESA-Listed species during the implementation process are outlined in the proposals.

#### Cultural Resource Protection and Preservation

CTUIR submitted a letter and attachments with necessary project descriptions and geo-referenced maps on November 6, 2011 for assisting BPA with section 106 National Historic Protection Act consultations and environmental compliance. The following projects were submitted for compliance:

- 1) Meacham Creek Floodplain Restoration and In-stream Enhancement Project RMs 7.0 to 8.5,
- 2) Meacham Creek Natural Channel Design and Levee Modification Project RM 2.4-4.4,
- 3) Birch Creek Taylor Diversion Dams Removal and Habitat Restoration Project RM 0-1.0, and
- 4) West Birch Creek Low Barrier Removal and Habitat Restoration Project RM 5-6.

The CTUIR DNR Cultural Resource staff completed the cultural resource project area surveys and reports and submitted to BPA for cultural resource compliance with the State Historic Preservation Office (SHPO) and Tribal Historic Preservation Office (THPO) for all projects with the exception of the Meacham Creek Natural Channel Design and Levee

Modification Project RM 2.4-4.4. The survey was completed but the report will be completed at a later date.

#### UAFHP Environmental Compliance Documentation

ESA consultation with NMFS for FY 2011 project activities was covered under the Terms and Conditions of the HIP II Programmatic Biological Opinion (HIP II BO). Project activities covered under the HIP II BO included:

- Develop RM&E Methods and Designs (I: 156): Incorporate developed strategic and scientifically accepted monitoring methods for application. Conduct necessary experiments (e.g., tracer release experiments, thermographs in ground and surface water, and floodplain piezometers) to assess the hydrologic dynamics and spatiotemporal patterns of ground- and surface-water in proposed restoration reaches.
- Collect/Generate/Validate Field and Lab Data (J: 157): Juvenile production surveys and salvages were completed in relationship to habitat projects. Fish densities, species composition and biometric data were collected and analyzed for pre- and post-project implementation comparisons. Fish were salvaged (moved) as needed to safe refuge during in-stream project work. Conducted aquatic habitat inventory baselines (e.g., tracer release experiments, thermographs in ground and surface water, and floodplain piezometers) necessary to assess the hydrologic dynamics and spatiotemporal patterns of ground- and surface-water in proposed restoration reaches as it relates to summer steelhead, spring Chinook salmon, bull trout and Pacific lamprey.
- Maintain Vegetation (L: 22 and V: 22): Irrigated vegetation and removed noxious weeds (hand, tractor mow and till) to maximize survival of riparian plantings on existing and new easement and project locations.
- Plant Vegetation (M: 47): Supplemented riparian areas, existing and new projects, with additional vegetation.
- Remove Vegetation (N: 53): Physical and/or chemical treatment of noxious weeds on 109 acres of riparian non-wetland habitat and 403 acres of upland non-wetland habitat.

#### Meacham Creek Floodplain Restoration and In-stream Enhancement Project RMs 6.0-7.0 Environmental Compliance Documentation

The Meacham Creek Floodplain Restoration and In-stream Enhancement Project RMs 6.0-7.0 project planning and design began in December 2009. Funding for the Meacham Creek project is provided by the Bonneville Power Administration (BPA), a federal agency under the Department of Energy. This project area occurs on both National Forest System land and CTUIR fee lands. Under Section 7 of the Endangered Species Act (ESA) all federal agencies must, through consultation with the USFWS and the NMFS, ensure that that actions which they authorize, fund, or conduct are not likely to jeopardize the continued existence of threatened or endangered species or adversely modify their habitats. Therefore, both CTUIR and the USFS had to demonstrate Section 7 compliance.

Habitat for endangered and threatened species listed under the ESA was identified in the Meacham project focus area: bull trout (and designated critical habitat; project area is within the Umatilla-Walla Walla recovery area) and steelhead (middle Columbia River DPS).

The following permits and approvals were required for the project:

- NMFS. Endangered Species Act Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation

- Recommendations for the Meacham Creek Floodplain Restoration Project. Issued December 3, 2010.
- USFWS. Biological Opinion for the Meacham Creek Restoration Project. Issued December 14, 2010.
- U.S. Army Corps of Engineers Nationwide Permit No. 27 (Aquatic Habitat Restoration, Establishment, and Enhancement Activities) and 33 (Temporary Construction, Access, and Dewatering). Issued February 3, 2011.
- USFS Categorical Exclusion Decision Memo. Issued April 8, 2011.
- USFS notification provision (FS Agreement No. 11-PA-11061400-003) established between the CTUIR and USFS. Issued April 8, 2011.
- Oregon Department of State Lands Removal/Fill Permit No. 46087-RF. Issued March 17, 2011.

**Work Element D: 132. Produce Annual Progress Report**

**Work Element Title: Produce Annual Progress Report for the Fiscal Year 2009 Period (February 2009) to (January 2010)**

**Milestone Deliverable: Attach 2009 Annual Progress Report in Pisces**

- A. Review progress report format requirements
- B. Internal agency/tribal review of draft
- C. Revisions in response to review of draft
- D. Submit progress report for external review
- E. Submit draft for technical/co-manager review
- F. Finalize report

CTUIR UAFHP staff combined the FY 2009 BPA Annual Report for contract period (February 2009 to January 2010) with the FY 2010 contract period report (Work Element E:132) as one report. The FY 2009-2010 BPA Annual Report was completed and uploaded to BPA through Pisces in September 2012.

**Work Element E: 132. Produce Annual Progress Report**

**Work Element Title: Produce Annual Progress Report for the Fiscal Year 2010 Period (February 2010) to (January 2011)**

**Milestone Deliverable: Attach 2010 Annual Progress Report in Pisces**

- A. Review progress report format requirements
- B. Internal agency/tribal review of draft
- C. Revisions in response to review of draft
- D. Submit progress report for external review
- E. Submit draft for technical/co-manager review
- F. Finalize report

CTUIR UAFHP staff combined the FY 2010 BPA Annual Report for contract period (February 2010 to January 2011) with the FY 2009 contract period report (Work Element D:132) as one report. The FY 2009-2010 BPA Annual Report was completed and uploaded to BPA through Pisces in September 2012.

**Work Element F: 114. Identify and Select Projects**

**Work Element Title: CTUIR Umatilla Subbasin Restoration Coordination**

**Milestone Deliverable: List of Final Projects**

- A. Coordinate regularly with project partners and landowners
- B. List projects

CTUIR UAFHP staff annually coordinated and planned projects with State, Federal, and local partners, and private landowners to develop habitat restoration and enhancement projects consistent with local planning documents. CTUIR project development is guided and prioritized by project activities that are supported by the CTUIR Department of Natural Resources ecological and First Foods mission statements to enhance or protect ecological and physical processes thus sustaining biota production (Jones et al., 2008). The CTUIR is guided in its habitat restoration activities by multiple planning documents:

- 1) Final Umatilla Willow Subbasin Plan (Umatilla/Willow Subbasin Planning Team 2005),
- 2) Middle Columbia River Steelhead Recovery Plan (NMFS 2009),
- 3) Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan (USFWS 2002), and
- 4) Five-Year Action Plan for the Development and Maintenance of Habitat Improvement Projects in the Umatilla Subbasin: 2006-2010 for BPA-Funded Fish Habitat Improvement Programs sponsored by: Oregon Department of Fish and Wildlife (ODFW) and Confederated Tribes of the Umatilla Indian Reservation (CTUIR and ODFW 2006).
- 5) Meacham Creek Watershed Analysis and Action Plan (Andrus & Middel, 2003)

Projects were identified, prioritized and developed with project partners (ODFW, UBWC, and SWCD) who implement restoration projects within the Umatilla River Basin. Projects that were ranked by priority, CTUIR identified funding sources and projects were prepared for planning, engineering design, permitting and implementation and included in the FY 2012 BPA statement of work and budget.

#### **Work Element G: 122. Provide Technical Review**

**Work Element Title: Review and Provide Technical Input on Issues and Topics that Affect the Areas Natural Resources**

**Milestone Deliverable: Provide Technical Input and Summaries to Enhance or Protect Natural Resources in the Subbasin**

- A. Conduct review and provide input as necessary on natural resource preservation issues.
- B. Review and provide technical input on issues that may adversely affect natural resources.

CTUIR UAFHP staff reviewed and provided technical input as applicable on plans and proposals by entities within the Umatilla River Basin that may adversely impact floodplain or riverine processes and biota productivity, public project planning relevant to floodplain, river and wetland restoration or impacts, development and review of grant funding proposals, and proposed landowner projects. Project staff provided input to multiple CTUIR departments on annual activities relevant to work within the floodplain, rivers, and wetlands, US Army Corps of Engineers/Oregon Division of State Lands removal-fill permit applications, and CTUIR Stream Zone Alteration (SZA) Permit applications on work proposed within the floodplain on Reservation land.

#### **Work Element H: 191. Watershed Coordination**

**Work Element Title: Umatilla River Watershed Coordination Duties**

**Milestone Deliverable: Coordinate Watershed Association Activities**

- A. Coordinate with NRCS and local conservation districts
- B. Coordinate with Umatilla Basin Watershed Council
- C. Coordinate with co-manager ODFW and other Federal agencies
- D. Network with professionals in the field of habitat restoration

CTUIR UAFHP staff participated and coordinated with multiple agencies and stakeholders in the Umatilla River Basin including ODFW, USFS, NRCS, conservation districts, USFWS, Umatilla Basin Watershed Council and local stakeholders to enhance natural resources, identify problems and solutions, coordinate efforts to prevent duplication, enhance communication and cooperation and identify funding and cost share opportunities within the Umatilla River Subbasin. Staff further coordinated with other agencies in planning and implementing partner habitat restoration and enhancement projects, ESA planning processes, and project prioritization and selection processes. We prepared agreements, if necessary, to assign duties and responsibilities to the appropriate entities. We also developed documents, press releases, web sites, and other communications to impart information to participating stakeholders and the public.

In 2010, CTUIR and ODFW habitat project staff partnered to organize and establish the Umatilla Basin Restoration Team (Restoration Team). The first official meeting of the Restoration Team was April 2, 2010. The Restoration Team is an informal group formed of agency or entity representatives that do restoration work within the Umatilla River Subbasin floodplain and riverine system. Initial members included CTUIR, ODFW, conservation districts, USFWS, USFS, The Freshwater Trust, NRCS, UBWC, and the Columbia-Blue Mountain Resource Conservation & Development Council.

The purpose of the Restoration Team was established to build a coordinated and strategic approach to the restoration of habitat in the Umatilla Basin. Identified benefits of the Restoration Team include:

- 1) Have similar objectives in our mission statements, and where our mission statement objectives are unique we have an opportunity to utilize that uniqueness as a team,
- 2) Opportunity to share long range objectives and forecasted work activities,
- 3) Coordination meetings and correspondence can be used as a venue for identifying projects, and working together towards accomplishing restoration work in the Umatilla Basin,
- 4) Facilitate grant writing, and
- 5) Local economic project benefit of matching dollars to facilitate projects through money contribution, manpower, equipment or expertise.

The Restoration Team met monthly for the first couple months in development of the team and now has settled on quarterly meetings. The Restoration Team agreed the primary focus area was the Umatilla River/Willow Creek Basin. Initially, CTUIR UAFHP staff organized the first couple meetings, created agendas and provided meeting notes. The UBWC Coordinator is now responsible for organizing meetings and providing meeting agendas and minutes. The Restoration Team will be the future vessel for fish habitat restoration coordination the Umatilla River Basin.

In 2011, CTUIR UAFHP staff updated the Restoration Team, UBWC, CTUIR Committees and Commissions, and permitting agencies on project activities by presentation and in writing on project activities. Our primary project was the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RMs 6.0-7.0.

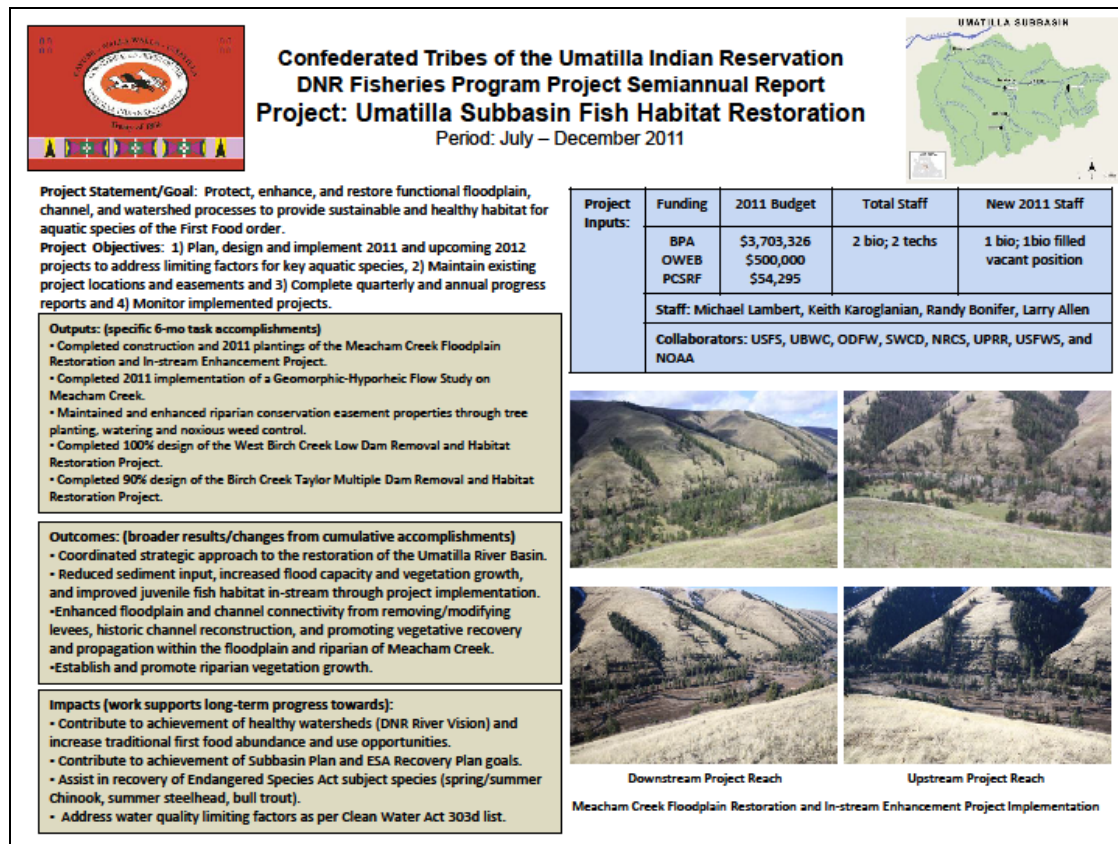
**Work Element I: 99. Outreach and Education**

**Work Element Title: Public Outreach and Education**

**Milestone Deliverable: Complete Outreach and Education Activities**

CTUIR UAFHP staff educated the public on natural resource protection and restoration principles, and communicated on project activities throughout the year. This work included giving project tours and presentations (field, written, and verbal) and participating in local and regional workshops, symposia and/or conferences (training, project presentation, and memberships), newspaper articles and public education (local school districts or college programs).

CTUIR UAFHP staff completed CTUIR semi-annual reports summarizing project objectives and outputs, expected outcomes, and resulting impacts of project restoration activities (Figure 5). These reports are used by the CTUIR Department of Natural Resources to inform CTUIR staff and government officials, other agencies and entities, and the public of project activities.



**Figure 5. CTUIR semi-annual report for the Umatilla Subbasin Fish Habitat Restoration Project, July – December, 2011.**

**Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1**

The Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7, was a historic partnership between CTUIR and USFS that restored processes in Meacham Creek that create and maintain habitat complexity (See Section **SELECTED FY 2011 FISH HABITAT ENHANCEMENT AND RESTORATION ACTIVITIES**). A partnership and project of this significance and magnitude was one that demanded the spotlight. A high level

of coordination between the USFS and CTUIR went into ensuring a consistent, common, and clear message was portrayed to our local communities. This project received attention throughout the region and country for its success. Additionally, the community was involved in the fish relocation and replanting portions of the project. In April 2012, Mike Lambert, the CTUIR Umatilla Basin Program Manager, received the “Rise to the Future” award from the USFS for “Collaborative/Integrated Aquatic Stewardship.” This was to recognize his work leading the Meacham Creek restoration and coordinating with the USFS.

Communication education and involvement were integral to the success of the Meacham Project. Nearly 140 people from partner agencies and organizations participated in a five-day fish rescue and relocation. The USFS personnel from multiple departments joined forces with local youth, two Conservation Corps crews, Tribal members, and State and Federal officials including the NMFS in the hands-on fish removal. The Meacham Project area was replanted and reseeded with the help of the community; elementary, high school, and college students; and agency personnel. The CTUIR, ODFW, UBWC and USFS were involved with outreach and education efforts and provided materials and supplies for the fish removal and replanting and reseeding efforts. This project offered students and youth an opportunity to be involved with a hands-on restoration project and learn about the various issues and functions of our local watershed and environment (Figure 6).

In June 2011, multiple newspaper articles were written on the Meacham Project by local community newspapers. The Confederated Umatilla Journal published a feature multi-page article entitled “Restoring the Meander in Meacham Creek.” The story highlighted the project’s partnership approach and benefits to the watershed, endangered species, and community (<http://www.umatilla.nsn.us/cuj%20june%202011.pdf>). The East Oregonian on June 30, 2011 featured a multi-page article entitled “Setting a new course, the CTUIR rebuilds a one-mile section of Meacham Creek.” The story highlighted the floodplain and channel restoration work in the historic context of the watershed.

Several stories about the Meacham Project were also featured by web and television in 2011. NOAA Fisheries Service published a story, “Down in the Coulees of Meacham Creek, Floodplain Restoration Spurs Recovery of Middle Columbia River Steelhead,” highlighting the contribution of the project to endangered species recovery. NOAA asserted “Thanks to this on the ground action, the future looks bright for Middle Columbia River steelhead.” In addition, The Columbia Basin Bulletin posted a story on June 3, 2011 article “Umatilla Project Rebuilds Miles of Creek Channel to Restore Salmon, Steelhead, Bull Trout, Lamprey (<http://www.cbbulletin.com/409526.aspx>).” Furthermore, on August 22, 2011 Oregon Public Broadcasting Northwest Public Radio made public a written story and audiovisual story, “A Railroaded Oregon Creek Recovers From its Past (<http://earthfix.opb.org/water/article/meacham-creek-restoration-nears-completion/>).” This story was also run on the radio for several weeks following release. Lastly, The Northwest Indian News developed a video “Meacham Creek Restoration” highlighting the cultural significance of Meacham Creek and the restoration work underway to protect and restore floodplain/channel processes for enhanced fish habitat in order to restore CTUIR native foods (<http://www.nwin.tv/NWIN51.html> ).

Project and managerial staff from CTUIR and USFS led many public tours of the Meacham Creek Project during and after construction in 2011. A professional handout outlining a common message of the project including background, partners, strategies, goals, objectives and monitoring was developed for message consistency amongst agencies.



**Figure 6. Community Education and Involvement on the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7, 2011.**

**Community Education**

CTUIR UAFHP staff has participated in educational activities in the Umatilla River Basin specific to floodplain and riverine restoration. Two annual educational opportunities that we participate in include the 5<sup>th</sup> Grade Watershed Field Days organized by the Umatilla County SWCD and the CTUIR organized Seeds of the Future Building Workshop. The 5<sup>th</sup> Grade Watershed Field Days are multiple workshops throughout Umatilla County where 5<sup>th</sup> grade classes from all local school districts participate in a one-day outside workshops in April. Students rotate hourly through stations that cover hands-on educational material on plants, soils, macro-invertebrates, water quality, orienteering, and streambank stabilization. Our staff teaches the streambank stabilization class where we educate students on natural streambank processes and benefits of stable riparian vegetation. We show comparisons between an unstable and stable bank and discuss reasons for the differences. Lastly, kids

participate with CTUIR staff in planting 300 native plant 12 cubic inch plugs within the riparian. About 250 students and 25 adult teachers and assistants participate in the educational workshop.

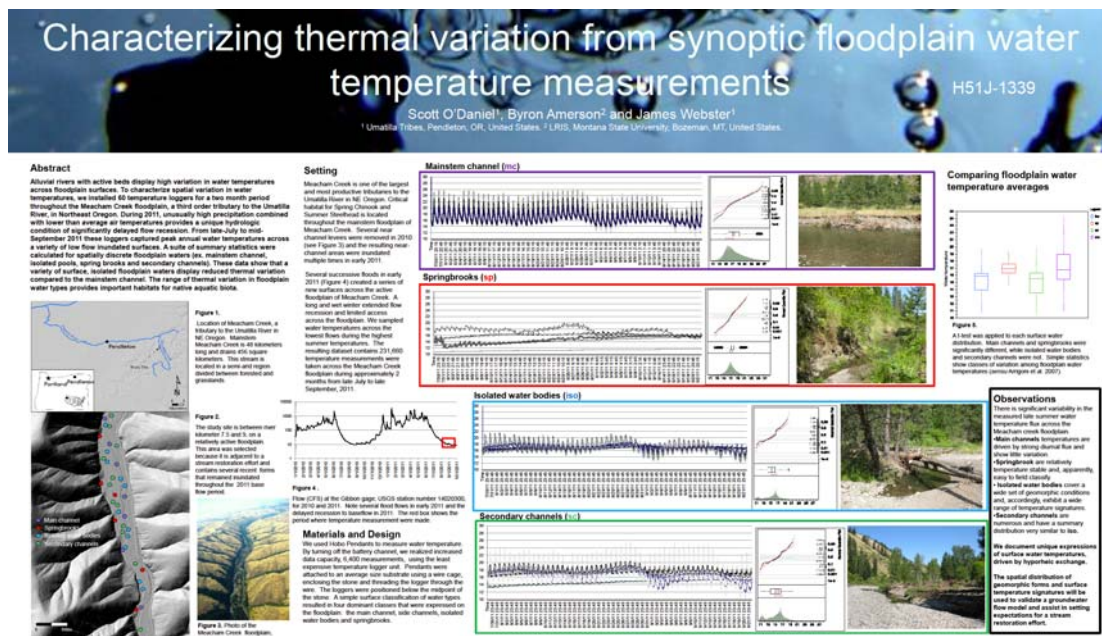
Another educational activity our staff participated in is the Seeds for the Future Building Workshop. Each November, the natural resource students from the University of Idaho (U of I) and CTUIR DNR staff participate in a two day workshop in Pendleton, Oregon. This is an annual service learning partnership to foster a significant means of integrating student learning from the Tribes perspective and sharing about our community across state, cultural, and landscape boundaries. U of I students assisted in CTUIR UAFHP staff in planting native vegetation at the Meacham Creek Floodplain Restoration and In-stream Enhancement Project for an entire day on October 20<sup>th</sup>, 2010 (Figure 6). About 40 college students and several professors participate in the workshop.

