WALLA WALLA RIVER BASIN
FISH HABITAT ENHANCEMENT PROJECT

Project No. 1996-046-01
Contract Numbers: 46692, 53046

ANNUAL REPORT OF PROGRESS
February 1, 2014-January 31, 2015

Prepared by:

Jonathan Thompson

Confederated Tribes of the Umatilla Indian Reservation
Department of Natural Resources
Fisheries Program
Pendleton, OR 97801

Prepared for:

U.S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife
Portland, Oregon 97208-3621

Submitted February 2015

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The Bonneville Power Administration funded accomplishments made by this project. We wish to specifically thank BPA employees Tracey Yerxa, Peter Lofy, and Brenda Heister for all of their patience and assistance in project activities.

The authors would also like to thank several CTUIR employees for their dedicated contributions to the project:

Gary James, Fisheries Program Manager, for project management and administrative assistance. Jed Volkman, former Habitat Biologist for the Walla Walla Basin, for his many years of work improving fish habitat. Mike Lambert, Habitat Program Supervisor, for assistance in project supervision. James Bill and Mark French, fish habitat technicians, for their dedicated work in completing all necessary field tasks. Michelle Thompson and Julie Burke for contract administration and support; and Celeste Reeves for secretarial assistance.

We also appreciate the technical expertise and coordination of Dave Karl, Glen Mendel, and Mark Grandstaff of WDFW, Brian Wolcott with the Walla Walla Watershed Council, Brian Burns of the Tri-State Steelheaders, Rick Jones, Jeff Klundt, and Greg Kinsinger of the Walla Walla County Conservation District, and Steve Martin and Kris Buelow of the Snake River Salmon Recovery Board.

Finally, we wish to thank the many landowners in the Walla Walla River Basin committed to improving habitat conditions for native Fish and Wildlife.

Introduction

The First Foods are considered by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Department of Natural Resources (DNR) to constitute the minimum ecological products necessary to sustain CTUIR culture. The CTUIR Department of Natural Resources has a mission to protect First Foods and a long-term goal of restoring related foods in the order to provide a diverse table setting of native foods for the Tribal community. The mission was developed in response to long-standing and continuing community expressions of First Foods traditions, and community member requests that all First Foods be protected and restored for their respectful use now and in the future (CTUIR River Vision, 2008).

The production of First Foods are tied to hydrology, connectivity, aquatic biota, geomorphology, and riparian vegetation. This project strives to meet each of these key management areas through the restoration and protection of stream habitat in the Walla Walla Basin. The Bonneville Power Administration (BPA) provides funding for this work. Focal species include ESA-listed summer steelhead (*Oncorhynchus mykiss*), spring chinook (*Oncorhynchus tshawytscha*) and resident bull trout (*Salvelinus confluentus*). The primary cooperators include the Washington Department of Fish and Wildlife, the Oregon Department of Fish and Wildlife, the Walla Walla Watershed Council, and the County Conservation Districts.

The project objectives are designed to meet limiting factors specific to each individual site and those listed in the Walla Walla Subbasin Plan (NPPC, 2004), the NOAA Fisheries Middle Columbia Steelhead Recovery Plan, and components of the CTUIR River Vision (2008).

Project Goal:

To protect, enhance and restore functional, healthy and sustainable floodplain, channel and watershed process for the purpose of restoring fisheries, aquatic species, and Tribal First Foods in the Walla Walla Basin.

Project Objectives:

1. Identify priority actions and geographic areas based on factors limiting anadromous salmonids and other important aquatic species populations.

2. Improve watershed function and fisheries habitat.

3. Ensure project success through the maintenance of project sites.

4. Measure the effectiveness of fisheries habitat projects through monitoring and apply learned lessons to future planning efforts.

5. Develop coordinated partnerships with other key agencies and stakeholders in order to maximize project efficiency and success.