**Professional Workshops and Working Groups**

Project staff also developed and fostered relationships with participating experts in related fields by attending training, professional workshops and working groups, and gained professional advancement and improved project success through informative, instructional interactions. CTUIR UAFHP and DNR Fisheries Habitat Program staff attended multiple professional conferences and workshops, and participated in oral and poster presentations of project activities including:

American Geophysical Union (AGU) Annual Conference (November 2011)

**Characterizing thermal variation from synoptic floodplain water temperature measurements – Scott O’Daniel, CTUIR, Pendleton, OR (co-authors: Byron Amerson and James Webster (Figure 7)**



**Figure 7. Staff poster presented at the AGU 2011 Annual Conference, November 2011, San Francisco, California.**

Workshop of Project Synthesis for Watershed Restoration

**Workshop developed through partnership between the CTUIR Fisheries Habitat Program and GeoEngineers, Inc. – Panel Moderator James Webster** (CTUIR Habitat Program Supervisor), CTUIR, Pendleton, OR and **Wayne Wright**, (Water & Natural Resources Director, GeoEngineers, Inc.).

**Overview and Setting:**

The purpose of this workshop was to unite CTUIR Fisheries Habitat Program with professional staff of GeoEngineers, Inc. to collaboratively develop workshop components for understanding watershed restoration project development (conception to construction). The program approach was as followed: A GeoEngineers staff member or associate teammate with professional credentials in a specific area of expertise teamed up with a CTUIR Fisheries Habitat Program staff member to prepare a 2-hour training brief (PowerPoint presentation) based on five program elements:

- Project identification/Conceptualization
- Geomorphic Setting and Project Tapestry Development
- Project Design Process
- Permitting and Subcontract Development
- Project Construction

This approach intended to 1) unite the private consulting side with the Tribal government side to generate a better understanding of the entire process used to address various watershed restoration efforts, 2) provide a forum for learning a gamut of topics related to watershed restoration development, and 3) provide an opportunity for building team relationships. This comprehensive effort was a thorough approach to presenting the basic steps taken to plan, design and construct a river restoration (or related) project.

**Work Element J: 156. Develop Research, Monitoring and Evaluation Methods and Designs**

**Work Element Title: Incorporate Developed Strategic and Scientifically Accepted Monitoring Methods for Application**

**Milestone Deliverable: Produce Methods for Monitoring Project Effectiveness**

- A. Assist in refining aquatic habitat inventory assessment methodology for restoration projects.
- B. Implement biological monitoring protocol to show fish community response to habitat components.

The CTUIR has and continues to invest substantial resources in restoring the sustainability of five Columbia subbasins that constitute the ceded lands, including the Umatilla subbasin. The Umatilla River Vision (Jones et al. 2008) describes well the rationale for these investments in relationship to the importance of first foods to the future of the Tribal people. In 2009, CTUIR began development of a conceptual bio-monitoring design that evaluates the biotic outcomes from restoration actions throughout the five subbasins to ensure that investments result in actual improvements to the biological productivity.

Detection of measurable changes in biotic conditions, specifically changes to survival and productivity of various salmon life stages, is presumed to be predicated on habitat improvements that result from directed restoration actions taken by CTUIR. Such changes in physical habitat characteristics will be tracked by CTUIR UAFHP staff, and the resulting data

will substantially contribute to elements of the study design for this biotic monitoring program implemented by the CTUIR Fisheries Monitoring and Evaluation Program. The relationship between the physical conditions, carrying capacity and productivity of the habitat is thus foundational to the approach taken to measure improvements in life cycle characteristics of target native fish populations, over many generations.

The overall goal of the bio-monitoring design is to understand how the restored ecological processes that maintain essential functions and increased habitat complexity individually and accumulatively affect spring Chinook, summer steelhead and bull trout in the five subbasins. Coinciding with the bio-monitoring design, project staff developed monitoring strategies in relationship to habitat restoration actions that specifically address fish limiting factors. In 2011, our project continues to incorporate developed monitoring strategies in relationship to the bio-monitoring design into ongoing subbasin project work. Developed monitoring protocols and methods were uploaded on the Pacific Northwest Aquatic Monitoring Partnership website (MonitoringMethods.org) as part of contract responsibilities. Results derived from associated methods are incorporated into the annual report.

**Work Element K: 157. Collect/Generate/Validate Field and Lab Data**

**Work Element Title: Monitoring and Evaluation CTUIR Umatilla Anadromous Fish Habitat Project**

**Milestone Deliverable: Complete Data Collection and Summarized Findings**

- A. Environmental compliance requirements complete.
- B. Analyze suspended solids and turbidity data from project area streams.
- C. Analyze fish population data in relation to habitat enhancement project areas.
- D. Analyze macroinvertebrate data from project area streams.
- E. Conduct photo point documentation of project conditions related to specified project areas.
- F. Geomorphic-Hyporheic flow study on Meacham Creek.
- G. Do aquatic habitat inventory baseline at project areas prior to implementation.

Data analysis and findings from biological and physical monitoring are incorporated into project planning, designs, permitting, environmental compliance, and pre- and post-project assessment of project response. Results of the findings are available in various outsourced reports and can be requested through CTUIR's UAFHP. A summary of applicable monitoring results can be found in the monitoring section later in the document.

**Work Element L: 22. Maintain Vegetation**

**Work Element Title: Maintain Trees and Shrubs, and Grass Seeding in Umatilla River Basin Habitat Enhancement Areas**

**Milestone Deliverable: Maximize Survival of Planted Trees and Shrubs in Enhancement Project Areas**

- A. Environmental compliance requirements complete.
- B. Water vegetation and reduce weed competition to improve survival at CTUIR pre-existing project areas.
- C. Water vegetation; reduce weeds to maximize survival of riparian plantings at new project sites.

Project activities conducted in FY2011 included the monitoring and maintenance of 23 conservation easements on 19 individual landowner properties. CTUIR personnel routinely maintain and replant vegetation, water and weed plantings, and maintain structural integrity

of riparian enclosure and livestock fencing at project sites. In FY2011, project staff began digitally GPS surveying individual landowner property lines where conservation easements exist for development of an ArcGIS data base. This will provide a tool for tracking management of acreage and conservation project activities. UAFHP staff manually maintained noxious weeds around plants on tarps within CREP project areas. More emphasis was placed on maintaining vegetation within the Peterson easement located on Birch Creek, river mile 2.6-3.1. An irrigation system was installed to water newly planted willow stakes and whips along the FY2010 restored banks for spring and summer water maintenance. From April 6-8, 2010, project staff repaired fence enclosures on Meacham Creek for excluding cows within a 7-mile maintained project area.

**Work Element M: 47. Plant Vegetation**

**Work Element Title: Supplement Riparian Areas of Existing and New Projects with Additional Vegetation**

**Milestone Deliverable: Complete Scheduled Tree and Shrub Plantings in Project Areas**

- A. Environmental compliance requirements complete.
- B. Agreement with the Native Plant Nursery for growing plants and developing plant protocol.
- C. Establish planting locations in existing project areas for increased recovery.
- D. Establish improved vegetative conditions in new project areas.

The UAFHP staff annually plant vegetation and distribute native grass seed in areas we have implemented existing or new habitat enhancement projects or have identified a need in maintained riparian conservation easement areas. In 2011, project staff focused the entire spring and fall planting season within the newly implemented Meacham Creek Floodplain Restoration and In-stream Enhancement Project (RM 6.0-7.0) area (WE's P29 & Q180). As part of the project planting plan, CTUIR staff planted 6,817 potted plants and 10,000 willow cuttings by hand and mechanical means (Table 1).

Planting tasks include site planning and development of planting strategies, collection and preparation of materials (pruning and conditioning of live willow material), pre-order coordination with the CTUIR Tribal Native Plant Nursery, and installation. Planting techniques are customized for conditions within each project area. Planting location, species, age, form (cuttings, saplings, bare-roots, potted, plugs), and soil/substrate conditions were considered and addressed during the implementation planning phase. The CTUIR UAFHP staff work closely with the Tribal Native Plant Nursery to collect local seed and plant stock to provide native plants for particular project areas by elevation and planting zones.

**Work Element N: 53. Remove Vegetation**

**Work Element Title: Control of Noxious Weeds in Project Areas by Physical and Chemical Means**

**Milestone Deliverable: Treat 512 Acres (109 Riparian and 403 Upland) in Enhancement Areas**

- A. Environmental compliance requirements complete.
- B. Physical removal of non -preferred species of vegetative growth from project areas.
- C. Weed control in project areas by chemical means.

Noxious and/or undesirable weeds are controlled through hand and mechanical removal, and herbicide and biological control applications in project areas. Weed control is essential in

establishing native grass and plant species. CTUIR subcontracts a professional, licensed applicator to spray/control noxious weeds on sites where chemical application is necessary. CTUIR complies with BPA standards and supplies a report to BPA detailing the types and quantities of herbicides applied to specified locations. Biological controls are used in advantageous areas.

The frequency of watering, weeding and maintenance methods for each easement or project site varies. Strategies to address weeds are included in agreements that are either completed by the landowner, CTUIR, subcontractor, and/or through the County Weed Control Board. CTUIR staff provides assistance to landowners by coordinating and managing herbicide application vendors, providing funding, and developing treatment strategies. Manual, biological and chemical treatment options are utilized by CTUIR and may be employed when consistent with existing standards.

Noxious and/or undesirable weeds are controlled in project enhancement areas by a professional, licensed applicator. The contractor identifies problem weeds, determines the appropriate herbicide and selects the most effective application methods and rates in accordance with the National Oceanic and Atmospheric Administration's (NOAA) Biological Opinion under BPA's Habitat Improvement Program. The contractor utilizes handgun spraying, backpack spraying and wiper applications to treat perennial, annual and biennial weed species. All herbicide applications are consistent with Oregon Revised Statute (ORS).570.505 and Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Regulations.

Noxious and/or undesirable weeds are present on several project areas. As with our work on conservation easements, CTUIR subcontracts professional, licensed applicators to spray/control noxious weeds on several project sites. In FY2010, CTUIR removed noxious and/or undesirable weeds through mechanical, biological, or chemical means. CTUIR currently maintains 23 conservation easements on 19 individual landowner properties including 12 locations where CTUIR is obligated to control noxious weeds on 109 riparian non-wetland habitat and 403 upland non-wetland habitat acres in Wildhorse Creek, Umatilla River, McKay Creek, Spring Hollow Creek, Birch Creek and Meacham Creek. CTUIR complied with BPA standards and supplied a report to BPA detailing the types and quantities of herbicides applied to specified locations (Table 2). In 2011, CTUIR chemically treated 39 riparian non-wetland habitat and 89 upland non-wetland habitat acres (Table 2). These are ongoing work sites where environmental compliance has been cleared in prior contract periods.

In addition to the CTUIR UAFHP, the CTUIR DNR Range Department used goat grazing for biological control treatment of yellow starthistle along the canyon walls of Meacham Creek from river mile 1.0 to 4.0.

**Table 1. Planting materials and grass seed by species, quantity, and size, planted and established at Umatilla River Basin existing and new project sites, 2011.**

Water body	River mile	Date planted	Project site location	Species (Common Name)	Quantity	
					Trees/Shrubs	Seed (lbs)
Meacham Creek	6.0-7.1	Apr-June, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Willow species	3250 cuttings	
Meacham Creek	6.0-7.1	Oct-Nov, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Willow species	6750 cuttings	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Mountain Alder	216 1 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Red Osier Dogwood	1475 1,10,25 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Serviceberry	2030 2,5 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Black Hawthorn	396 1 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Wood Rose	1478 2 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Willow species	240 1 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Cottonwood	442 1 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Ninebark	408 1 gal pots	
Meacham Creek	6.0-7.1	Oct-Dec, 2011	Meacham Creek Floodplain Restoration and In-stream Enhancement Project	Snowberry	132 1 gal pots	

**Table 2. BPA form annually submitted by CTUIR listing actual herbicide application, both the active ingredient and adjuvant, by location within the Umatilla River Basin, 2011.**

LOCATION		6th HYDROLOIC UNIT CODE	ACTIVE INGREDIENT	ADJUVANT USED	RIPARIAN			UPLAND		
Township Range & Section (can be found in Pisces)	OR Latitude and Longitude				Estimate Acres Treated	Estimate of Total Volume of Herbicide Only (Gallons)	Application Method	Estimate Acres Treated	Estimate of Total Volume of Herbicide Only (Gallons)	Application Method
Umatilla R., Becker (Wolfè)	45° 39' 13.05" 118° 57' 28.66"	170701030703	Clopyralid	R-11	2	0.187 gal	hand wand / spot spraying			
Umatilla R., Becker (Wolfè)	45° 39' 13.05" 118° 57' 28.66"	170701030703	Chorsulfuron	R-11	2	1.5 oz (dry)	hand wand / spot spraying			
Umatilla R., Becker (Wolfè)	45° 39' 13.05" 118° 57' 28.66"	170701030703	Imazapic	R-11	1	0.094 gal	Mechanized			
Umatilla R., Becker (Wolfè)	45° 39' 13.05" 118° 57' 28.66"	170701030703	Aminopyralid	R-11	6	0.11 gal	Mechanized			
Umatilla R., Becker (Wolfè)	45° 39' 13.05" 118° 57' 28.66"	170701030703	Metsulfuron methyl	R-11	6	0.66 oz (dry)	Mechanized			
Umatilla R., Becker (Wolfè)	45° 39' 13.05" 118° 57' 28.66"	170701030703	2, 4D (amines)	R-11	6	0.375 gal	Mechanized			
Birch Cr., Peterson	45° 37' 54." 118° 51' 28"	170701030609	Aminopyralid	R-11				8	0.16 gal	Mechanized
Birch Cr., Peterson	45° 37' 54." 118° 51' 28"	170701030609	2, 4D (amines)	R-11				8	0.5 gal	Mechanized
Birch Cr., Peterson	45° 37' 54." 118° 51' 28"	170701030609	Metsulfuron methyl	R-11				8	1 oz (dry)	Mechanized
Birch Cr., Peterson	45° 37' 54." 118° 51' 28"	170701030609	Chorsulfuron	R-11				8	9 oz (dry)	Mechanized
Birch Cr., Peterson	45° 37' 54." 118° 51' 28"	170701030609	Aminopyralid	R-11				4	0.11 gal	Mechanized
Birch Cr., Peterson	45° 37' 54." 118° 51' 28"	170701030609	Metsulfuron methyl	R-11				4	0.4 oz (dry)	Mechanized
Birch Cr., Peterson	45° 37' 54." 118° 51' 28"	170701030609	2, 4D (amines)	R-11				4	0.125 gal	Mechanized
Birch Cr., Whitney	45° 37' 54." 118° 51' 28"	170701030609	Aminopyralid	R-11	3	0.11 gal	Mechanized			
Birch Cr., Whitney	45° 37' 54." 118° 51' 28"	170701030609	2, 4D (amines)	R-11	3	0.375 gal	Mechanized			
Birch Cr., Whitney	45° 37' 54." 118° 51' 28"	170701030609	Metsulfuron methyl	R-11	3	0.66 oz (dry)	Mechanized			
Birch Cr., Whitney	45° 37' 54." 118° 51' 28"	170701030609	Chorsulfuron	R-11	1	0.25 oz (dry)	hand wand / spot spraying			

**Table 2. Continued.**

LOCATION		6th HYDROLOIC UNIT CODE	ACTIVE INGREDIENT	ADJUVANT USED	RIPARIAN			UPLAND		
Township Range & Section (can be found in Pisces)	OR Latitude and Longitude				Estimate Acres Treated	Estimate of Total Volume of Herbicide Only (Gallons)	Application Method	Estimate Acres Treated	Estimate of Total Volume of Herbicide Only (Gallons)	Application Method
Birch Cr., Whitney	45° 37' 54." 118° 51' 28"	170701030609	Dicamba	R-11	1	0.187 gal	hand wand / spot spraying			
Birch Cr., Whitney	45° 37' 54." 118° 51' 28"	170701030609	Imazapic	R-11	1	0.046 gal	hand wand / spot spraying			
Spring Hollow Cr., Pambrum	45° 46' 4.96" 118° 32' 55.89"	170701030402	Aminopyralid	R-11	4	0.0625 gal	hand wand / spot spraying			
Spring Hollow Cr., Pambrum	45° 46' 4.96" 118° 32' 55.89"	170701030402	Metsulfuron methyl	R-11	4	0.4 oz (dry)	hand wand / spot spraying			
Spring Hollow Cr., Pambrum	45° 46' 4.96" 118° 32' 55.89"	170701030402	2, 4D (amines)	R-11	4	0.046 gal	hand wand / spot spraying			
McKay Cr., Cripes	45° 30' 30.79" 118° 42' 34.29"	170701030703	Triclopyr (TEA)	R-11				2	0.5 gal	Mechanized
McKay Cr., Cripes	45° 30' 30.79" 118° 42' 34.29"	170701030703	Chorsulfuron	R-11				1	0.12 oz (dry)	hand wand / spot spraying
McKay Cr., Hailey	45° 30' 31" 118° 41' 56"	170701030703	2, 4D (amines)	R-11				5	0.5 gal	Mechanized
McKay Cr., Hailey	45° 30' 31" 118° 41' 56"	170701030703	Metsulfuron methyl	R-11				5	0.25 oz (dry)	Mechanized
McKay Cr., Hailey	45° 30' 31" 118° 41' 56"	170701030703	Aminopyralid	R-11				5	0.11 gal	Mechanized
Wildhorse Cr., Adams	45° 45' 12.79" 118° 34' 33.13"	170701030404	Aminopyralid	R-11	6	0.252 gal	Mechanized	18	0.756 gal	Mechanized
Wildhorse Cr., Adams	45° 45' 12.79" 118° 34' 33.13"	170701030404	Metsulfuron Methyl	R-11	6	0.525 oz (dry)	Mechanized	18	1.575 oz (dry)	Mechanized
Wildhorse Cr., Adams	45° 45' 12.79" 118° 34' 33.13"	170701030404	2, 4D (amines)	R-11	6	0.375 gal	Mechanized	18	1.125 gal	Mechanized
Wildhorse Cr., Adams	45° 45' 12.79" 118° 34' 33.13"	170701030404	Dicamba	R-11				10	0.50 gal	hand wand / spot spraying
Wildhorse Cr., Adams	45° 45' 12.79" 118° 34' 33.13"	170701030404	Chorsulfuron	R-11				8	13 oz (dry)	Mechanized/ hand wand
Wildhorse Cr., Schmidtgal	45° 44' 32.06 118° 35' 55.72"	170701030404	Aminopyralid	R-11	12	0.504 gal	Mechanized			
Wildhorse Cr., Schmidtgal	45° 44' 32.06 118° 35' 55.72"	170701030404	Metsulfuron Methyl	R-11	12	1.05 oz (dry)	Mechanized			

**Table 2. Continued.**

LOCATION		6th HYDROLOIC UNIT CODE	ACTIVE INGREDIENT	ADJUVANT USED	RIPARIAN			UPLAND		
Township Range & Section (can be found in Pisces)	OR Latitude and Longitude				Estimate Acres Treated	Estimate of Total Volume of Herbicide Only (Gallons)	Application Method	Estimate Acres Treated	Estimate of Total Volume of Herbicide Only (Gallons)	Application Method
Wildhorse Cr., Schmidtgal	45° 44' 32.06 118° 35' 55.72	170701030404	2, 4D (amines)	R-11	12	0.75 gal	Mechanized			
Wildhorse Cr., Reynold's	45° 44' 57.92" 118° 35' 0.61"	170701030404	Aminopyralid	R-11	10	0.42 gal	Mechanized	3	0.126 gal	Mechanized
Wildhorse Cr., Reynold's	45° 44' 57.92" 118° 35' 0.61"	170701030404	Metsulfuron Methyl	R-11	10	0.875 oz (dry)	Mechanized	3	0.26 oz (dry)	Mechanized
Wildhorse Cr., Reynold's	45° 44' 57.92" 118° 35' 0.61"	170701030404	2, 4D (amines)	R-11	10	0.625 gal	Mechanized	3	0.1875 gal	Mechanized
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Aminopyralid	R-11	2	0.03 gal	hand wand / spot spraying			
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Triclopyr (TEA)	R-11	3	0.09 gal	hand wand / spot spraying			
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Glyphosate 1	R-11	6	4.44 gal	Mechanized			
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Metsulfuron methyl	R-11				30	8 oz (dry)	Mechanized
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	2, 4D (amines)	R-11				30	2.44 gal	Mechanized
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Aminopyralid	R-11				30	2.5 gal	Mechanized
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Dicamba	R-11				2	0.125 gal	hand wand / spot spraying
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Triclopyr (TEA)	R-11				8	1.625 gal	hand wand / spot spraying
Meacham Creek, CTUIR	45° 38' 31.2" 118° 21' 28.8"	170701030206	Glyphosate 1	R-11				2	2.5 gal	Mechanized

**Work Element O: 186. Operate and Maintain Habitat/Passage/Structure**  
**Work Element Title: Inspect and Maintain Function of In-stream Improvement Structures**  
**Milestone Deliverable: Maintain Proper Operation of In-stream Habitat Structures**

- A. Environmental compliance requirements complete.
- B. The inspection, replacement and/or maintenance of passage and habitat structures.
- C. Hire contractor to perform work.
- Deliverable: D. Maintain proper operation of in-stream habitat structures.

CTUIR monitors 6 passage rectification projects to assure that treatments are effectively working and to insure that intrusive objects are not interfering with the designed function of the passage structures (Table 3). Routine quarterly scheduled site visits of individual projects are conducted either independently by the CTUIR or jointly with project partners such as ODFW. Site visits also follow significant flow events or responses to landowner requests at project sites.

**Table 3. Habitat passage structures monitored and maintained by CTUIR to meet design specifications.**

Year	Stream	Stream Location	Project Description
2007	Meacham Creek	RM 1.7	Passage rectified by removing large cabled boulders (improved adult passage)
2007	Meacham Creek	RM 20.2	Partial dam removed (juvenile and adult passage)
2007	Camp Creek	RM 0.3	Partial dam removal (juvenile and adult passage)
2007	Greasewood Creek	RM 0.4	Partial dam removal (juvenile and adult passage)
2007	West Birch Creek	RM 3.2	Roughened channel to restore proper gradient and reduce step height at road bridge crossing for adult passage
2008	West Birch Creek	RM 2.7	Hoelt Dam fish passage rectification (juvenile and adult passage)

Project maintenance includes, but is not limited to, meeting specified conditional language in state and Federal permits, maintaining debris that is routinely captured or caught on in-stream structures, responses to landowner requests and concerns, and completion of post-treatment surveys to monitor and quantify changes to physical and ecological responses. If necessary a work plan is developed and contractor hired for completion for project activities greater than routine maintenance. The 2011 project activities involved routine maintenance.

**Work Element P: 186. Operate and Maintain Habitat/Passage/Structure**  
**Work Element Title: Maintenance of Habitat Features Associated with Project Conservation Easements**  
**Milestone Deliverable: Maintenance of Land or Structures Associated with Conservation Easements**

- A. Environmental compliance requirements complete.
- B. Adhere to details of existing easements and/or initiate additional agreements as feasible.
- Deliverable: C. Maintenance of land or structures associated with conservation easements.

CTUIR currently manages and maintains property in compliance with 23 existing conservation easements within the Umatilla Basin (<http://data.umatilla.nsn.us/maps/ConservationEasements/index.html>). The purpose of these

conservation easements is to protect, enhance, and restore functional floodplain, channel, and watershed processes to provide sustainable and healthy habitat for aquatic species in the Umatilla River subbasin. CTUIR routinely conducts custodial maintenance on individual projects to ensure that project structures and fencing are functioning and habitat recovery is progressing towards meeting projects goals and objectives. Activities include, but are not limited to, installing and repairing riparian cattle exclusion fences, maintaining or installing water gaps, riparian and floodplain plantings and maintenance, noxious weed control, maintenance of fish habitat improvement structures, and landowner coordination and education.

**Table 4. Conservation Easements Maintained by the CTUIR: Locations, Duration, Agreement Details.**

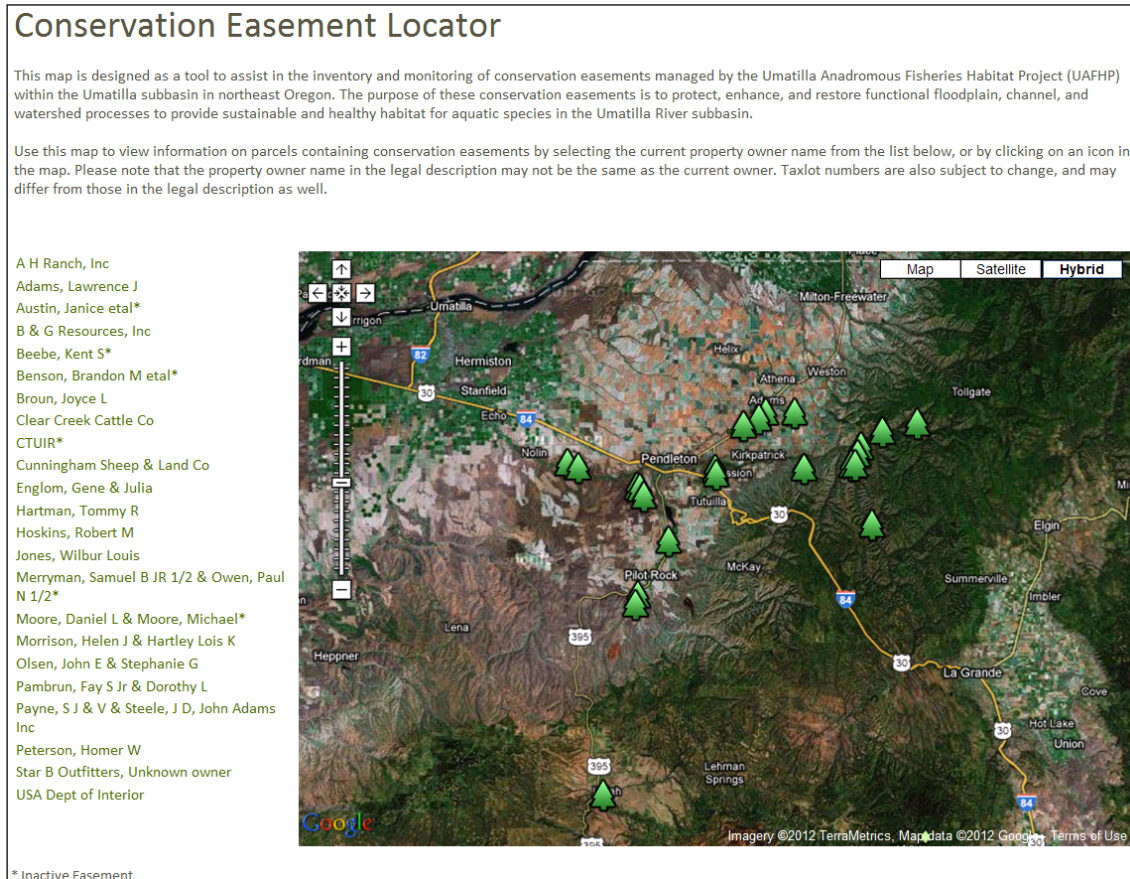
#	Waterway	RM	Start Date	End Date	Actions Performed
1	Wildhorse	9.5	5/1/2004	5/1/2024	fence, weed, plant, watering, weeding, gradient
2	Wildhorse	12.0	10/12/1995	10/12/2010	fence, weed, plant, watering, weeding, gradient
3	Wildhorse	12.5	5/1/2004	5/1/2024	fence, weed, plant, watering, weeding, gradient
4	Umatilla	42.0	1/1/2001	1/1/2016	fence, weed
5	Umatilla	43.0	1/25/2003	1/25/2023	fence, weed, well
6	Cottonwood	1.0	10/1/2001	10/1/2026	culvert replacement
7	Umatilla	68.5	10/1/1999	10/1/2014	none
8	Buckaroo	1.0	10/1/1999	10/1/2014	none
9	West Birch	3.2	11/4/1999	11/4/2014	barrier remedy, plantings, water, weed
10	McKay	16.5	6/1/1999	6/1/2014	education, bio monitoring, plant, weed
11	Umatilla	40.0	9/30/2004	9/30/2024	plant, weed, water, wells
12	East Birch	10.5	9/1/1997	9/1/2017	fence construction, maintenance
13	Umatilla	82.5	7/1/2000	7/1/2015	in-stream bank protection
14	McKay	17.0	12/2/1995	12/2/2011	education, bio monitoring, plant, weed
15	West Birch	2.7	2/1/2005	2/15/2025	passage remedy, plant, water, weed
16	Buckaroo	1.0	10/1/1999	10/1/2014	none
17	Buckaroo	1.5	5/7/2002	5/7/2022	fence, bio monitoring
18	Spring Hollow	2.5	9/1/1996	9/1/2011	plant, fence, bio monitor
19	Birch	2.7	10/1/1999	10/1/2014	plant, weed, water
20	Wildhorse	8.5	10/1/2002	10/1/2020	fence, gradient, weed
21	Umatilla	87.5	10/1/2002	10/1/2020	in-stream bank protection, channel shaping
22	Umatilla	61.5	10/1/2002	INDEF	in-stream bank protection, planting
23	Meacham	0.5	10/1/1999	10/1/2014	fence, weed

Conservation Easement Locator

The conservation easement web map locator was designed in 2010 and updated annually as a tool to assist in the inventory and monitoring of conservation easements managed by the Umatilla Anadromous Fisheries Habitat Project (UAFHP) within the Umatilla subbasin in northeast Oregon (Figure 8;

<http://data.umatilla.nsn.us/maps/ConservationEasements/index.html>). Conservation agreements are digitized and stored with the web map locator for easy reference. This web map can be used to view information on parcels containing conservation easements by selecting the current property owner name and clicking on an icon in the map. Please note that the property owner name in the legal description may not be the same as the current owner. Tax lot numbers are also subject to change, and may differ from those in the legal description as well. At the very least, it is currently a useful tool to locate and identify the tax lot(s) upon which each specific easement is located, along with the name(s) of the current and previous owner(s), and an aerial view of the tax lot upon which the easement is located. Over

time, additional features such as tarps, riparian fences, and riparian buffer areas will be delineated on the map for project management. This web tool will be further developed to become a repository of project metrics such as ft of riparian fencing, planting totals, acres treated with herbicide, and total easement acres, etc.



**Figure 8. Screen shot of the UBAFH Project conservation easement locator web map.**

**Work Element Q: 29. Increase In-stream Habitat Complexity and Stabilization**  
**Work Element Title: Meacham Creek Floodplain Restoration and In-stream Enhancement, River Miles 6.0 to 7.1**  
**Milestone Deliverable: Complete Channel Reconstruction or Enhancement on 1.1 Miles of Stream**

- A. Environmental compliance requirements complete.
  - B. Materials for structure composition obtained (purchase of logs, boulders, cable, etc.).
  - C. Materials for structures staged at implementation sites.
  - D. Construction begins.
  - E. Inspect completion of the project.
  - F. Complete as-built active channel and floodplain surveys.
- Deliverable: G. Complete channel reconstruction or enhancement on 1.1 miles of stream.

This work element was originally planned for construction in FY 2010 but do to the magnitude of the project and associated work activities including planning, permitting, NEPA and ESA consultation, cultural resource clearance, and design; implementation work activities were re-scheduled for completion in FY 2011. This work element was completed

in association with the following work element R: 180 Enhance Floodplain/Remove, Modify, Breach Dike. Project activities are fully described in report section **Selected FY 2011 Fish Habitat Enhancement and Restoration Activities**.

**Work Element R: 180. Enhance Floodplain/Remove, Modify, Breach Dike**

**Work Element Title: Enhance Floodplain Connectivity and Function via Levee Setback on Meacham Creek, River Miles 6.0-7.1**

**Milestone Deliverable: Complete Levee Removal and Floodplain Enhancements to Meacham Creek**

- A. Environmental compliance requirements complete.
- B. Implement levee removal.
- C. Complete as-built active channel and floodplain surveys.
- Deliverable: D. Complete levee removal floodplain enhancements to Meacham Creek.

This work element was originally planned for construction in FY 2010 but due to the magnitude of the project and associated work activities including planning, permitting, NEPA and ESA consultation, cultural resource clearance, and design; implementation work activities were re-scheduled for completion in FY 2011. This work element was completed in association with the prior work element Q: 29 Increase In-stream Habitat Complexity and Stabilization. Project activities are fully described in report section **Selected FY 2011 Fish Habitat Enhancement and Restoration Activities**.

**Work Element S: 40. Install Fence**

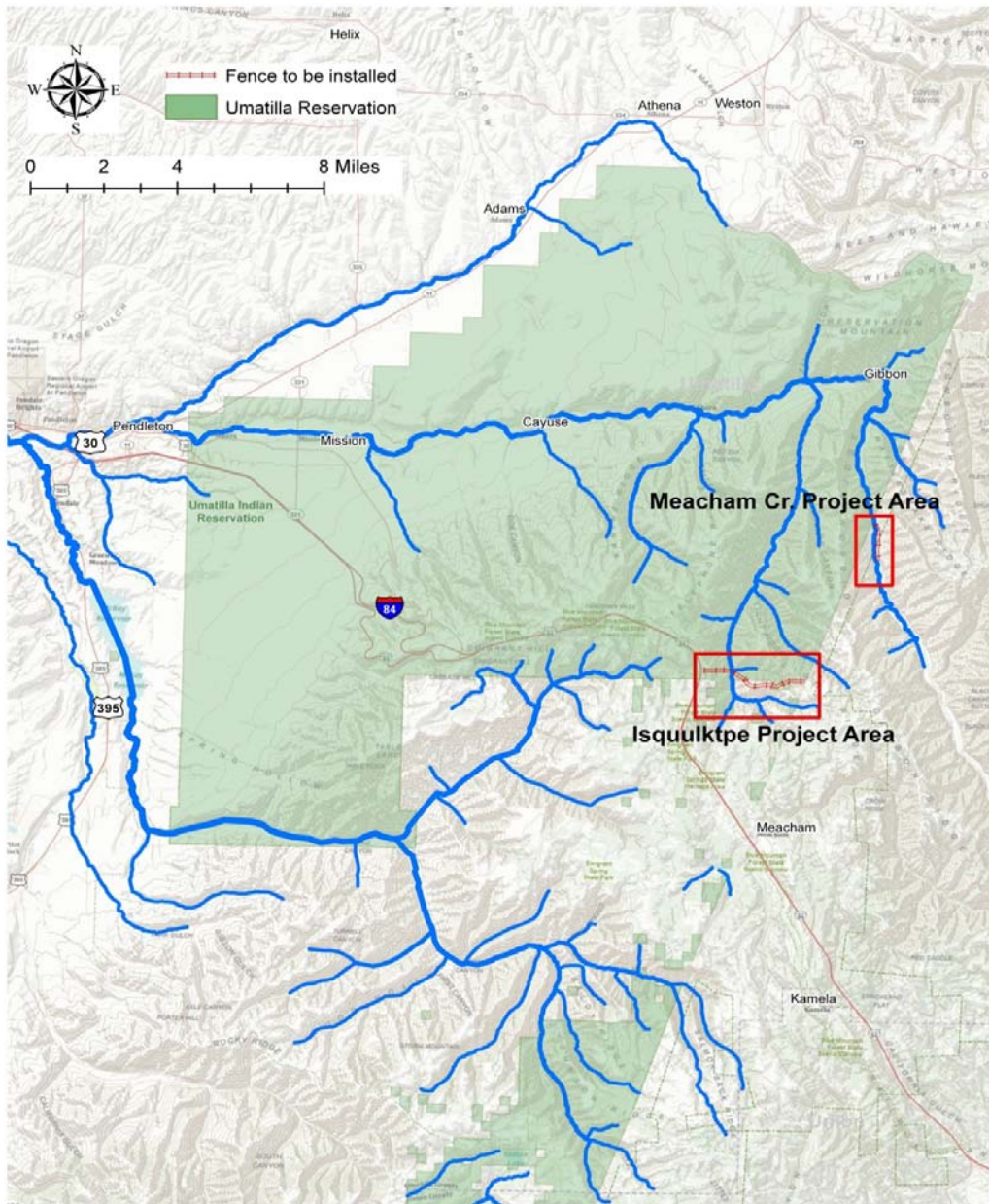
**Work Element Title: Install Riparian Fence Enclosure in Meacham Creek, River Miles 2.0-9.0**

**Milestone Deliverable: Three Miles of Fence Constructed on Meacham Creek**

- A. Environmental compliance requirements complete.
- B. Flag area for fence location.
- C. Complete and send out bid packages.
- D. Selected contractor for construction.
- E. Fence construction.
- F. Approve construction work.
- Deliverable: G. 3.0 miles of fence constructed on Meacham Creek.

This project originally called for constructing an estimated 1.4 miles of riparian protection fencing along the UPR right of way at RM 6-7 and uppermost property boundary at RM 8.5 on Meacham Creek (Figure 9). This project expands on a fence that was built in 2009 along the east side of the floodplain along the Union Pacific Railroad Right-of-Way in Meacham Creek to completely exclude trespass livestock from entering the floodplain and stream for the purpose of vegetation enhancement and recovery. In FY 2010, CTUIR completed a survey and design, and due to the steep slope on the west side of the canyon we strategically designed the fence to utilize steep facing slopes to detour livestock. In addition, CTUIR fully expanded the fence along the east side of the floodplain to exclude livestock. The newly designed fence involved less constructed fence but full protection of the planned project area. In addition, the newly proposed fence was partially located within the project work area identified in the prior WE's P29 and Q180 to restore a portion of Meacham Creek. Given the new fence was to be installed within an area planned for disturbance CTUIR chose to delay the fence project until FY 2011.

The project was located between river miles 6 and 7 as well as RM 8.5 of Meacham Creek, in Township 2N, Range 36E Sections 18, 19, 30 and 31. Natural Resource Conservation Service specifications are used for fence construction. A total of 271 acres of upland non-wetland habitat, 65 acres of riparian non-wetland habitat, and 3 acres of riparian wetland habitat were protected by the fence. CTUIR staff, during summer base stream flow, installs an electric fence crossing at the lower and upper ends of the Meacham Creek project area. Furthermore, CTUIR staff regularly inspects the fence enclosure for livestock entry and annual maintenance.



**Figure 9. Detailed map showing the locations of the Meacham and Isquilktp Creek fence project areas, 2011.**

**Work Element T: 100. Construction Management**

**Work Element Title: Construction Oversight of Boundary Fence in Iskúultpe Watershed**

**Milestone Deliverable: Oversight of Fence Construction in Iskúultpe Watershed**

- A. Review contractor bid documents.
- B. Review and approve fence design.
- C. Provide construction inspection.
- D. Recommend final approval.

Deliverable: E. Oversight of fence construction in Iskúultpe Watershed.

In FY 2011, the UAFHP staff provided construction oversight for fence installation on the south boundary of Iskúultpe Watershed (Figure 9). Costs of fence construction are being shared with: Project 1995-060-01, Iskúultpe Watershed Project. As part of annual work activities for the CTUIR wildlife project 1995-060-01 Iskúultpe Watershed Project, BIA grazing rights are leased in the Iskúultpe Watershed, and the watershed is rested from livestock grazing. However, livestock are permitted to graze in the private lands in the headwaters of the watershed, south of the Umatilla Indian Reservation Boundary. The Reservation Boundary is unfenced and livestock trespass occurs every fall as the operator's cattle move into Iskúultpe Creek when the weather cools. Unacceptable levels of utilization on desirable woody vegetation, documented by project staff in fall 2007, have continued through the end of 2009. Construction of a fence across the Reservation Boundary will greatly reduce the instances of trespass livestock.

Our UAFHP staff (1987-100-01) has experience evaluating contractors and overseeing fence construction projects. UAFHP assisted in construction oversight over the Iskúultpe Watershed Project by providing construction management oversight. UAFHP staff provided oversight in 1) evaluating contractor bid documents; 2) assuring fence construction/installation met specifications outlined in contract documents; and 3) final closeout of construction completion. A total of 3.1 miles of 4-strand barbed wire fence was installed on the Iskúultpe Watershed south boundary.

**Work Element V: 22. Maintain Vegetation**

**Work Element Title: Enhance Native Vegetation Growth in the B&G Resources Property, Umatilla River (River Miles 41-44)**

**Milestone Deliverable: Maintain 355 Acres (61 Riparian, 294 Upland) in Project Area**

- A. Environmental compliance requirements complete.
- B. Till established weed areas of the B&G Property.
- C. Manual and mowing application to retard weed growth.
- D. Truck water 13,400 plants on CREP riparian tracts (61 acres).

Deliverable: E. Maintain 355 acres (61 riparian, 294 upland) in project area.

The B&G Resources Property project site consists of a property parcel along the Umatilla River between river miles 41-44, about 10 miles downstream of Pendleton, Oregon (Figure 10). The landscape setting ranges from active channel floodplain to abandoned floodplain terrace and upland. In October 2004, CTUIR and B&G Resources signed a Riparian Conservation Agreement for the purpose of promoting sound riparian management that will achieve benefits for fish and wildlife habitat, soil and water conservation and increased productivity of adjacent lands. A total of 355 acres (61 riparian and 294 upland acres) have been treated with, but not limited to, riparian fence enclosure or protection, planting native

vegetation in riparian, weed control, watering planted vegetation, and alternative water developments (CTUIR 2008).

CTUIR developed the following table to track progress at the B&G Property site. Table 5 shows the date actions were taken by various agencies and the contracting firms hired to carry out the project actions.

**In spring 2009, NRCS CREP tracts were replanted with 13,400 sapling trees by CTUIR using a local contractor encompassing 61 acres (**

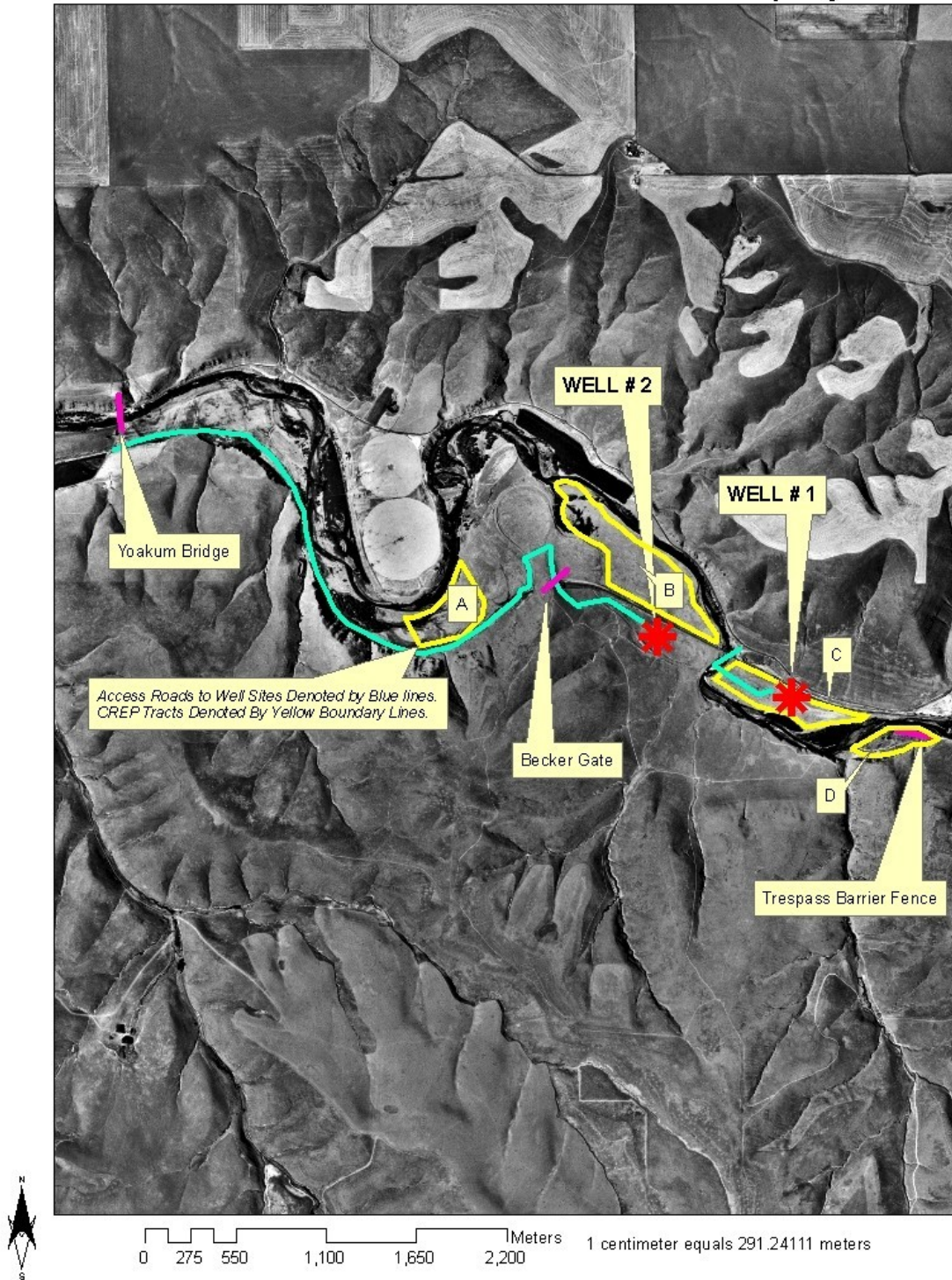
Table 6). Original 2006 CREP plantings failed for multiple reasons: 1) poor preparation by original contractor to prepare soil for CREP tract plantings, 2) plantings occurred on high terraces where significant channel incision had occurred resulting in plants largely devoid of water due to the distance from the water table and arid climate at this location, 3) a typical NRCS CREP tract planting plan was developed with no consideration of planting riparian and upland plant species viable at the designated area elevations and low moisture growing environments, and 4) lack of necessary CREP tract maintenance, such as manual and chemical noxious weed control.