PROJECT AREA

The Walla Walla River Basin originates in the Blue Mountains at an elevation of nearly 6,500 feet. The Walla Walla River and its major tributaries the Touchet River and Mill Creek comprise a subbasin of 1,758 square miles and 2,454 stream miles in northeast Oregon and southeastern Washington (Figure 1). Of this area, 73 percent is located in Washington and 27 percent in Oregon. The basin is bordered by the Snake River Basin on the north, the Tucannon and Grande Ronde Basins to the east, and the Umatilla Basin to the south (US Army Corps of Engineers, 1997). Approximately 15 percent of the subbasin is comprised of forestland, and 82 percent is used for cropland and grazing. Over 90 percent of the subbasin in Washington is privately owned.

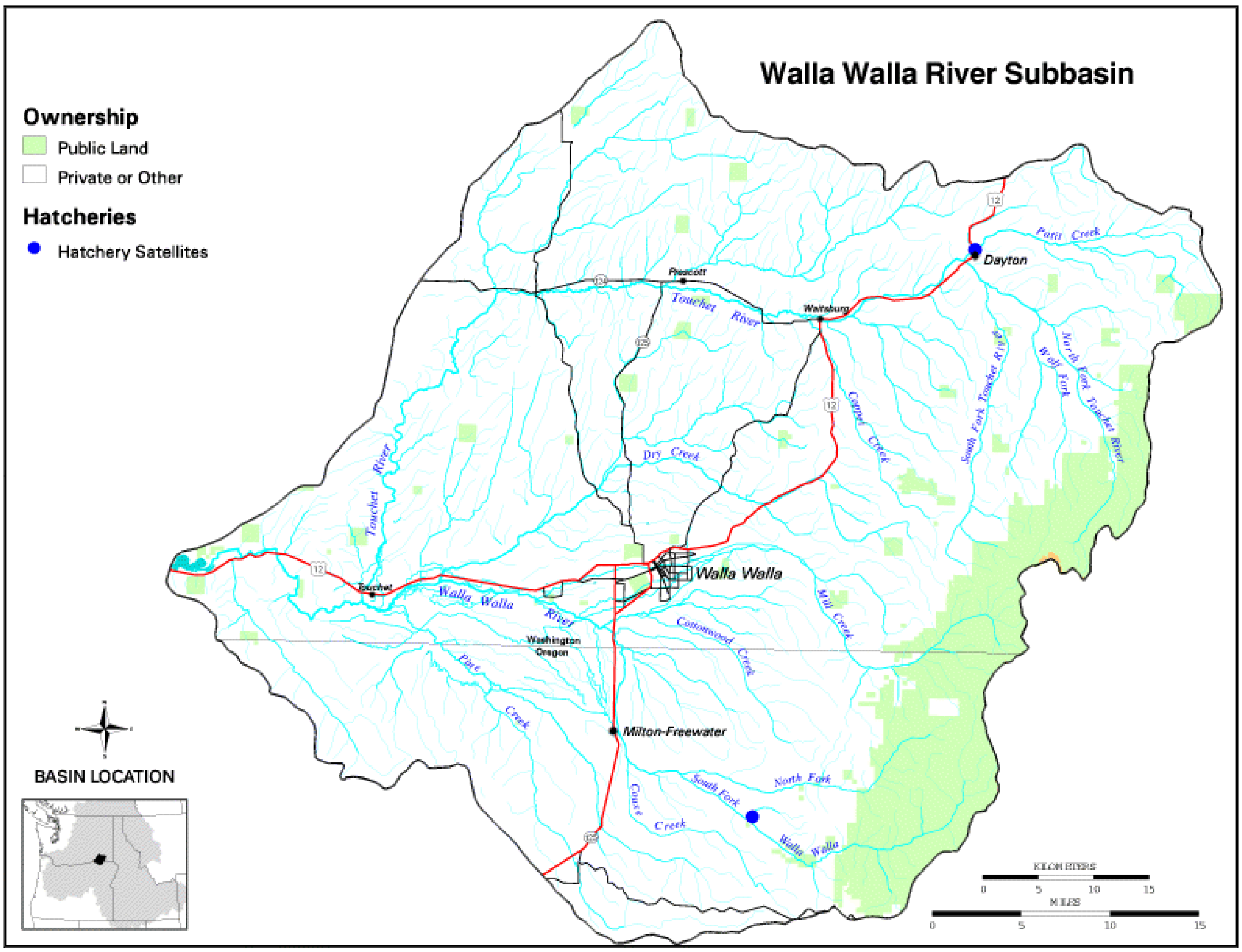


Figure 1: Map of the Walla Walla River Basin.