In FY 2008 and FY2009, prior to upcoming FY 2009 plantings, CTUIR worked with the landowner, local property manager and NRCS to devise a site-specific planting and maintenance strategy through the CREP program. The plan included a strategy to meet survival estimates of NRCS CREP tracts of 50% survival of plants after two years. This strategy included preparations of the soil in fall 2008 and winter 2009 prior to planting the CREP tracts:

- Plowing once to discourage weed growth, break down existing herbicide residuals, and prepare for planting.
- Rototilling once to break up soil and rigid plant matter to prepare soil for planting.
- Disking three times to break up soil and rigid plant matter to prepare soil for planting.
- Cultivating twice to break up soil and rigid plant matter to prepare soil for planting.
- Rod weeding twice to remove rigid plant matter to prepare soil for planting.
- Spraying herbicide to control noxious weed
- Mowing once to retard weed growth and reduce fire risk.

Following plantings in FY 2009, the strategy for increased survival of NRCS CREP tract plantings further established a maintenance approach to watering plants during the hot summer months for several years to establish root systems for short- and long-term survival. An approach was established to deliver supplemental water to the plants within the CREP tracts. CTUIR applied to the Oregon Water Resources Department and received a Limited Water Use License for using well #1 and well #2 established on the property in FY 2008 for off-site livestock watering (Figure 10). The permit allowed the landowner manager and CTUIR to draw water from the well to water plantings until 30-September 2013. CTUIR project staff watered and weeded CREP tracts several times as necessary from June through October with a truck equipped with a 300G water tank system. The CTUIR watered a total of 70 acres of CREP tracts. In addition to watering CREP tracts, CTUIR staff mowed outside of the tracts in April, June, August and October to promote growth of native grass seed and retard weed growth.

## Noteable Characteristics of the B & G Property



**Figure 10. Aerial Photograph of B&G Resources Property, CREP Tracts, and Well Sites.**

**Table 5. B&G Resources Project Actions, Dates of Work, Contracting Agencies and Contractors.**

<b>Date</b>	<b>Action</b>	<b>Contracting Agency</b>	<b>Contractor</b>
10/2004	CTUIR Easement signed	CTUIR	B&G Resources
12/2004	CREP contract signed	NRCS/FSA	B&G Resources
7/2005	Installed exclusion fence on east field near well #1.	CTUIR	CTUIR
7/2005	Installed trespass fence on southeast side.	CTUIR	CTUIR
8/2005	Prepare for work, cultural resource coordination.	CTUIR	CTUIR
12/2005	Burn and mow fields	CTUIR	A2Z Engines
1/2006	Riparian planting (CREP)	B&G	Wild West Riparian
3/2006	Weed removal on tarp areas	B&G	Wild West Riparian
4/2006	Mow areas around tarps	CTUIR	CTUIR
4/2006	Weed control spraying in Zones 1 & 2 (Weed R, Milestone, Aqua neat)	CTUIR	Umatilla County
6/2006	Weed control, aerial spraying of field (Tordon 22k, 2-4D Amine, R-11)	CTUIR	Cliff Hoeft
6/2006	Watered riparian plants	CTUIR	CTUIR
7/2006	Watered riparian plants	CTUIR	CTUIR
7/2006	Weed control, targeting thistle (Clopyralid, Picloram, Chorsulfuron)	CTUIR	McLain Spraying
11/2006	Weed control, aerial spraying (Roundup RT, Class Act, Coral Poly)	CTUIR	Cliff Hoeft
4/2007	Mow in preparation for grass seeding.	CTUIR	Cliff Hoeft
4/2007	Plant grass, no-till drill	CTUIR	Cliff Hoeft
5/2007	Weed control (Clopyralid, Picloram, Chorsulfuron)	CTUIR	McLain Spraying
8/2007	Mowed areas around tarps	CTUIR	CTUIR
1/2008	Drilled 2 wells for livestock watering	CTUIR	Wallace Drilling
5/2008	Noxious weed control – herbicides and physical removal	CTUIR	Ellis Ranch
6/2008	Access Restriction Project, B&G and Becker Easement	CTUIR/ODFW	ODFW
7/2008	Extensive soil preparation for future plantings	CTUIR	Ellis Ranch
1/2009	CREP tract preparation by rod weeding	CTUIR	Ellis Ranch
1/2009	Riparian planting (CREP) – 13,400 saplings	CTUIR	Ellis Ranch
1/2009	Installed 2 solar panels and livestock watering tanks	CTUIR	Ellis Ranch
3/2009	Chemical noxious weed control	CTUIR	Ellis Ranch
3/2009	Apply native grass seed around tarps and mow to retard weed growth	CTUIR	Ellis Ranch
4/2009	OWRD Limited Water Use License attained for watering CREP tracts	CTUIR	CTUIR
6/2009	Installation of PVC experimental watering tubes for CREP tract saplings	CTUIR	Ellis Ranch
6/2009	Well site setup for truck tank and ATV tank watering of CREP tracts	CTUIR	Ellis Ranch
6/2009	Mowed areas around tarps to retard weed growth	CTUIR	Ellis Ranch
10/2009	Watered and weeded sapling trees twice per week over five months to increase survival	CTUIR	CTUIR/Ellis Ranch
10/2009	Mowed areas around tarps to retard weed growth	CTUIR	Ellis Ranch
6/2010	Well site setup for truck tank and ATV tank watering of CREP tracts	CTUIR	Ellis Ranch
6/2010	Mowed areas around tarps to retard weed growth	CTUIR	Ellis Ranch/CTUIR
6/2010	Chemical noxious weed control	CTUIR	Ellis Ranch
10/2010	Watered and weeded sapling trees twice per week over five months to increase survival	CTUIR	CTUIR/Ellis Ranch
10/2010	Mowed areas around tarps to retard weed growth	CTUIR	Ellis Ranch

10/2011	Mowed areas around tarps four times over 7 months to retard weed growth	CTUIR	CTUIR
10/2011	Watered and weeded sapling trees three times over five months to increase survival	CTUIR	CTUIR

**Table 6. Sapling planted at CREP Sites on the B&G Resources Property by tree species and quantities.**

Site 9896		Site 10504		Site 11948	
Tree Species	#	Tree Species	#	Tree Species	#
Alder, Thinleaf	100	Ponderosa Pine	50	Alder, Thinleaf	50
Choke Cherry	750	Choke Cherry	400	Choke Cherry	300
Cottonwood, Black	200	Cottonwood, Black	100	Cottonwood, Black	200
Currant, Golden	800	Currant, Golden	400	Currant, Golden	300
Dogwood, Red Osier	200	Dogwood, Red Osier	75	Dogwood, Red Osier	50
Elderberry, Blue	1,400	Elderberry, Blue	600	Elderberry, Blue	300
Mock Orange	800	Mock Orange	400	Mock Orange	300
Rabbit Brush	150	Rabbit Brush	100	Ponderosa Pine	50
Rose, Wild	1000	Rose, Wild	400	Rose, Wild	200
Sage Brush	1,500	Sage Brush	600	Sage Brush	250
Sumac	600	Sumac	300	Sumac	50
Willow, Coyote	150	Willow, Coyote	75	Willow, Coyote	50
Ponderosa Pine	150				
<b>Total Seedlings</b>	<b>7,800</b>	<b>Total Seedlings</b>	<b>3,500</b>	<b>Total Seedlings</b>	<b>2,100</b>

With the increased watering, CTUIR set a minimum targeted survival of 70% over two years with a target goal of 80% for the 2011 growing season. On October 15 2009 CTUIR conducted a survival survey and found that we had a survival rate of 72.4%, project-wide. Although we would expect a typical 10% plant loss on CREP tract projects following planting we had a slightly lower survival than our original 2009 target survival. The total water usage in 2011 under the OWRD Limited Use Permit was about 9,850 gallons, or 0.03 acre/feet from well #2.

In 2011, CTUIR continued to implement the newly developed watering plan and control noxious weeds in this project area. Project activities included watering and maintaining plants on NRCS CREP tracts and maintaining noxious weeds (Table 5). Plant watering, weeding and mowing on CREP tracts were maintained four times during the summer.

**Work Element W: 175. Produce Design and/or Specifications**

**Work Element Title: Birch Creek Taylor Dam Removal and Habitat Restoration Project**

**Milestone Deliverable: Project Design and Implementation Plan**

- A. Determine cost estimate, including cultural surveys, permitting, construction, and monitoring and evaluation.
  - B. Subcontract for project design and implementation plan.
  - C. Hold/attend meeting to review design.
- Deliverable: D. Project Design and Implementation Plan.

The project is located at the mouth of Birch Creek at the confluence with Umatilla River and extends 0.7 stream miles. This project considers potential impacts on species listed under the Endangered Species Act, the Middle Columbia summer steelhead which is federally listed as threatened and the inland Columbia redband trout, a vulnerable species on the ODFW

Sensitive Species List. Birch Creek watershed is one of the nine major Steelhead spawning areas according to the Recovery Plan for Oregon’s Middle Columbia River Steelhead (NMFS 2009). Salmonid habitat in this watershed has degraded considerably during the past century. Extensive riparian vegetation removal and disturbance associated with urban development, agriculture, forestry, transportation corridors, flood control, and navigation has occurred and continues to occur. As a consequence, the aquatic environment is suffering from inadequate stream flow, increment in water temperatures from a lack of riparian vegetation and water flow, structural impediments, inadequate riparian corridors, reduced in-stream habitat, and excessive erosion.

The length of the project is approximately 0.7 stream miles with two abandoned, full spanning, concrete diversion dams (Figure 11). Diversion #1 consists of a dam with a concrete-encased pipe with a jump height of 1.5 feet and is located upstream from the confluence at approximately river mile 0.5 on Birch Creek. Diversion #2 is located approximately 100 yards upstream from diversion #1. It has a jump height of 3.8 feet and consists of a dam and a decadent three pool fish ladder which is located on the west bank of the dam. Diversion #2 supports a bridge on an agriculture road and acts as a control structure for an OWRD stream flow gauging station. These two man-made structures are migratory fish barriers and limit stream channel morphological function. Upon implementation, this project will provide unhindered access to a 3 stream mile corridor for juvenile and adult fish migration. This project is part of an ongoing effort in the watershed to enhance fish habitat and migration.



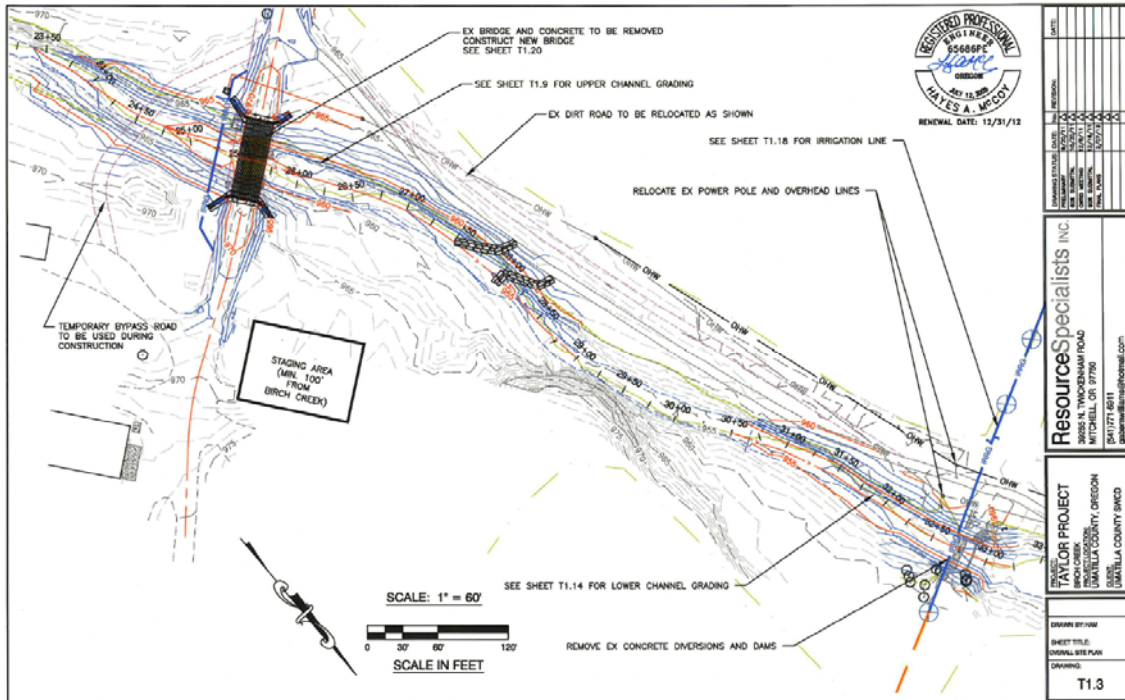
**Diversion #1**



**Diversion #2**

**Figure 11. Diversion dams on Birch Creek proposed for removal (RM 0.0-0.7).**

CTUIR worked with ODFW (project lead), UCSWCD, and the private landowner to provide management and technical guidance, and cost share dollars for development of the engineering design and technical report, and hiring of the contractor for FY 2012 construction. The project team completed the design and implementation plan in FY 2011 (Figure 12).



**Figure 12. Birch Creek Taylor Dam Removal and Habitat Restoration Project design.**

## **SELECTED FY 2011 FISH HABITAT ENHANCEMENT AND RESTORATION ACTIVITIES**

### **Meacham Creek Floodplain Restoration and In-stream Enhancement Project, RM 6 to 7.1**

#### **Introduction**

The 114,000 acre Meacham Creek watershed is a 37-mile long tributary of the Umatilla River, entering at river mile 78.8 and contributes approximately half of the flow to the Umatilla River during high flow events and a significant amount to the base flow (Figure 4??). Meacham Creek originates near the town site of Kamela, Oregon at approximately 4500 feet elevation. Data from CTUIR shows that Meacham Creek runs 2-3 °C degrees warmer (16 °C [60.8 °F] vs. 13.5 °C [56.3 °F]) during the summer than the Umatilla River at the confluence. The USGS maintains a gauging station on Meacham Creek at RM 1.4 at Gibbon, OR (USGS 14020300) in cooperation with the CTUIR. The drainage area covered is 176 mi<sup>2</sup> with a maximum peak flow recorded as 8,800 cubic feet per second (cfs), while minimums of 7 cfs constitute summer base flows. Three channel reaches of Meacham Creek flow intermittently and subsurface during the summer months, but provide short reprieve to high temperatures during low summer flows.

The primary negative impact to Meacham Creek is an adjacent railway built in the early 1900's that has included the construction of extensive levees, channel relocation, channelization, and vegetation alteration. The Meacham Creek Watershed Assessment and Action Plan (Andrus and Middell 2003) concluded the following: 1) Railroad tracks border

the stream for the majority of its 37-mile length; 2) A ledge was blasted out of the adjacent hill slope in the upper canyon to make room for the railway; 3) Following construction, Meacham Creek repeatedly collided into the railroad prism in the lower valley and threatened to undo what had been built; 4) Angled dikes and parallel levees were constructed to force the stream away from the tracks and, following floods, bulldozers were used to create a straight channel that was free of logs; and 5) Early trains were fueled by wood and may partly explain the shortage of large woody material in the valley.

A significant secondary impact to Meacham Creek is high intensity grazing by domestic livestock in the riparian area. More than a century of concentrated cattle and sheep grazing has limited tree regeneration in many areas, degraded shrub and herbaceous conditions, and has led to unstable streambank conditions. Current natural regeneration of riparian plant species is most successful in areas where livestock are excluded.

Additional impacts have included timber harvest (high-grading from the riparian area), road construction, and some urban development. These activities have contributed to high water temperatures, unstable channel bed and banks, simplified and degraded aquatic habitat conditions, poor riparian vegetation conditions, and possibly reductions in late season flow. The extent of impacts dictates that watershed scale processes must be considered in restoration planning and a holistic watershed approach is necessary for success.

The Meacham Creek Meacham Creek Floodplain Restoration and In-stream Enhancement Project (RM 6-7.1) was supported by the Meacham Creek Assessment and Action Plan (Andrus, 2003). The development of action alternatives draws from knowledge gained from other restoration and assessment efforts. As a result of these efforts, the portion of the mainstem Meacham Creek from the confluence of the North Fork Meacham Creek downstream to the confluence with the Umatilla River (approximately 15 river miles) has been identified as the highest priority for active watershed restoration and termed the “Focus Area” (Figure 13). The proposed project actions build on restoration activities since 2006. As a multi-year and multi-funded effort, the implementation actions overlap locations within the 15-mile Focal Area and may include the same action being implemented over several years. For example, there have been and will continue to be multiple efforts of riparian planting in the Meacham Creek floodplain during the spring and fall that will overlap with whole tree additions, levee removal/setback and natural channel construction. These efforts are integrated and designed to provide support to each other.

### Limiting Factors

Historically Meacham Creek was a major spring Chinook, steelhead and Coho Salmon producing tributary to the Umatilla River, along with healthy populations of bull trout and resident redband trout. Currently, Meacham Creek provides habitat and refuge for spring Chinook salmon, summer steelhead and bull trout, but well below historic levels due to degraded habitat and water quality conditions.

Meacham Creek is water quality limited primarily by high water temperature. Physical aquatic habitat is also in poor condition and been shown to be a limiting factor to the health of important aquatic species. The primary cause of habitat degradation in Meacham Creek is hydro-modification from simplification of the channel by channelization and streambank modification for the purpose of protecting the infrastructure of the UPR Railway.

## Meacham Creek Focus Area

THE CONFEDERATED TRIBES OF THE  
UMATILLA INDIAN RESERVATION



**Figure 13. Meacham Creek Restoration Project Focus Area, River Miles 0-15.0.**

### Support for Implemented Work

The Meacham Creek subbasin is of historical significance to the Tribe because of its traditional hunting, fishing and gathering opportunities. There are various ancient sites of cultural significance located adjacent to the Meacham waterways. The Meacham Creek subbasin produces an anadromous salmonid component which contributes to traditional and subsistence harvest by Tribal members. Proposed goals and objectives will support capacity building and long-term progress towards 1) achievement of the CTUIR DNR ecological river vision and first foods mission statements, 2) Endangered Species Act delisting of Columbia

River bull trout and middle Columbia River steelhead, and 3) addresses water quality limiting factors per the Clean Water Act 303d list.

The Middle Columbia River Steelhead Recovery Plan supports this project by identifying the actions of reconnecting Meacham Creek to the floodplain, removing dikes and levees, as well as reconnecting side channels and off-channel habitat as the first priority under Strategy 3. Restoring natural channel form, placing stable wood and other large organic debris in the streambed, stabilizing and protecting streambanks, and constructing rock and log weirs to create pool habitat or elevating incised channels have also been identified as first priorities in the Middle Columbia River Steelhead Recovery Plan under Strategy 4. Degraded floodplain and channel structure, altered sediment routing, altered hydrology, and water quality (temperature) have been identified in the Middle Columbia River Steelhead Recovery Plan as major factors limiting steelhead populations in Meacham Creek (NMFS 2009).

Exploring solutions with UPR for improving migratory habitat in the Meacham Creek Subbasin is identified as the highest priority in the Bull Trout Draft Recovery Plan within the Umatilla/Walla Walla Recovery Unit (RU). Furthermore, restoring floodplain function and channel complexity is the second highest priority identified in the Bull Trout Draft Recovery Plan within the Umatilla/Walla Walla RU. Altering dikes in the mainstem of Meacham Creek has been identified in the Bull Trout Draft Recovery Plan as an action that would improve channel complexity and improve fish habitat and potential use by bull trout. The construction and maintenance of the UPR, which parallels mainstem Meacham Creek, along with dikes or levees in place to protect the railroad from flooding, is identified in the Bull Trout Draft Recovery Plan as significantly altering stream and channel complexity, riparian shade, and likely affecting stream temperatures (USFWS 2002).

The project is a cooperative project between CTUIR and USFS, each own and manage about 50% each of the project area, that directly addresses the processes that support the First Foods of water and salmon and the five Umatilla River Vision touchstones (Jones et al. 2008), water quality limitations identified in the CTUIR TMDL and Umatilla TMDL, and degraded habitat conditions identified in the Meacham Creek Assessment and Action Plan (Andrus et al. 2003) and Umatilla Watershed Analysis (Umatilla National Forest 2001).

The Meacham Creek Floodplain Restoration and In-stream Enhancement Project (RM 6-7.1) was designed in 2009-2010, floodplain and channel construction completed in 2011, and floodplain and riparian plant restoration completed in 2011-2012. Full project details of planning, design, consultation and permitting, construction, monitoring and assessment can be found in the Meacham Creek Floodplain Restoration and In-stream Enhancement Project Completion Report (CTUIR 2012).

## Objectives and Goals

The main activity of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project (RM 6-7.1) was to restore, enhance and protect about 70 acres of floodplain habitat and restore stream morphology by returning Meacham Creek to its historic flow pattern through RM 6 to 7.1. Restoring channel morphology, floodplain connectivity and in-stream and riparian ecological processes were achieved by fulfilling the following project objectives:

- Restore floodplain connectivity through removal or modification of the spur dikes in the floodplain, and removal of the 2,800-foot levee along the existing channel.
- Improve channel morphology and in-stream process through realignment of Meacham Creek into its historic channel and meanders present in the floodplain, maximizing

channel access to the floodplain and allowing it to migrate between the west valley wall and floodplain features.

- Improve hydrologic connectivity and the three dimensional hydrologic mosaic.
- Improve hydrologic function in the area, including hyporheic and river water exchange and summertime hydrologic connectivity.
- Enhance in-stream habitat and diversity for listed and non-listed species while restoring channel morphology and in-stream processes by incorporating in-stream habitat features in the channel and throughout the floodplain in anticipation of channel migration.
- Increase riparian shade to Meacham Creek by using available vegetation in the floodplain where the historic channel and meanders are present and by reestablishing native plants and/or re-seeding with a native seed mix throughout the Project area.

As part of the design criteria, key criteria and goals for fish utilization, physical habitat features, geomorphic features, riparian management, and wildlife were developed and evaluated to meet project objectives.

The project was designed to restore a section of Meacham Creek by moving the stream into its historic channel alignment and excavating historic meanders in the floodplain, resulting in 5,800 feet of new, reconfigured stream channel (Figure 14). Habitat complexity was increased by incorporating in-stream habitat improvement features in the channel throughout the project area. The project design incorporated modification and/or removal of two large spur dikes in the floodplain and removal of the 2,800-foot levee along the existing channel. The existing access road embankments were enhanced at specific locations along the floodplain to provide flood protection for events great than 100-year flood flows near the UPR railway and right-of-way access road. Large log and rock structures were incorporated throughout the floodplain. An alcove was constructed at the downstream extent of new configured channel where it connects to the existing channel. Finally, the design included re-vegetating with native plants and/or re-seeding with a native seed mix in disturbed areas in the floodplain and along the channel throughout the project area. The design was modified near the end of the project construction to incorporate an additional full spanning log and rock plug structure in the original channel near mid-project. The modification occurred due to a shortage of fill material and observed subsurface water flow leakage from the newly constructed channel to the original channel.

## Implementation

The Meacham Creek Floodplain Restoration and In-stream Enhancement Project construction and re-vegetation occurred from April to December, 2011. Major construction activities included mobilization and construction initiation; reshaping the floodplain; reconfiguring the stream channel and installation of habitat features; channel initiation, fish salvage and levee removal; and re-vegetation and cleanup (Figure 15).

Prior to commencement of construction activities, all base erosion and sediment control measures were put in place and approved through initial inspection. Sediment barriers included sediment fence, hay bales, wattles and berms constructed out of mulch, chippings, or other suitable material. Tree and wetland protection areas were clearly delineated with orange construction fencing. Specific construction entrances were fenced off and maintained for the duration of the project. After ensuring erosion and sediment control measures were in place, project construction began by clearing and grubbing the proposed new floodplain.

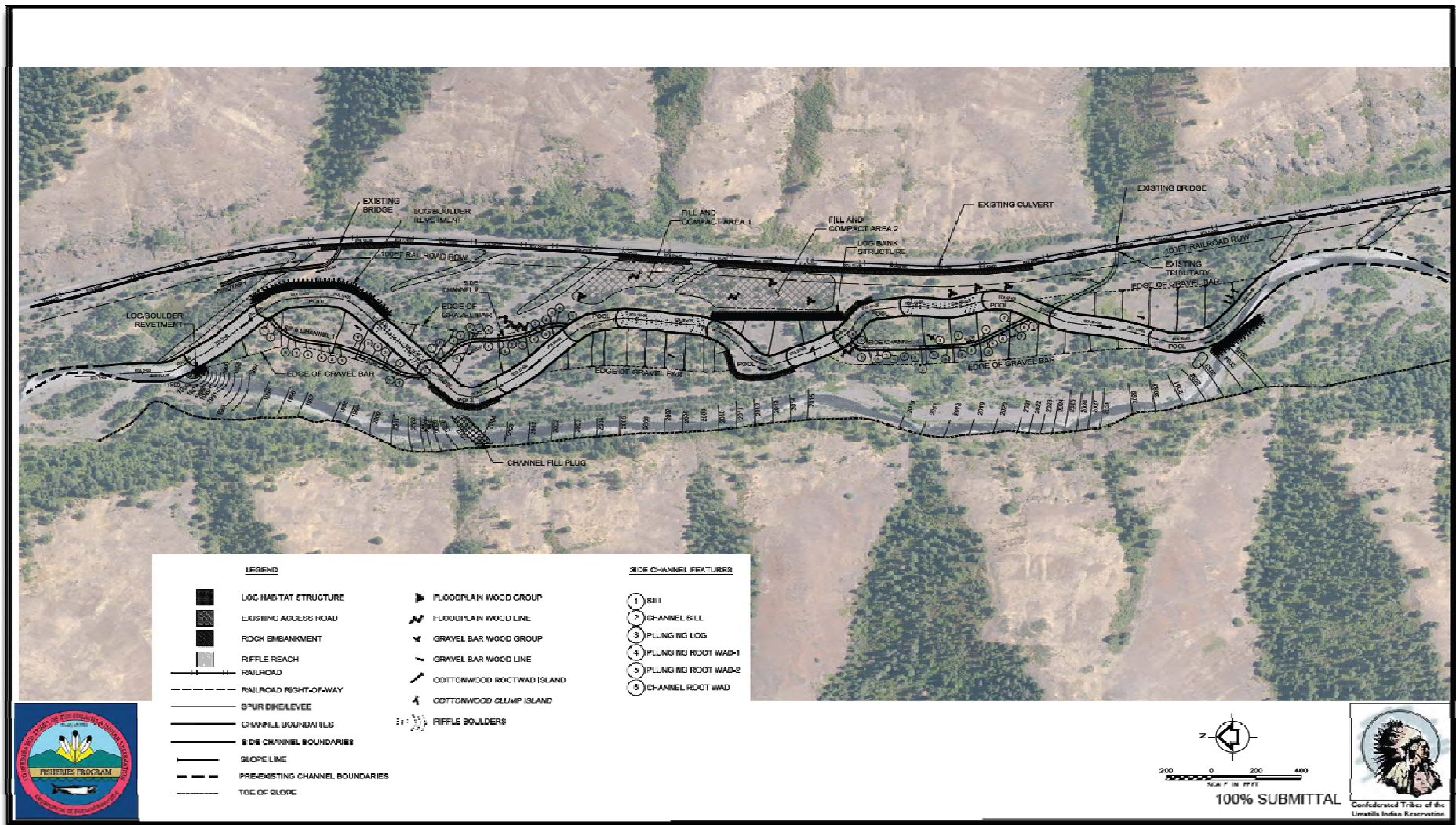


Figure 14. Meacham Creek Floodplain Restoration and In-stream Enhancement Project Design Features.



**Figure 15. Implementation photos of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1; photos from top right going clockwise: 1-installing stream bed gravel, 2-excavating new channel, 3-fish salvage, 4-installation of diversion plug, 5-installing habitat structures, and 6-clearing and grubbing project area.**

Using an excavator, front-end loader, dozer, and dump truck, the new floodplain was graded and shaped following the project design. Low areas in the proposed floodplain were filled with excavation spoils and large wood material to obtain design surface elevations. Concurrent with clearing, grubbing, excavating, grading, and shaping of the new floodplain, existing spur dikes in the floodplain were either removed or modified. All spoils from the spur dikes were separated

and stockpiled for use in backfilling the existing channel and construction the UPR right of way protection embankment.

Following clearing, grubbing, and shaping of the new floodplain, excavation and configuration of the new stream channel and secondary channels began. Construction equipment was used to excavate the new channel alignment and meanders in the historic floodplain, which was outside of the active flow channel. Once final alignment and grade controls were constructed and approved, stream bed gravel mixture was installed in the constructed stream bottom to a depth of 12 to 18 inches. Stream bed gravel had specifications which generally consisted of a mixture of sand, pea gravel, and 1- to 4-inch rounded gravel.

Following the new channel excavation and substrate addition, in-stream fish habitat improvement features were incorporated into the newly excavated channel and side channels. Approximately 2,500 linear feet of in-stream habitat features utilizing large wood and rock were constructed and 993 pieces of wood were placed on gravel bars, the floodplain, and in side channels to construct 10 major rock and log features and 286 medium rock and log features. All specifications for anchoring and securing large wood followed the ODF and ODFW manual for placing large wood in streams (ODF and ODFW 1995).

At the upstream end of the project, the spur dike was removed to connect the old channel to the new channel and a diversion structure (i.e., cofferdam and gravel berm) was installed to divert 50 percent flow to the new channel. During the 50–50 split of the flow, fish salvage in the existing stream channel began.

Coordinated by the Umatilla National Forest, Umatilla Basin Watershed Council, and CTUIR, nearly 140 people from partnering agencies, such as NMFS, ODFW, Umatilla County Soil and Water Conservation District, along with the USFS Youth Conservation Crews and adult and youth community volunteers completed the fish salvage. Fish salvage involved first blocking the upstream and downstream extents of the old channel and then capturing and releasing fish from the isolated area by seining and electrofishing. Multiple passes were conducted through the salvage area to ensure all fish were removed. Block nets remained in place until the existing channel was blocked with fill material and the reconfigured channel was watered to prevent fish from entering the project area. An additional lamprey salvage team carried a Smith-Root backpack electrofisher designed specifically for capturing lamprey. Salvaged fish were hauled with buckets to a liberation tank that was supplied with oxygen tanks and cool river water. Fish salvage operations started in the early morning with generally ended in the early afternoon due to temperatures reaching 18°C to prevent excessive fish stress. As the salvage reach was dewatered, fish were removed from any remaining pools with dip nets and electrofishers. Fish were transported to a location with large pools approximately 4 miles above the project area for release. A total of 26,983 fish were salvaged from the existing channel including, 5,972 juvenile summer-steelhead, 2 bull trout, 209 juvenile and 9 adult spring Chinook, 24 white fish, and 652 Western brook lamprey. Of the 5,972 juvenile summer steelhead-rainbow trout and 2 bull trout, there were 74 summer steelhead-rainbow trout mortalities (0+) fish. Total fish recovered during the fish salvage were consistent with the NMFS Biological Opinion (NMFS 2010) estimate of 7,111. However, the amount of take anticipated in the USFWS Biological Opinion (USFWS 2010) was one bull trout and, although there were no mortalities, two bull trout were recovered during fish salvage.

Following fish salvage of the old channel, all stream flow was diverted into the new reconfigured channel and the main wood and boulder diversion structure was installed and temporary diversion berm/cofferdam was removed. Once all flow was diverted to the newly constructed channel the removal of the 2,800-foot levee (about 12,038 cy) along the old channel and backfilling of the old channel began. All spoils from the levee were separated, stockpiled, and used to backfill the old channel. Backfill material also included stockpiled materials from floodplain excavation, channel excavation, and spur dike removal. As the existing channel was backfilled, large wood material was incorporated into the fill to mimic floodplain conditions. Approximately 48,030 cy of material was used for backfilling and grading of the existing channel, resulting in a 44,727 cy shortage of material for backfilling the existing channel. This shortage in backfill material for the existing channel during construction resulted in the need for a project design modification.

About 40 acres of a 60-acre disturbed area in the floodplain were planted with native plants including trees and shrubs ranging from 10 cubic inch plugs up to 25-gallon potted plants (Table 7). About 20 acres surrounding the new channel were not planted to allow the channel to adjust during winter flows and not scour out any plantings. Additionally, all disturbed acres were re-seeded or hydroseeded with a native grass seed mix at a rate of 30 pounds per acre and then hand seeded in areas that could not be reached effectively with the hydroseeder. Where available, plant and seed stock for these plantings were from local seed sources to ensure all plants are adapted to the growing conditions at the project area. Final field activities included finish grading, topsoil placement, revegetation, project area cleanup and repairs, and demobilization.

**Table 7. Quantity of potted plants, plugs, cones and cutting by species planted in the Meacham Creek Floodplain Restoration and In-stream Project RM 6-7.1disturbed area.**

<b>Quantity of Species Planted at Project Area</b>		
<b>Plant Species</b>	<b>Potted Plants (1G to 25G)</b>	<b>Plugs/Cones/Cuttings</b>
Red Osier Dogwood <i>Cornus sericea</i>	934	1202
Mountain Alder <i>Alnus viridis</i>	216	425
Serviceberry <i>Amelanchier arborea</i>	1389	-
Black Hawthorn <i>Crataegus douglasii</i>	396	-
Willow <i>Salix spp.</i>	240	10,000
Wood Rose <i>Rosa woodsii</i>	1258	300
Cottonwood <i>Populus basamifera</i>	442	3910
Ninebark <i>Physocarpus malvaceus</i>	408	1020
Snowberry <i>Symphoricarpos albus</i>	132	4669
Ponderosa Pine <i>Pinus ponderosa</i>	-	7600
Oceanspray <i>Holodiscus discolor</i>	-	149
Douglas Fir <i>Pseudotsuga menziesii</i>	-	3600
<b>Total</b>	<b>5415</b>	<b>32,875</b>

The Meacham Creek Floodplain Restoration and In-stream Enhancement Project, was a historic partnership between CTUIR and USFS that has restored processes in Meacham Creek that create and maintain habitat complexity. By restoring channel morphology, and in-stream and riparian ecological processes, the project is helping to achieve an ecologically functional and healthy river system that supports the continued natural production of key fish species (Figure 16). The project resulted in a newly constructed channel within the historic channel alignment in the floodplain, resulting in 5,780 feet of new, reconfigured stream channel. The project included removal or modification of six large spur dikes, and removal of a 2,800 ft levee along the

**Before**

**After**



**Figure 16. Before and after photos of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1.**

**Table 8. Comparison of pre-project, design, and as-built conditions for the Meacham Creek Floodplain Restoration and In-stream Enhancement Project.**

Channel Characteristics	Pre-Project	Design	As-Built
Description/Form	Straight Channel	Meandering with Multiple Channels	Meandering with Multiple Channels
Levees/Dikes	Five spur dikes present and 2,800 ft levee along channel	Levee removed, dikes modified, and rail protection embankment enhanced	Levee removed, dikes modified, and rail protection embankment enhanced
Meanders	Confined Straight Channel	6	6
Secondary Channels	Limited	5	5
Off-Channel Areas	14.3 acres of wetland complexes and 326 ft of off-channel habitat	11.88 acres of wetland complexes and 1,039 ft of off-channel habitat (not including side channels)	12.58 acres of wetland complexes and 3,568 ft of off-channel habitat (not including side channels)
Flood Prone Area	115.5 – 215.1 (177.4) ft	140.5 – 295.5 (225.4) ft	165.6 – 363.6 (253.1) ft
Belt Width	160–250 ft	300–553 ft	319–2,620 (1,219) ft
Valley Width Occupied	160–250 ft	600–922 ft	600–922 ft
Stream Length	5,470 ft	5,922 ft	5,922 ft
Sinuosity	1.1	1.15	1.3
Meander Length	1,545 ft	1,280–1,480 ft	563 – 4,755 (1,489) ft
Amplitude	317 ft	206–480 ft	284–546 ft
Mean Radius of Curvature	291 ft	229–560 ft	100 – 928 (350) ft
Bankfull Width	99 ft	80–100 ft	98.4–123.3 ft
Bankfull Depth	3 ft	2.5 ft	1–4.2 ft
Bankfull Cross-Section Area	297 ft <sup>2</sup>	324–334 ft <sup>2</sup>	78.1–265.8 ft <sup>2</sup>
Width/Depth Ratio	33–46	32–40	23.4–123.3
Entrenchment Ratio	1.8–2.3	3–6	1.5–3.3 (2.3)
Channel Materials (D50, D84)	83 mm	41, 90 mm	41, 90 mm
Channel Gradient	0.0086 ft/ft	0.0001–0.01 (0.0075–0.01) ft/ft	0.0081 ft/ft
Morphology	Plane-Bed; Rosgen Type C3	Braided; Rosgen Type C4 to D4	Braided; Rosgen Type C4 to D4
Summer Water Width	42 ft	10–20 ft	20–30 ft
Average Velocity	7 ft/s	4–5 (4.5) ft/s	2.2–5.6 (4.5) ft/s
Channel Stability/Equilibrium	Non-equilibrium–confined	Equilibrium – capable of adjusting and maintaining variables	Equilibrium – capable of adjusting and maintaining variables
Unit Stream Power	165 W/m <sup>2</sup>	113 W/m <sup>2</sup>	52 W/m <sup>2</sup>
Major Rock and Log Features	3	10	10
Medium Rock and Log Features	3	286	286
Pools	5	12	12
Riffles	7	7	7
Glides	1	3	3
Particle at Threshold of Motion in mm (τ*c = 0.06)	79	70	40
Bedload Sediment Rate (ft <sup>3</sup> /s per foot width)	0.0012–0.0146	0.00467–0.0327	0.00086–0.0031

existing channel resulting in increased floodplain connectivity and geomorphic and hydrologic complexity. The new channel base elevation averages 4 to 6 feet higher than prior conditions. In-stream complexity and roughness has been improved by the addition of 7 complex pools and 10 major and 286 medium rock and log features. The sinuosity of the stream was increased by 50% with significantly increased side-channel and off-channel fish habitat along the 1.1 mile reach (Table 8).

#### Press Recognition and Awards

The project has received attention throughout the region and country for its success. In April 2012, Mike Lambert, the CTUIR Umatilla Basin Program Manager, received the national “Rise to the Future” award from the Forest Service for “Collaborative/Integrated Aquatic Stewardship.” This was to recognize his work leading the Meacham Creek restoration and coordinating with the U.S. Forest Service.

Multiple newspaper articles were written on the Meacham Project by local community newspapers. The Confederated Umatilla Journal (CUJ) published a feature multi-page article entitled “Restoring the Meander in Meacham Creek.” The story highlighted the project’s partnership approach and benefits to the watershed, endangered species, and community (<http://www.umatilla.nsn.us/cuj%20june%202011.pdf>). The East Oregonian printed two articles on the project; the first was published on June 30, 2011 and featured a multi-page article entitled “Setting a new course, the CTUIR rebuilds a one-mile section of Meacham Creek.” The story highlighted the floodplain and channel restoration work in the historic context of the watershed. The second article was printed on July 28, 2011 and was titled "Fishy Business" and highlighted the fish salvage activities along with the huge volunteer effort.

Several stories about the Meacham Project were also featured by web and television. NOAA Fisheries Service published a story, “Down in the Coulees of Meacham Creek, Floodplain Restoration Spurs Recovery of Middle Columbia River Steelhead,” highlighting the contribution of the project to endangered species recovery. In addition, The Columbia Basin Bulletin posted a story on June 3, 2011 entitled “Umatilla Project Rebuilds Miles of Creek Channel to Restore Salmon, Steelhead, Bull Trout, Lamprey” (<http://www.cbbulletin.com/409526.aspx>). Furthermore, on August 22, 2011 Oregon Public Broadcasting Northwest Public Radio made public a written story and audiovisual story, “A Railroaded Oregon Creek Recovers From its Past” (<http://earthfix.opb.org/water/article/meacham-creek-restoration-nears-completion/>). This story was also run on the radio for several weeks following release. Lastly, The Northwest Indian News developed a video “Meacham Creek Restoration” highlighting the cultural significance of Meacham Creek and the restoration work underway to protect and restore floodplain/channel processes for enhanced fish habitat in order to restore CTUIR native foods (<http://www.nwin.tv/NWIN51.html>).

Project and managerial staff from CTUIR and USFS led many public tours of the Meacham Creek Project during and after construction in 2011.

## Lessons Learned

While the project has achieved success on many levels, many lessons were learned during the design and implementation. Much of the project design relied upon topographic surveys and LiDAR flights done the winter and summer prior to project initiation. With Meacham Creek being a gravel-bed fluvial system that routinely modifies its physical characteristics and alignment, resurvey was required in many locations to account for topographic changes from peak flows the winter prior to project work. Additionally, when relying on multiple topographic data sets it was realized that varying coordinate systems can cause for confusion when coordinating project details and project construction with varying agencies and groups.

When a project is this large there are a number of activities that may often be overlooked on smaller projects that need to be addressed on projects of this magnitude. One of the main lessons learned is that active management needs to be practiced. Often designs on paper don't translate to the field as well as planned. Due to the large scale of the project this happened often and it was crucial to have open dialogue between owners, designers, contractors and partners so that everyone is aware of changes and comfortable with design changes. In addition, a fluid design process will require more flexibility built into the design. For design of a project on Meacham Creek where the system is dynamic and channel adjustment is annual, a less rigid design process is necessary with the design team frequently evaluating if the design, alternatives, and any contingencies in the design reflect original project objectives.

A lesson learned that is more specific to project was a better assessment of available fill material and contingency plans for shortage of material. When accounting for fill available it is critical to account for all potential sources of deficiencies. On the project it was found that slight differences in topographic surfaces used, lack of compaction specifications (over compaction, compaction due to altered access roads), under excavation and unplanned "save islands" resulted in a significant deficiency in fill material. Once it was realized that there was a shortage of fill, there was a brief panic due to the lack of a contingency plan. This problem was addressed through open dialogue with all parties and eventually resolved, but slowed project efficiency.

Another lesson that was realized during project construction was the importance of having a detailed and sound plan for dewatering project areas. During project construction work had to be delayed or suspended due to sediment levels exceeding permit limitations. Contractors sometimes view dewatering during in-stream construction as a time consuming exercise, but time can be saved when a wet work environment is not continually encountered and the majority of the work is performed under dry conditions. Because contractors push construction timelines and often recognize that dewatering of all water is not likely practical or in their opinion feasible, dewatering details and specifications established prior to construction are not always adhered to during implementation. For example, the downstream berm that was constructed for dewatering and isolating the alcove and connection of the new channel alignment during construction was not effectively built to the design specification and did not provide sufficient protection from flows breaching the berm. This resulted in the contractor working in wet conditions that made it difficult to excavate.

Once project construction and earthwork was done, an immense amount of time and effort went into revegetating disturbed areas. With a mix of riparian and upland plants to be installed, an

approximate area for each type of plant was charted out and planted. Once winter flows approached it became evident that some areas received more water than expected and some areas received less water than expected and plant varieties may have been planted in inappropriate areas. In hind sight it would have been better to leave an area near the stream "plant free" until the stream was able to establish its self within the floodplain and depositional and erosional areas were established. Although plantings were very successful, it was later realized that planting efforts could've been more focused in certain areas and less focused in other areas once the channel was exposed to increased flows.

Finally, when working on a project of such a large proportion, such as Meacham Creek, it is important to have many people on the ground familiar with the project and inspecting the project. Construction crews were spread out within a 70 acre project area which made it difficult to monitor all project activities with one or even two people. When this happens many details that may seem minute to construction personal can be overlooked and cause determent to project objectives. This is another instance where open dialogue needs to be established in order to resolve any issues as they arise.

## Recommendations

Based on the lessons learned from the use of varying coordinate systems in project design, it is recommended that a single common coordinate system be adopted at project initiation for use throughout the design, implementation and monitoring for all parties involved. This may entail applying GIS standards and or requirements to survey and design data.

Review project objectives at the beginning and end of each design meeting. For example, during the Design Team's assessment of the existing channel and during the development of design alternatives, additional discussions should have occurred concerning whether off-channel habitats such as wetlands or wall-based channels would more effectively achieve project objectives rather than backfilling the old channel. Although the Design Team may have retained the decision to backfill the old channel due to concerns of reoccupation of the alignment, contingencies could have been considered to address reoccupation, shortage in backfill material, or improvements to the project design that may arise during construction.

In order to address unexpected changes during project construction, it would be recommended to utilize a fluid design process that incorporates alternatives and contingencies that reflect project objectives. For example, although selection of a single preferred alternative is necessary to advance the design and apply for construction permits, construction contingencies should have been discussed by the design team for instances where materials are in surplus, such as large wood, or shortage, such as backfill material, when historic meander alignments exceed current constraints on the ground, or when groundwater is encountered and limits the contractor's ability to excavate. While it is not feasible or cost effective to discuss and evaluate all scenarios, alternatives, and contingencies during each design review meeting, the design team should keep a concise running log of potential scenarios, constraints, and alternatives and contingencies, and should agree on the process to evaluate and address these throughout the design and construction.

# MONITORING

## Background/Rationale

The CTUIR-Umatilla Fisheries Habitat Program continues to invest substantial resources in restoring the fisheries habitat within the Umatilla Subbasin and its tributaries. In order to ensure that investments result in actual improvements to biological productivity, an extensive long-term monitoring plan has been setup. This monitoring plan aims to evaluate the effects on biotic and abiotic ecological processes as a result of habitat restoration efforts. With time, we expect watershed treatments to improve stream functions by 1) diversifying channel morphology 2) increasing floodplain connectivity 3) decreasing annual maximum stream temperatures 4) increasing summer base flows 5) increasing abundance of and diversity of riparian vegetation and 6) increasing macroinvertebrate abundance and diversity.

Within the subbasin we have setup baseline monitoring to help understand relationships between our in-stream restoration efforts and aforementioned ecological processes. In order to accomplish this we continue to conduct a combination of monitoring activities and methods included within the Umatilla Subbasin Fish Habitat Restoration Monitoring Plan located at the Pacific Northwest Aquatic Monitoring Partnership website (Citation URL: <http://www.monitoringmethods.org/Protocol/Details/681> ). This protocol is specific to physical monitoring (except for aquatic macroinvertebrate monitoring) and is continually being refined. The protocol does not include any information on monitoring fish populations. It is believed that measurable changes in physical habitat improvements are a predictor for improved changes to survival and productivity of various salmon and trout life stages.

Furthermore, in the context of habitat restoration actions, project staff must consolidate regional and local data in order to assist in project activities, such as local and regional project presentations, permitting, development of biological assessments and evaluations, design, pre- and post-project analysis, project effectiveness, and long-term biological and physical recovery response. The Umatilla Anadromous Fish Habitat Project coordinates with multiple CTUIR and ODFW research projects that monitor and evaluate the success of the Umatilla Fisheries Program as a whole. These projects deal with natural production monitoring (CTUIR Umatilla Basin Natural Production Monitoring and Evaluation Project; 1990-005-01 and ODFW Evaluation of Juvenile Salmonid Outmigration and Survival in the Lower Umatilla River; 1989-024-01) and are critical for evaluating natural production relative to sustainable habitat for salmonids. This project utilized data from research projects in the basin to identify trends in response to habitat management actions which will help prioritize future restoration actions. Juvenile production and adult spawn surveys from the above fish monitoring projects were used to examine relationships between production and restored function in the Umatilla River Basin and help to document fish benefits to restoration actions. In addition to biological and physical monitoring, project staff further coordinated with the CTUIR Water Quality Program to attain water quality data as environmental baseline and response for project activities.

In 2011, the majority of monitoring conducted by the Umatilla Fish Habitat Project was done on Meacham Creek. More specifically, the monitoring was focused on the 2011 Floodplain Restoration and In-stream Enhancement Project. Due to the large nature of the project, the large scale changes expected and limited time, 2011 monitoring focused on this project.

## **Monitoring Objectives**

1. Evaluate changes in water quality as a result of stream restoration within the Umatilla Subbasin
2. Evaluate changes in summer low flow periods as a result of stream restoration within the Umatilla Subbasin
3. Study changes in thermal regime as a result of stream restoration projects within the Umatilla Subbasin
4. Evaluate changes in riparian stands as a result of stream restoration projects within the Umatilla Subbasin.
5. Track changes in biotic and abiotic ecological process within the Umatilla Subbasin, specifically in and around restoration project areas.
6. Track the effectiveness of designed stream restoration features within the Umatilla Subbasin
7. Track the changes in macroinvertebrate populations and richness within the Umatilla Subbasin

## **Key Assumptions**

Improvements in fish habitat and physical stream characteristics will result in improvements in sustainable fish populations.

## **Temporal Design Description**

### **Photo Point Documentation**

Protocol: CTUIR-Umatilla Basin Photo Points (URL Citation: <https://www.monitoringmethods.org/Method/Details/1313>)

Photo point monitoring intensity varies depending on the magnitude of size and project type. Photo points are taken prior to project initiation in order to capture pre project conditions and project progression. If possible photos will be taken showing high and low flow conditions. During project construction photos are taken in order to capture major changes within the project area. After project completion, photos are repeated opportunistically to capture major changes or during bankfull plus events, low flows and/or every 2-5 years. New projects typically have a higher intensity of photo point monitoring due to the high level of changes that can occur. Currently, CTUIR is heavily monitoring the 2011 Floodplain Restoration and In-stream Enhancement Project. Photo point sites are set up in order to track the progression of landscape features (i.e. vegetation, channel morphology) of past, present and future projects (i.e. Figure 16). Repeatable photo point documentation is used to monitor and quantify the general magnitude of change in habitat characteristics to distinguish trends and determine the relation to habitat enhancement projects as a means of effectiveness monitoring. Besides monitoring the Meacham Creek Project, CTUIR continues to use photo point monitoring to assess changes on past projects on Meacham Creek, Birch Creek, the Umatilla River, Wildhorse Creek and McKay Creek.

The CTUIR (Confederated Tribes of the Umatilla Indian Reservation)-Umatilla Basin Photo Points Method is based off of the 2002 USDA "Photo Point Monitoring Handbook" by Frederick C. Hall (<http://www.fs.fed.us/pnw/pubs/gtr526/gtr526A1.pdf>). Photo points are uploaded and archived in the CTUIR photo point database depository (<http://intranet/resources/dnr/fisheries/Photo%20Points/Forms/AllItems.aspx>) for comparable visuals for tracking physical appearance changes over time. This database is currently only accessible by CTUIR staff.

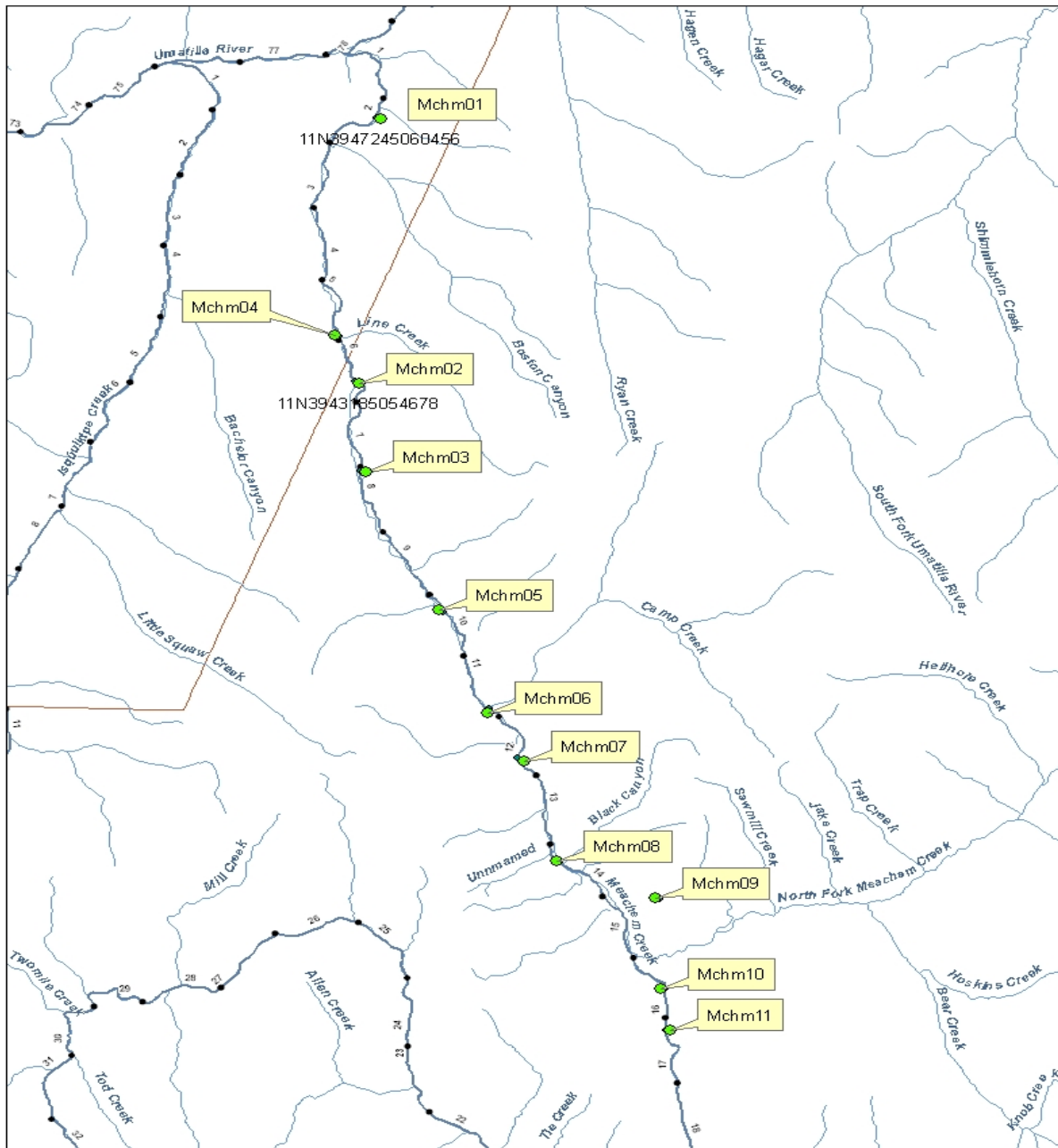
### **Time Lapse Photography**

In addition to photo point documentation a time lapse photography station was established to track progress of project construction and monitor changes to the project area. The time lapse station consisted of a digital SLR camera mounted in a weather proof box on a ridgeline with a good vantage of the project area. The camera was set up to take photos every 20 minutes of the same location throughout the day. The camera was set up in the early phases of project construction (mid-May) and left up to through project completion and project revegetation (early December). After all photos were taken, they were combined to be shown in sequence and create a time lapse movie that was and will be used for project documentation, public education, public relations and outreach. This video is not yet publicly available but will be on the CTUIR website once approved.

### **Water Quality, Temperature and Sediment Monitoring**

Meacham Creek is listed on the state 303(d) list as having elevated summer temperatures that are detrimental to fish rearing. High summer temperatures are one of the drivers for the extensive restoration efforts taking place on Meacham Creek. In an effort to monitor long term changes in summer water temperatures a longitudinal profile of HOBO pendant stream temperature loggers have been deployed in Meacham Creek since 2005. Eleven temperature monitors are arranged in a longitudinal fashion starting at RM 2 and ending at RM 16.5 from July through September (Figure 17). Many of the temperature loggers bracket planned habitat restoration reaches. Temperature loggers are deployed to go off hourly starting in mid-spring and ending in early fall with the expectations of capturing stream temperatures during low flow and high temperature periods during the summer months. Low flow and high temperature periods are important to monitor because they are when fish are most vulnerable to physical stressors, particularly temperature. These longitudinal temperature collection sites are well supported by CTUIR management and are expected to be collected well into the future.

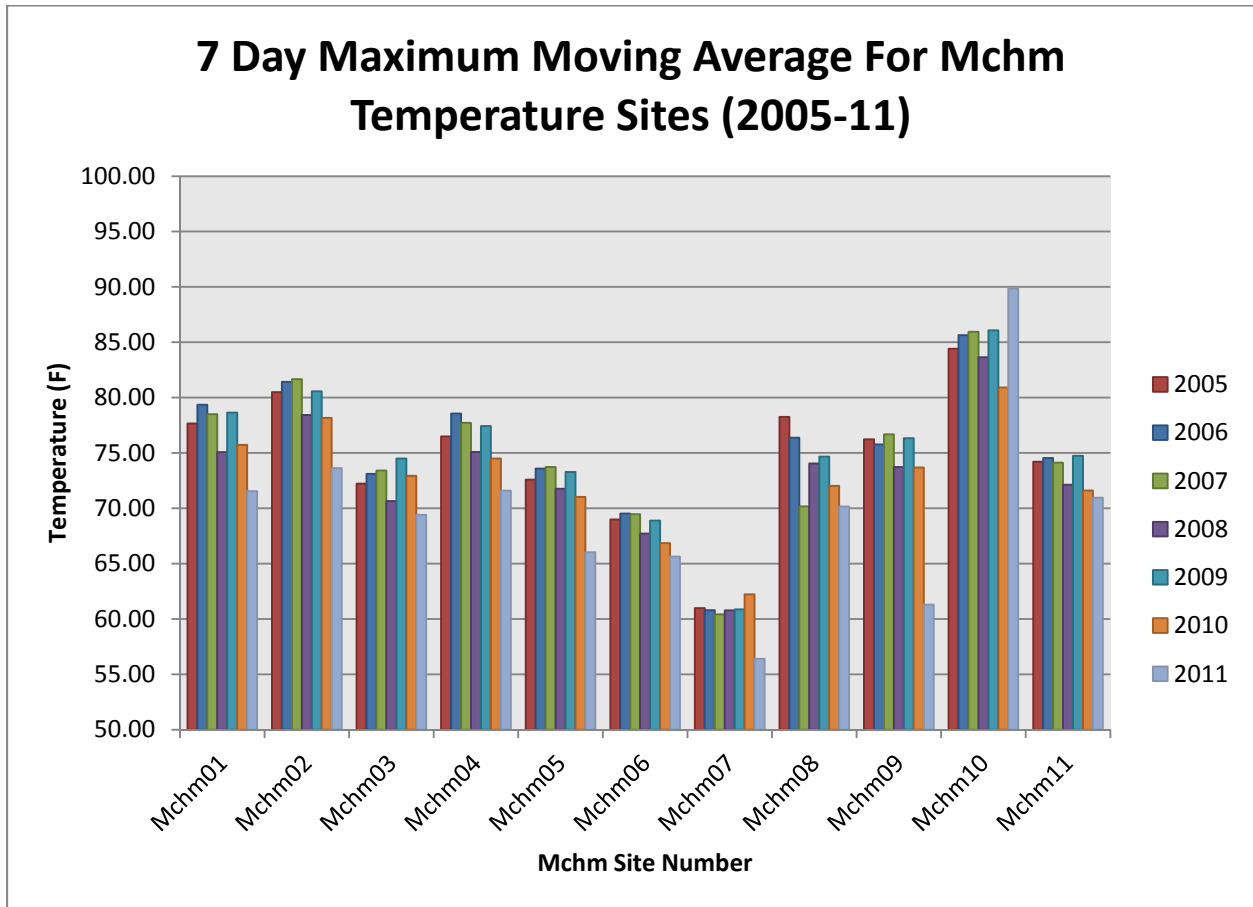
Additional temperature sites are setup in off channel pools, spring brooks and other similar features that are only connected to Meacham Creek during the summer months through hyporheic/groundwater exchange. These sites are meant to monitor the effectiveness of the 2011 Meacham Creek project (RM 6-7.1) to contribute cool thermal refuges for rearing fish. These sites are also meant to complement the Meacham Creek Geomorphic-Hyporheic Flow Study, being conducted by Montana State University, which is described below. CTUIR is expecting to continue to monitor some of these sites after the groundwater monitor project is complete, and is planning on adding the sites to its annual stream temperature monitoring program described above.



**Figure 17. Temperature monitoring sites located within the Meacham Creek subbasin between RM 0-16.5, 2005 to present.**

In order to analyze stream temperature data and the effectiveness of aforementioned restoration projects CTUIR has adopted the Oregon Department of Environmental Quality’s standards of generating a 7 day maximum average daily temperature (7DADMax) for each site (Figure 18). The 7DADMax averages the highest daily temperatures in any given consecutive seven day period. Long term exposure to high temperatures are more indicative of how temperature affects fish health rather than short term exposure to elevated temperatures. Additionally, the

7DADMax helps eliminate any bias in temperature monitoring that could be affected by one or two days of abnormally elevated ambient temperatures.

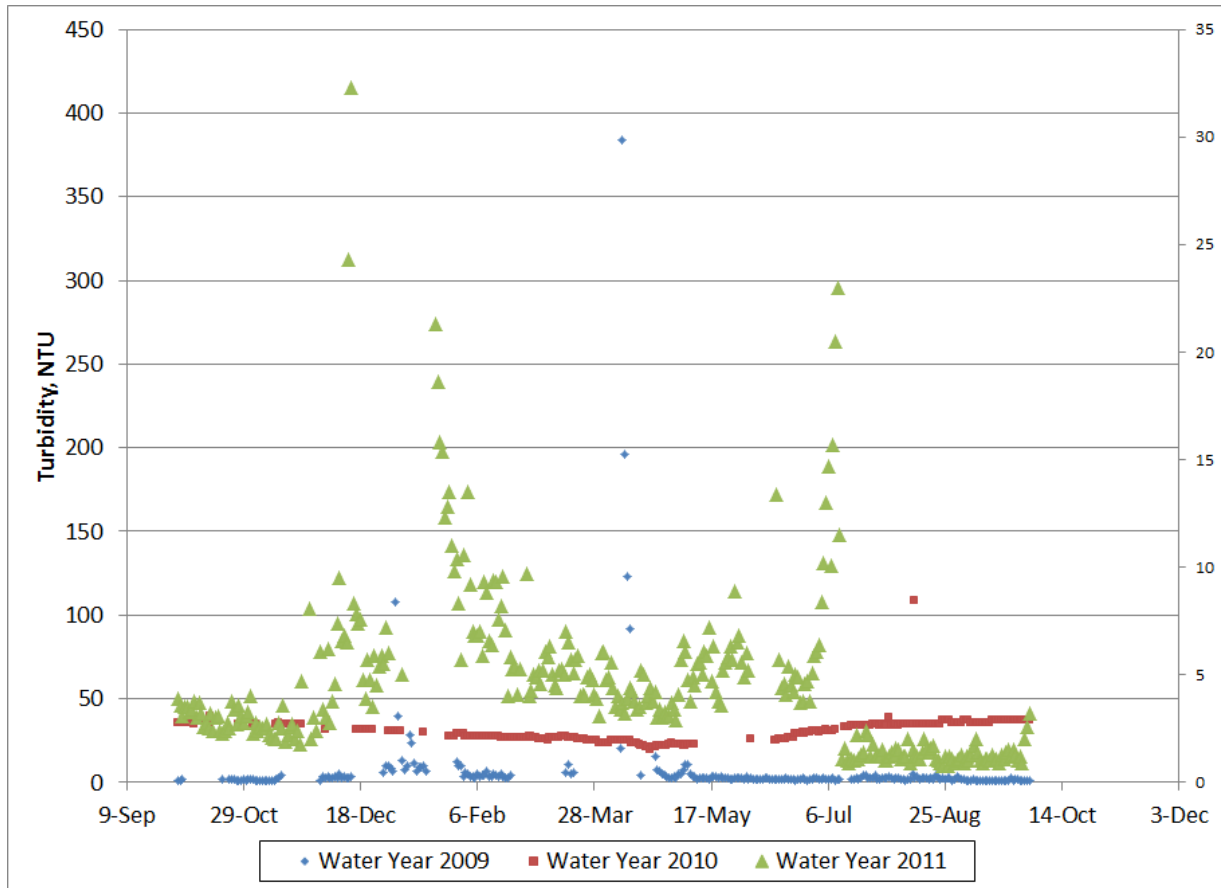


**Figure 18. Seven consecutive day average of the daily maximum temperatures (7-DADMax) at all Meacham Creek Sites since 2005.**

CTUIR cost share operates with the USFS an automated water sampler (ISCO) near the mouth of Meacham Creek (RM 2.0). Water samples are analyzed under subcontract at the USFS Water Quality Laboratory for turbidity, total suspended solids (TSS), total dissolved solids, and specific conductivity. Data is entered into the CTUIR water quality data base. About 1,460 samples are processed yearly for Meacham Creek and approximately 6,550 samples are processed for other locations on the CTUIR ceded lands.

Analyzed data can measure changes in suspended solids and turbidity from watershed activities, and is a good measure of water quality. Samples for turbidity, TSS, and specific conductivity will be collected and transported to the USFS Water Quality Laboratory for analysis. Sampling procedures and water quality analysis will conform to the stipulations included in the latest edition of EPA’s Water Quality Criteria (1986) and *A Guide to the Sampling and Analysis of Water and Wastewater* (1987). All approved data is then uploaded to the CTUIR water quality data base semi-annually. Figure 19 is a summarized turbidity plot from 2009 to 2011. Meacham Creek is a low sediment input stream and not listed for turbidity, but this helps monitor for any

significant changes in turbidity levels. Monitoring will continue to be used for evaluating habitat project effectiveness from long-term project ground disturbance.



**Figure 19. Meacham Creek turbidity plot (NTU's), 2009-2011.**

**Meacham Flow/Hydrology Monitoring (USGS)**

The flow/hydrology monitoring is a 50% cost share funded project with the USGS to operate and maintain the Meacham Creek real-time flow gage at river mile 1.5 (near Gibbon; 35-yr record). USGS provides timely and accurate instantaneous stream flow data for various in-stream actions. Data is utilized for long-term monitoring and hydrological flow analysis for project planning and design. This data coincides with project goals for the Umatilla Subbasin to increase summer flows from floodplain connection and shallow aquifer recharge as well as examining flood time durations. This data is integral in CTUIR's ability to design effective restoration projects in Meacham Creek, which is a priority area for restoration. Flow estimates for the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1 site were determined by evaluating the USGS average daily stream flow data collected at the Meacham Creek gage (Figure 20).

Characteristic flows represent the typical range of flows that can be expected in a stream or river during the hydrologic year. These flows, shown in Table 1, include average annual flow, seven-day average low flow, and one-day average flood flow.

<b>TABLE 1. CHARACTERISTIC FLOWS FOR MEACHAM CREEK PROJECT SITE</b>	
Average Annual Flow (cubic feet/second)	193
Seven-Day Average Low Flow (cubic feet/second)	8.8
One-Day Average Flood Flow 2 Year RI (cubic feet /second)	1900
Bank Full Flow 1.5 RI (cubic feet/second)	1427

Monthly flows represent the range of flows to be expected during each month of the year. These flows, shown in Table 2, include average monthly maximum, monthly mean, and average monthly minimum.

<b>TABLE 2. MONTHLY FLOWS FOR MEACHAM CREEK AT PROJECT SITE</b>												
	Monthly Flow (cubic feet/second)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Maximum	25	280	657	859	1098	1097	1177	771	257	38	16	14
Mean	15	68	182	235	345	483	533	322	101	22	11	11
Minimum	11	19	59	74	102	188	263	127	37	13	9	9

Flood flows represent the high flows that can be expected at different recurrence intervals. These flows, shown in Table 3, include average daily flood flows and instantaneous peak flood flows.

<b>TABLE 3. FLOOD FLOWS FOR MEACHAM CREEK AT PROJECT SITE</b>											
	Flood Flow (cubic feet/second)										
	5 Yr	10 Yr	20 Yr	25 Yr	40 Yr	50 Yr	60 Yr	75 Yr	80 Yr	100 Yr	
Average Daily Flood	2510	3051	3585	3758	4123	4301	4444	4621	4673	4852	
Instantaneous Peak Flood	3407	4328	5272	5585	6258	6589	6860	7197	7295	7640	

**Figure 20. Calculated characteristic flows, average monthly flows and flood flows for the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1 site.**

## **Aquatic Habitat Inventory**

Following completion of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1 a detailed topographic survey of the “as built” project conditions was completed (Figure 21 and Figure 22). The survey mapped out elevations throughout the floodplain and included channel centerline, habitat unit breaks, floodplain elevations, and bank full elevations. This surface will be used to analyze if project objectives were met and to compare site conditions as the project site when exposed to winter flows.

After project completion additional Columbia Habitat Monitoring Program (CHaMP) habitat surveys will be completed within Meacham Creek in 2012. Surveys will be conducted to assess baseline conditions in Meacham Creek such that the primary impacts and restoration and enhancement projects intended to address these impacts can be assessed. Three locations were selected for survey using a spatially balanced sample design to monitor the physical habitat conditions in project areas as well as provide a control reach. The areas selected for monitoring include the reach between RM 2.5 to 3.0 (future project site), RM 5.5 to 6.0 (existing project site) and RM 8.5-9.0 (non-treatment control site).

## **Fish Population Monitoring**

In the context of habitat restoration actions, project staff consolidated regional and local data in order to assist in project activities, such as local and regional project presentations, permitting, development of biological assessments and evaluations, design, pre- and post-project analysis, project effectiveness, and long-term biological and physical recovery response. The Umatilla Anadromous Fish Habitat Project coordinates with multiple CTUIR and ODFW research projects that monitor and evaluate the success of the Umatilla Fisheries Program as a whole.

These projects deal with natural production monitoring (CTUIR Umatilla Basin Natural Production Monitoring and Evaluation Project; 1990-005-01 and ODFW Evaluation of Juvenile Salmonid Outmigration and Survival in the Lower Umatilla River; 1989-024-01) and are critical for evaluating natural production relative to sustainable habitat for salmonids.

This project utilized data from research projects in the basin to identify trends in response to habitat management actions assisting with prioritizing future restoration actions. Juvenile production and adult spawn surveys from subbasin monitoring projects were used to examine relationships between production and restored function in the Umatilla River Subbasin and help to document fish benefits to restoration actions (Contor 2012). In addition to the ongoing monitoring efforts within the Umatilla River Subbasin, with direction from scientific review processes (e.g. ISRP), CTUIR recognized the growing need to document restoration effectiveness across multiple subbasins to direct future management efforts. The draft Biological Effectiveness Monitoring and Evaluation Plan (Stillwater Sciences 2011) for fisheries enhancement in CTUIR subbasins outlines a bio-monitoring program that would assess the effectiveness of CTUIR habitat improvements/restoration actions with respect to spring Chinook, summer steelhead and bull trout populations. Implementation is planned for 2013.

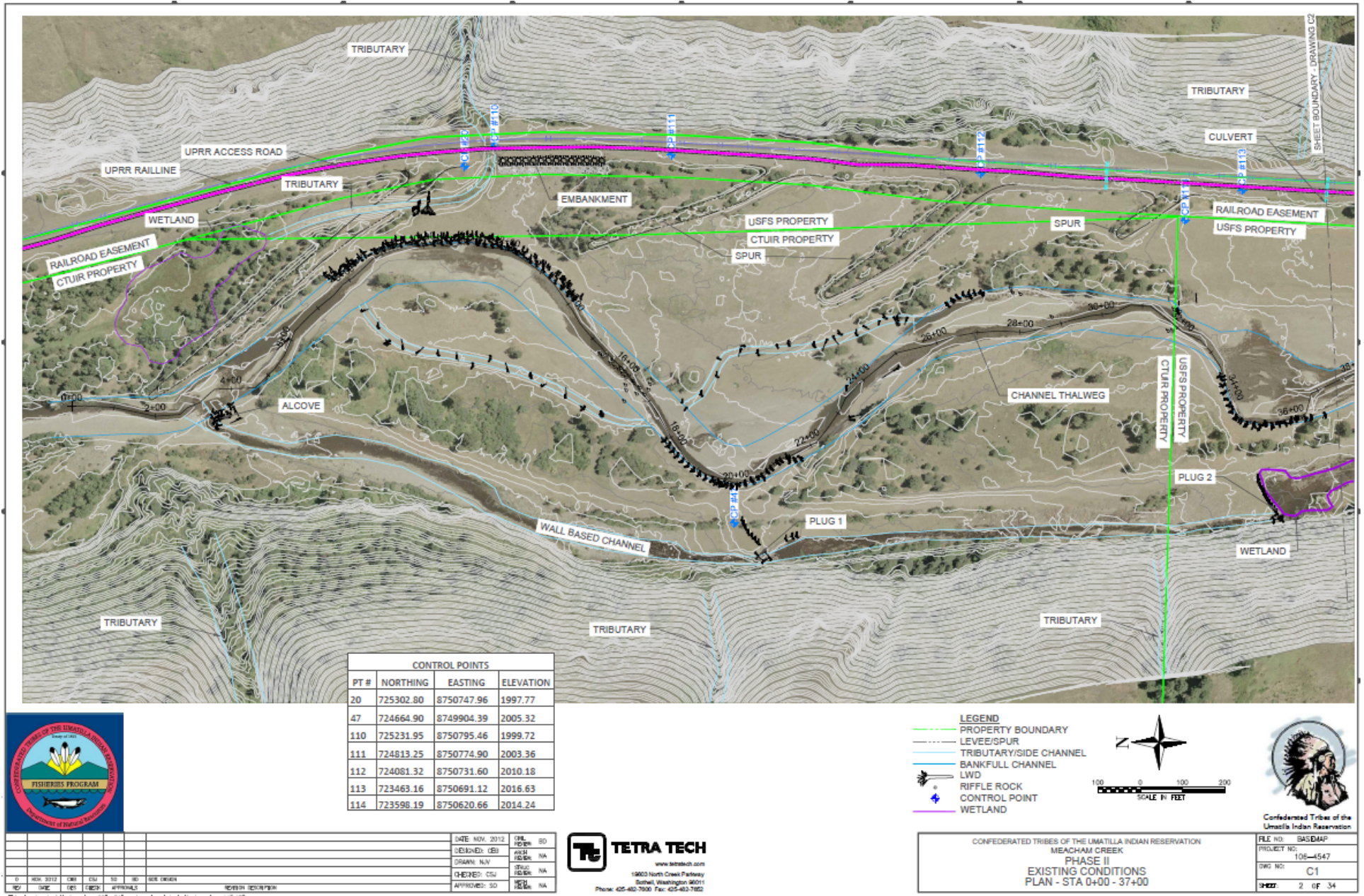
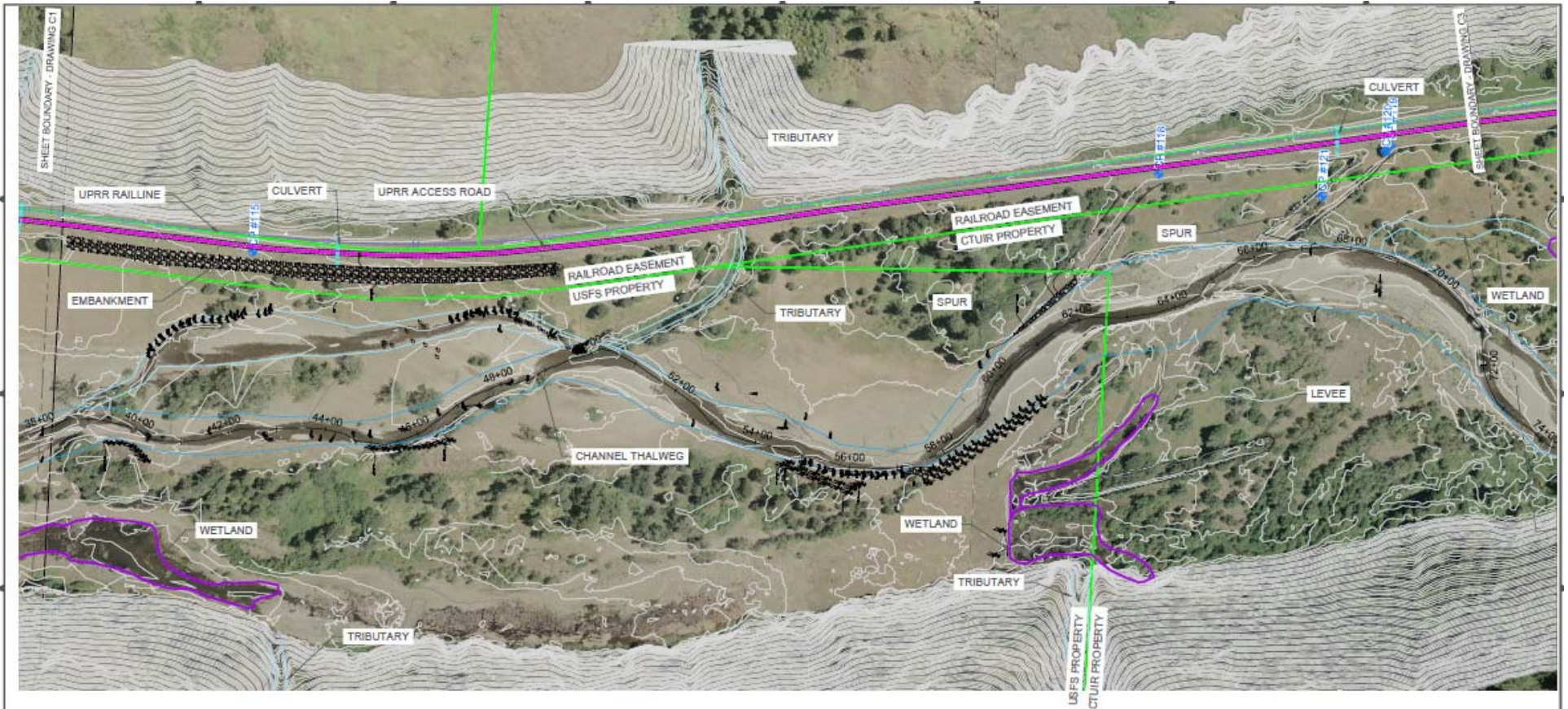


Figure 21. Existing conditions “downstream as built” survey of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1.



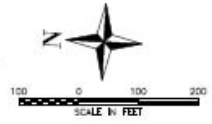
REV	DATE	BY	CHKD	DESCRIPTION

DATE	BY	CHKD
NOV. 2012		
DESIGNED		
DRAWN		
CHECKED		
APPROVED		



CONTROL POINTS			
PT #	NORTHING	EASTING	ELEVATION
115	722781.13	8750647.12	2023.93
118	720929.43	8750904.10	2042.32
119	720456.11	8750988.28	2046.89
120	720466.15	8750973.87	2047.14
121	720592.28	8750875.54	2045.46

- LEGEND**
- PROPERTY BOUNDARY
  - - - LEVEE/SPUR
  - TRIBUTARY/SIDE CHANNEL
  - BANKFULL CHANNEL
  - LWD
  - RIFFLE ROCK CONTROL POINT
  - + CONTROL POINT
  - WETLAND



CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION MEACHAM CREEK PHASE II EXISTING CONDITIONS PLAN - STA 37+00 - 72+00		FILE NO: BASEMAP PROJECT NO: 108-4547 DWG NO: C2 SHEET: 3 OF 34
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Figure 22. Existing conditions “downstream as built” survey of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1.

## Experimental Design Description

### Macroinvertebrate Study

Macroinvertebrate baseline data has been collected since 2005 using a modified EPA EMAP protocol for targeted riffle sampling (Peck et al. 2006). Prior to macroinvertebrate sampling, a suite of environmental variables were collected and measured at 16 site locations encompassing two large reach project areas in Meacham Creek. These reaches were between RMs 2-4.5 and RMs 5-7. The variables collected include habitat metrics such as: slope, substrate composition, water depth, water velocity, wetted width, cover, woody debris, percentage of filamentous algae, and water quality measurements (turbidity, conductance and dissolved oxygen). These metrics were collected to correlate macroinvertebrate composition to the collected habitat metrics and the effect they may have on each other. The primary objective of the macroinvertebrate sampling is to provide pre-restoration data on the macroinvertebrate community within Meacham Creek so that it can be used to examine after large restoration projects. Secondary objectives include: a) an examination of environmental variables that correlate with macroinvertebrate community structure. This provides insights into the variables that are important in driving macroinvertebrate community structure in Meacham Creek and b) a comparison of the macroinvertebrate community in Meacham Creek to that in the North Fork of the Umatilla River (independent, reference site).

Data analysis included a multivariate analysis (ordination) and an examination of five metrics commonly used in biological assessments:

1) Assemblage Tolerance Index (ATI). This metric was developed by the US Environmental Protection Agency using macroinvertebrate and human disturbance data from the US EPA EMAP survey of over 1100 sites in the western US (Whittier and Van Sickle 2010). To develop this metric tolerance values were assigned to individual macroinvertebrate taxa by relating their abundance to a synthetic human disturbance index. The human disturbance index was based upon nine variables from three general classes related to the lotic environment – water quality, physical habitat at the sample reach, and human activity in the sampled watershed above the sample reach (Whittier and Van Sickle 2010). The ATI is an average tolerance value for the macroinvertebrate assemblage at a study site weighted by the relative abundance of each taxon:

$$ATI = \Sigma(TV_i \times RA_i),$$

where  $TV_i$  is the tolerance value of taxon “i” and  $RA_i$  is its relative abundance within the assemblage.

Tolerance values for taxa are scaled from 0 to 10 with sensitive taxa having low tolerance values and tolerant taxa having high tolerance values. With improvement of conditions within a restored reach the ATI score is expected to decrease (as the relative abundance of sensitive taxa increases).

2) Inferred Temperature. This metric was developed by the Oregon Department of Environmental Quality using macroinvertebrate and temperature data from 328 sites throughout Oregon (Huff et al. 2006). This metric was developed and is calculated in a similar fashion as

the ATI. From the 328 sites, invertebrate taxa were assigned an optimal temperature based upon abundance and the average of the daily maximum water temperature for the warmest 7-day period. The inferred temperature metric is calculated as:

$$\text{Inferred Temperature} = \Sigma(\text{TempOpt}_i \times \text{RA}_i),$$

where  $\text{TempOpt}_i$  is the temperature optima for taxon “i” and  $\text{RA}_i$  is its relative abundance.

Summing these values across all taxa within an assemblage provides an “inferred temperature,” which is the water temperature estimated based upon a site’s assemblage composition. Huff et al. (2006) found a good fit between inferred temperatures and actual water temperatures (measured using dataloggers) for the Oregon data set. However, they found that in relatively warm systems, macroinvertebrate assemblages tended to underestimate actual maximum water temperatures and in cold systems macroinvertebrates tended to overestimate maximum water temperatures. In his bio-assessment of a restoration project in the Grande Ronde watershed that involved channel reconstruction, Whitney (2007) found this metric to be responsive to the restoration efforts.

3) Taxa Richness. This is a count of the number of taxa found in the macroinvertebrate assemblage. Taxa richness is predicted to increase with increasing environmental quality (Karr and Chu 1999; Whitney 2007).

4) Mayfly-Stonefly-Caddisfly (Ephemeroptera-Plecoptera-Trichoptera, EPT) Taxa Richness. This metric is a count of the number of taxa found within these three orders of aquatic insects. Taxa within these three groups are generally sensitive to a variety of human impacts, and thus their taxa richness is predicted to increase with increasing stream habitat quality (Karr and Chu 1999).

5) Assemblage Diversity. Assemblage diversity is a function of both taxa richness and the relative abundance of each taxon. Shannon diversity ( $H'$ ) is the specific diversity metric calculated for the Meacham Creek macroinvertebrate data:

$$H' = -\Sigma p_i \log_e p_i,$$

where  $p_i$  is the relative abundance of species “i”.

Diversity is predicted to increase with increasing habitat quality (Karr and Chu 1999).

Ordination analyses allow an examination of the entire macroinvertebrate community in a manner that takes into account both the taxa of organisms and their relative abundance. Results show the most likely environmental variables that determine community structure.

Monitoring results provide solid baselines for measuring changes in organism taxa and abundance after restoration activities are implemented. Only baseline data are available through sample year 2010. The data are shown in scatterplot form for all five metrics in Figure 23. A comparison of the regression slopes for the within-project sites and the control sites revealed that, as predicted for the before restoration data, no differences in slopes existed for any of the

five metrics examined (Table 9). In addition, none of the regression equations were significant (Table 9) indicating that the metrics are not displaying any linear trends through time.

Macroinvertebrate sampling occurred at the seven Meacham Creek sites in September 2011 approximately one month after the historic channel was opened. While these samples are still being processed, our observations in the field indicated that very few macroinvertebrates had colonized the new channel by September 2011. Because the restoration has recently taken place we propose to continue to sample macroinvertebrates in the project area (and at the control sites above and below the project area as well as at the North Fork Umatilla sites) annually for the next five years to capture the dynamics of the initial colonization of the opened channel. After five years enough data will have been collected to conduct the analyses we have outlined here in a robust fashion. After five years macroinvertebrate monitoring should continue; however, an evaluation of the need for annual monitoring should be made.

### **Meacham Creek Geomorphic-Hyporheic Flow Study**

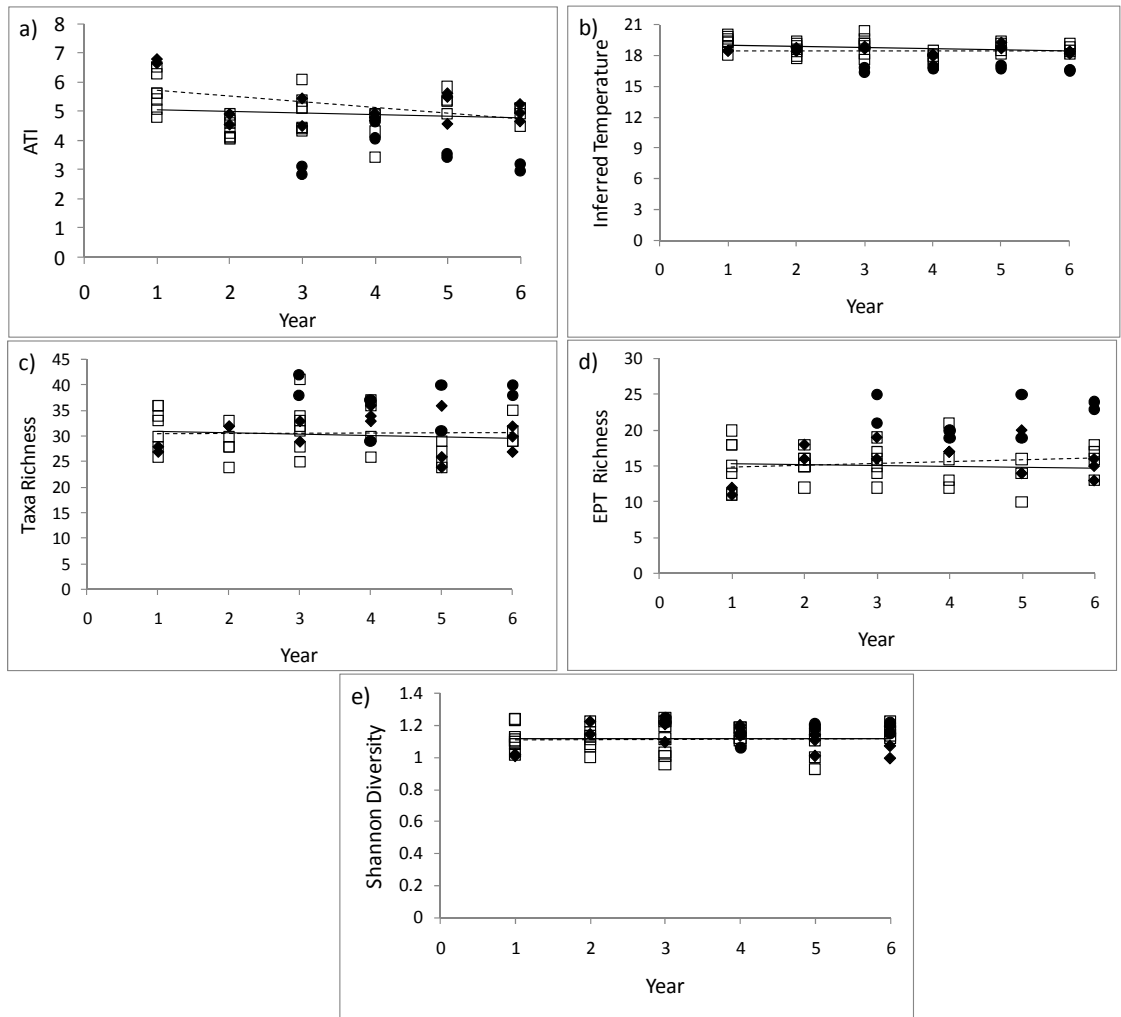
Protocol: Meacham Creek Geomorphic-Hyporheic Flow Study (URL Citation: <http://www.monitoringmethods.org/Protocol/Details/677> ).

#### Background/Rationale

CTUIR recently completed a large scale restoration project on Meacham Creek (RM 6-7.1) that included, but is not limited to, channel realignment (re-meandering), reconstruction, addition of large woody debris and flood plain reconnection. This project has many goals, as portrayed throughout this document, one of which is to enhance hyporheic exchange and create thermal refugia for rearing salmonid juveniles during summer low flow periods.

The Meacham Creek Geomorphic-Hyporheic Flow Study aims to document the effects of a large scale channel realignment restoration project on hyporheic exchange and water temperature. This study focus hopes to answer the following questions while documenting the changes that occur: 1) How are interactions between surface and subsurface hydrology influenced by channel realignment and large wood additions associated with stream restoration? and 2) How will water temperature respond to restoration induced changes in hyporheic hydrology?

This research is in partnership with Montana State University (MSU) and will be a critical first step in understanding the efficacy of conventional restoration strategies for hyporheic rehabilitation. Efforts will provide a first empirical test of whether geomorphic restoration is cost effective means of managing water temperature in streams that violate EPA's water temperature standards for the region and nationally. This research will also provide the first reach-scale evaluation of a stream restoration specifically implemented to meet the objectives of hyporheic restoration and temperature mitigation. Finally, this work would serve as a model for partnership between academia and managers in developing research-based monitoring strategies that facilitate learning and thus adaptive identification of effective structural and process-based restoration strategies for reestablishing vertical connectivity (Ward 1989, Stanford and Ward 1993) by restoring hyporheic hydrology in river ecosystems.



**Figure 23. The five metrics illustrated across the six sampling years. The metrics are a) the Assemblage Tolerance Index (ATI), b) inferred temperature, c) total taxa richness, d) richness of Ephemeroptera-Plecoptera-Trichoptera (EPT) taxa, and e) Shannon diversity. Values for control sites are open boxes and the regression is shown with a solid line. Values for within-project sites are shown as filled diamonds and the regression is shown with a dotted line. Values for the North Fork sites are shown as filled circles. The x-axis shows the sampling years with 2005 as Year 1 and 2010 as Year 6.**

**Table 9. Regression equations for control and within-project sites for each of the five metrics. Significance values for each regression are also given. The last column “Slope comparison” is a test of the control and within-project regression slopes for each metric.**

Metric	Site Group	Regression	Regression p-value	Slope comparison
ATI	Control	ATI = 5.1 – 0.053*Year	0.47	F = 1.22, p = 0.27
	Within-project	ATI = 5.9 – 0.19*Year	0.08	
Inferred Temperature	Control	Temp = 19.1 – 0.12*Year	0.11	F = 0.90, p = 0.35
	Within-project	Temp = 18.5 – 0.01*Year	0.86	
Taxa Richness	Control	Richness = 31 – 0.28*Year	0.53	F = 0.15, p = 0.70
	Within-project	Richness = 30 + 0.02*Year	0.97	
EPT Richness	Control	EPT = 15 – 0.13*Year	0.65	F = 0.60, p = 0.44
	Within-project	EPT = 15 + 0.26*Year	0.52	
Shannon Diversity (H')	Control	H' = 1.12 – 0.0002*Year	0.98	F = 0.001, p = 0.97
	Within-project	H' = 1.11 + 0.0003*Year	0.98	

### Study Design

A series of 30 monitoring wells were installed prior to project restoration initiation in 2011. The wells are distributed throughout the floodplain within, above and below the restoration reach. The wells are spatially-distributed in a pattern designed to capture changes in subsurface water movement and temperature in response to channel planform changes due to restoration. A temperature and water level logger is deployed in each well.

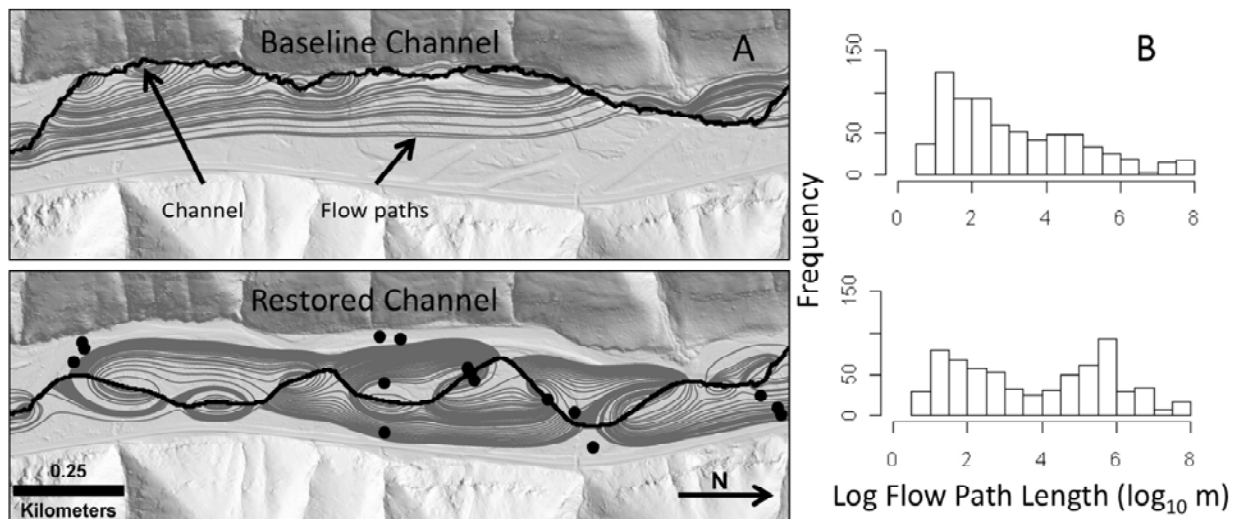
In addition, approximately thirty water temperature loggers have been deployed in open water locations in the main channel as well as in spring brooks and backwater channels throughout the floodplain at the restoration site. Each logger records a temperature/level measurement once per hour. The loggers will be deployed for a total of 18 to 24 months. The temperature loggers are deployed in a pattern meant to capture groundwater temperature shifts easily measured in hydrologic features that arise due to groundwater upwelling as a result of restoration actions. These data should allow relatively fine-scale measurement of the distribution of groundwater throughout the Meacham Creek floodplain. The wells and loggers have been either surveyed with a total station or their position logged via GPS.

**Groundwater Modeling:** In late 2010 and early 2011, groundwater hydrology of the baseline and restored channel alluvial aquifers was modeled using the USGS groundwater modeling software MODFLOW (Harbaugh 2005), where the main input into the aquifer was the water surface elevation of the creek plan form (Figure 24). Surface water elevation was derived from first-return LiDAR for the baseline condition, and under the restored condition it was based on "filling" the design channel pools and the riffle ground elevations. In either case, aquifer thickness was assumed to be 5 m in the valley center, tapering to 0.5 m at the valley wall using the LiDAR terrain model as the surface. Once the potentiometric flow surface was developed, subsurface flow path lines through the potentiometric flow field were generated by releasing "particles" along the creek using the USGS solute modeling software MODPATH (Pollock 2008).

In order to verify the hydrogeologic model observed vs. simulated changes in hyporheic temperature dynamics both prior to and after restoration will be used. Advection and dispersion of heat flux through the alluvial aquifer under pre-restoration and post-restoration scenarios will be simulated to determine groundwater heat flux at the reach scale and refine predictions of how heat flux will change in response to the change in channel planform as a result of the restoration. The heat flux simulations will be run with the USGS groundwater solute and energy flux model MT3DMS (Zheng et al. 2010, Zheng and Wang 1999). MT3DMS couples groundwater flow solutions from MODFLOW with the canonical solute and energy transport solutions (Zheng et al. 2010, Zheng and Wang 1999).

The groundwater modeling predicted that there would be a significant shift in groundwater surface elevation, as well as in the pattern and magnitude of exchange between groundwater and surface water in the project reach. Based on these initial hydrologic simulations of the site, it is predicted that the residence time distribution of hyporheic water will shift to include a higher number of intermediate duration hyporheic flow paths, but that the magnitude of gross hyporheic exchange may either increase or decrease, depending on the change in hydraulic conductivity.

**Aquifer properties (model parameter estimation):** Detailed field data collection of key aquifer properties will be used to refine the input parameters to the hydrogeologic model. In summer 2012, physical properties of the aquifer will be measured, including hydraulic conductivity via stress tests on monitoring wells (Freeze and Cheery 1979, Fetter 1994, Fetter 2008), specific heat capacity of the bulk sediments via pulsed heat methods (Domenico and Schwarz 1990, Stonestrom and Constantz 2003, Rosenberry *et al.* 2008, Fetter 2008), and hyporheic sediment



**Figure 24. A) results from MODFLOW simulation showing expected influence of restoration on hyporheic flow paths (grey lines) on the Meacham Cr. Restoration site. Dots show locations of installed monitoring wells. B) simulated hyporheic flow-path length distributions**

porosity via comparison of the saturated and oven-dried bulk samples collected on site (Freeze and Cheery 1979, Stonestrom and Constantz 2003).

**Radon-222 activity and geochemistry:** In order to verify the hydrologic model verification of the observed vs. simulated distributions of hyporheic water residence time across the post restoration site needs to be conducted. Radon-222 concentration is a reliable indicator of subsurface water residence time up to about 20 days (Hoehn and Cirpka 2006, Lamontagne and Cook 2007). We will perform periodic (high vs. low flow over 2 years) synoptic sampling for variation in radon-222 activity and geochemistry in both the hyporheic zone (e.g. from monitoring wells) and in the open channel. In October 2011, Radon-222 activity and geochemistry was measured and collected at twenty wells, five open channel locations, and four spring brook source waters using methods described by Schubert *et al.* 2006. Geochemistry data will be used to determine the magnitude of mixing between hyporheic and deep groundwater (Freeze and Cheery 1979, Hoehn and Cirpka 2006, Jones et al. 2008), a prerequisite for estimating hyporheic residence time from Radon-222. Where necessary, model parameters will be calibrated by re-adjusting parameters within observed empirical ranges to allow the model to represent the spatiotemporal distribution of observed hyporheic residence times on the site from Radon-222 analysis.

**Aquifer heat flux modeling:** The next step in verifying the hydrogeologic model will be to use observed vs. simulated change in hyporheic temperature dynamics both prior to and after restoration. Advection and dispersion of heat flux through the alluvial aquifer under pre-restoration and post-restoration scenarios will be simulated to visualize groundwater heat flux at the reach scale and refine predictions of how heat flux will change under each scenario. The heat flux simulations will be run with the USGS groundwater solute and energy flux model SUTRA (Voss and Provost 2010), using the same aquifer parameters identified from the residence-time modeling described above. Resulting predictions for spatial patterns of water and heat transfer from the alluvial aquifer to the river channel will be used to calculate a spatially explicit heat budget for the pre- and post-restoration stream channel, and spatial variation in predicted in-channel diel temperature patterns will be compared to those observed with the in-channel temperature loggers to assess hyporheic influence on channel water temperatures

## SUMMARY AND CONCLUSIONS

In accordance with the 2006 NPCC solicitation outline, the CTUIR UAFHP since 2007 focused its restoration activities primarily on Meacham Creek, Birch Creek, and mainstem Umatilla River. However, project restoration activities occur in other areas of the basin where floodplain and riverine processes are treated with outcomes that are beneficial to ecological processes, water quality and fish production. The Meacham Creek Watershed has long been a primary focal point of the CTUIR effort to improve habitat conditions in the Umatilla Basin because of its location, size, historical significance, and recovery potential. Table 10 highlights the CTUIR Umatilla Anadromous Fish Habitat Project restoration accomplishments since 2007.

Proposed restoration actions have focused on protection, enhancement, and restoration of functional floodplain, channel and watershed processes at multiple scales using passive and active restoration techniques. Over the past decade, the CTUIR Department of Natural

**Table 10. The CTUIR UAFHP restoration project descriptions by location, treated primary limiting factors (NMFS 2009) by CTUIR River Vision touchstones (Jones et al. 2008) and accomplishments; 2007-2011.**

Subbasin, Stream and Years	Project Description	Species	CTUIR River Vision Touchstones/ Habitat Limiting Factors (PLF's shaded in yellow-NOAA BiOP)								Comment/ Accomplishments	
			Biota- Connectivity	Geomorphology	Connectivity		Hydrology			Riparian Vegetation		
			Passage Barriers/ Entrainment	In-channel Characteristics	Habitat Diversity (LWD)	Floodplain Confinement	High Temps	High Turbidity	Low Flows	Riparian/ Floodplain		
<b>UMATILLA</b>												
Meacham Creek and Camp Creek, Tributary of Meacham Creek (2007)	Fish passage rectifications, pool development with rock structures, and plantings	STS	X					X			X	Rectified two diversion dams and one in-stream structure providing unimpeded access to the entire watershed, development of pools with boulder cross vanes, 335 ft of streambank stabilization with added wood complexity, 0.3 miles livestock exclusion fence, and 500 riparian plantings.
West Birch Creek (2007-2008)	Fish passage rectification, riparian protection fencing and plantings	STS	X		X			X			X	Rectification of the Cunningham and Hoeft Dams providing 2.4 miles unimpeded habitat, 335 ft of streambank stabilization with added wood complexity, 0.3 miles livestock exclusion fence, and 5,000 riparian plants.
Mainstem Umatilla River (Initiated 2008- 2011)	Treated and maintained 3.5 miles of floodplain and channel; riparian and uplands	CHS, STS, Coho			X			X	X	X	X	Conservation easement on B&G Property to maintain 355 (61 riparian and 294 upland acres; installation of 60.7 acres of CREP tract's), 2 off- channel water wells, 13,400 seedling trees

											planted, 1,335 lbs of native grass seed and noxious weed control; Installation of an access restriction fence (3 additional riparian acres protected).
Meacham Creek (2009)	Floodplain improvement with levee setback, initiation of off-channel rearing habitat, large wood placement, and riparian plantings	CHS, STS,BT, Pacific Lamprey	X	X	X	X	X		X	X	Restored 40 acres of floodplain connectivity over 1-mile of stream by removal or modification of 3 levees and 1 dike (3,200 linear ft, 24,000 cubic yards); distribution of large wood on floodplain; 15,000 planted hardwood and conifer seedlings (30acres).
Meacham Creek (Initiated 2008-2011)	Riparian protection fencing and plantings	CHS, STS,BT, Pacific Lamprey		X	X		X		X	X	Built 9.8 miles of livestock exclusion fence between RM 2.0-8.5 (~350 acres protected).
Birch Creek (2010)	Bank stabilization and large wood habitat complexity and riparian plantings	STS		X	X	X	X	X		X	Restoration of 335 ft of streambank stabilization with large wood and boulders over 0.1 miles of stream, 2 large wood in-channel habitat structures, and planted 5,000 riparian plantings over the 1-mile property.
Meacham Creek Floodplain Restoration and In-Stream Enhancement Phase I Project RM 6-7.1 (2011-2012)	Floodplain and channel improvement with levee setback, large wood placement, side-channel connectivity, wetland enhancement, and riparian plantings.	STS, CHS, BT, Pacific Lamprey		X	X	X	X	X	X	X	Restored 67 acres of floodplain over 1-mile of stream by removing a 2,800 foot levee and modification of two spur dikes (600 ft removed), realigned historic channel with meanders in the floodplain, developed 3 secondary channels and 3,568 ft of off-channel habitat, 12 large pool

											structures, 10 major and 286 medium rock and log features, and installed 38,290 plantings.
Basin-wide easements O&M (2008-2011)	Ongoing maintenance of 27 riparian conservation agreements on 23 properties including livestock exclusion fencing, tree planting and weed control	CHS, CHF, STS, Coho, BT, Pacific Lamprey	X	X	X	X	X	X	X	X	552 acres protected and maintained including noxious weed control, 15 miles of riparian fence protection (182 ac.), 7,000 planted hardwood seedling trees.

Resources and UAFHP have transitioned from restoration toward a fixed endpoint to address symptoms to a restoration of processes. The CTUIR UAFHP currently operates under the 2008 Columbia Basin Fish Accords Memorandum of Agreement between the Three Treaty Tribes and FCRPS Action Agencies (Fish Accords 2008). Restoration of process is more likely to address causes of river ecosystem degradation, whereas restoration toward a fixed endpoint addresses only symptoms. Specific restoration actions proposed for completion by CTUIR, partnering agencies and hired independent contractors include levee and dike removal and or modification, floodplain and channel construction, in-stream and floodplain large wood debris additions, in-stream structure placement, wetland enhancement, floodplain and riparian plantings, noxious weed removal, riparian management through fencing, and removal of physical migration barriers. The UAFHP have and will continue to maintain project areas under secured conservation agreements with landowners on private properties for protection and enhancement of floodplain and riparian habitat and investments from past passage and in-stream structure projects. Completed project activities are described below in more detail in the context of the watershed with reference to annual progress reports.

The CTUIR UAFHP completed three primary habitat enhancement projects centered on improving in-stream and riparian habitat complexity and restoring natural channel morphology and floodplain function within the Umatilla River Subbasin (Table 10). Maintenance work of ongoing riparian or passage projects continued at 23 pre-existing long-term easement properties with 19 individual landowners including watering, chemical and mechanical noxious weed control, structural maintenance and planting additional trees as necessary. The majority of project activity focused on the completion of the Meacham Creek Floodplain Restoration and In-stream Enhancement Project RM 6-7.1. This intense project included levee removal and modification, channel and side-channel construction, installation of large wood and rock habitat features, connectivity to off-channel rearing habitat and floodplain and riparian plant restoration. In addition, the UAFHP completed two additional fence projects on Meacham and Iskúultpe creeks. The UAFHP built 1.4 miles of fencing on Meacham Creek and 3.1 miles of fence in the headwaters of Iskúultpe Creek to exclude trespass livestock from migrating into managed lands by CTUIR (Table 10).

A principal strength and focus of the CTUIR UAFHP project is the ability to work cooperatively with the various entities throughout the restoration process. Staff participated and cooperated with multiple agencies and stakeholders in the Umatilla Basin Watershed including ODFW, USFS, Natural Resource Conservation Service, conservations districts, USFWS, Umatilla Basin Watershed Council and local stakeholders to enhance or protect natural resources, identify problems and solutions, coordinate efforts to prevent duplication, enhance communication and cooperation and identify funding and cost share opportunities within the Umatilla River Subbasin. This was magnified by the development of the Umatilla Basin Restoration Team. This forum was established to build a coordinated and strategic approach to the restoration of habitat in the Umatilla Basin.

The CTUIR continues to emphasize more attention toward project planning in regard to developing a systematic approach for site selection based on scientific data as well as to increase efforts towards effectiveness monitoring (both have been considered as shortfalls in the past from review committees). The new CTUIR philosophy emphasizes adaptive management as a means of maximizing success at each project site.

The Umatilla Anadromous Fisheries Habitat Project is an ongoing effort to protect, enhance and restore functional floodplain, channel and watershed processes to provide sustainable and healthy habitat for aquatic species in the Umatilla River Basin, including Threatened Mid-Columbia steelhead. Project work further supports the CTUIR Department of Natural Resource ecological and First Foods mission statements to sustain production. Applying the River Vision floodplain principles have been successfully applied in effort to reestablish the salmonids to self-sustaining levels. We expect an exponential response of salmonid populations once habitat floodplain and channel function is addressed and improved. We believe a positive correlation between habitat improvement, salmonid density, and fitness levels will shift the status of ESA-Listed species towards a safer level of sustainability in the Umatilla River Basin.

## SUMMARY OF EXPENDITURES

### CTUIR UMATILLA ANADROMOUS FISHERIES ENHANCEMENT PROJECT FY2010 BUDGET

Contract Period: February 1, 2011 – January 31, 2012

Project # 1987-100-01 – Contract 52770

		Contracted Budget	Actual Expenditures	Variance
	<b>PERSONNEL</b>			
<b>5000</b>	Salaries	\$305,551	\$301,173	\$4,378
<b>5010</b>	Fringe Benefits	\$93,625	\$90,727	\$2,898
	<b>PERSONNEL SUB TOTAL</b>	<b>\$399,176</b>	<b>\$391,900</b>	<b>\$7,276</b>
	<b>TRAVEL</b>			
<b>5101</b>	Per diem	\$12,035	\$3,144	\$8,891
<b>5150</b>	Training	\$8,135	\$2,800	\$5,335
<b>5160</b>	Vehicle Insurance	\$1,908		\$1,908
<b>5190</b>	Vehicle Expense	\$23,862	\$30,220	(\$6,358)
	<b>TRAVEL SUB TOTAL</b>	<b>\$45,940</b>	<b>\$36,164</b>	<b>\$9,776</b>
	<b>SERVICES &amp; SUPPLY (S&amp;S)</b>			
<b>5210</b>	Supplies	\$2,500	\$1,140	\$1,360
<b>5225</b>	Field Materials	\$38,783	\$23,679	\$15,104
<b>5226</b>	Books/Journals	\$250		\$250
<b>5250</b>	Non-Capital Equipment	\$23,824	\$10,830	\$12,994
<b>5400</b>	Communications	\$500	\$385	\$115
<b>5410</b>	Postage/Freight	\$329	\$266	\$63
<b>5430</b>	Dues and Subscriptions	\$250	\$424	(\$174)
<b>5432</b>	Permits/License	\$100		\$100
<b>5436</b>	Permits/Fees	\$5,000	\$2,023	\$2,977
<b>5440</b>	Equipment Rental	\$700	\$111	\$589
<b>5450</b>	Printing/Duplication	\$250	\$204	\$46
<b>5470</b>	Repairs & Maintenance	\$4,000	\$4000	\$0
<b>5770</b>	Professional Services	\$3,000		\$3,000
	<b>S&amp;S SUB TOTAL</b>	<b>\$79,486</b>	<b>\$43,062</b>	<b>\$36,424</b>
	<b>DIRECT TOTAL</b>	<b>\$524,602</b>	<b>\$471,126</b>	<b>\$53,476</b>
<b>8500</b>	Indirect 40.75%	\$213,775	\$191,984	\$21,791
<b>6100</b>	Subcontract Fees	\$2,964,399	\$2,807,079	\$157,320
<b>6510</b>	Utilities	\$550	\$382	\$168
	<b>PROJECT TOTAL</b>	<b>\$3,703,326</b>	<b>\$3,470,571</b>	<b>\$232,755</b>

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