Annual precipitation in the middle and lower reaches of the basin averages 10-16 inches with more than 40 inches accumulating in higher elevations (Corps of Engineers, 1997).

Cultivation, domestic livestock grazing, and flood control activities have affected riparian vegetation throughout much of the mid-lower elevation reaches. The loss of stream channel complexity is significant throughout the basin as a result of extensive levees and destruction of riparian, wetland, and forest areas.

Irrigation is the principal water use in the basin. Stream flows characteristically peak in April, dropping sharply in May as high elevation runoff subsides and low elevation irrigation diversions increase (CTUIR, et al.). These conditions annually lead to unacceptable habitat for salmonid fishes in the mid-lower portions of the basin.

Current Fish Habitat Conditions:

Habitat conditions are consistently favorable for salmonid fish in the upper portions of the Walla Walla Basin. The North and South Forks of the Walla Walla River, North Fork of the Touchet River, Wolf Fork, Mill Creek, and various smaller tributaries support strong populations of salmonid fish. Much of the uppermost reaches of the South Fork of the Walla Walla River on public lands are in near pristine forest condition and provide stable flows for native fish. Similar habitat conditions are found in the headwaters of Mill Creek providing both good habitat for salmonid fish and a consistent water supply for the city of Walla Walla.

As the Walla Walla Valley drains out of the Blue Mountains toward the Columbia River and into private lands to the west, stream habitat conditions become far less suitable for salmonid fish. Irrigation water extractions, diversion structures, upland practices, roads, levees, livestock grazing, riparian destruction, and urban development have all severely influenced native fish habitat in the lower river. Most of the stream sections within private properties are lacking adequate riparian corridors and have been straightened and disconnected from the floodplain. The river channel is incised below the mouth of Dry Creek near Lowden, Washington with high vertical eroding banks and virtually no vegetation. These conditions release prodigious amounts of sediment during high flow events, severely diminish slow-water areas needed by juvenile fish, and prevent proper functioning floodplain conditions. Several large irrigation districts near Milton Frewater, Oregon divert most of the surface flow during the summer and fall and small push-up irrigation diversions and pumps are present throughout the basin. Low flows and high water temperatures in the mid to lower portions of the basin provide ideal conditions for pisciverous bass, catfish, crappie, bluegill, and other non-native fish species. It is reported that smallmouth bass and catfish were present in high numbers as early as the 1940s near the old 9-mile dam (Fred Mitchell, Walla Walla, WA. personal communication).

Native Fish:

Historical accounts validate the presence of several now extinct species of salmon in the Walla Walla River. Runs of spring and fall chinook, chum, Coho, and sockeye salmon are reported to have been present at some level (Swindell, 1941). Several historical journals remark that the Touchet, Mill Creek, mainstem Walla Walla, and various other tributaries contained healthy populations of spring Chinook salmon at one time. The last spring Chinook salmon run of any significance was reported in 1925 (Van Cleve and Ting, 1960). By 1955, only 18 spring Chinook salmon were reported to have been captured in the sport fishery (Oregon Game Commission, 1956 and 1957).

Today, bull trout, summer steelhead, red band trout (*O. mykiss*), and reintroduced spring chinook are currently present in the upper Walla Walla, Mill Creek and Touchet drainages. Small numbers Coho and increasing numbers of fall chinook spawn in the lower portions of the basin each year. Other native species include dace, sculpin, bridgelip and mountain suckers, red side shiners, whitefish, northern pikeminnows, western brook lamprey, chiselmouth, and peamouth. For a more complete discussion of anadromous fish use in the basin, please see the annual report of progress for the Walla Walla Subbasin Salmonid Monitoring and Evaluation Project, BPA Project Number 2000-039-00.

METHODS

In 2008, the CTUIR Department of Natural Resources restructured itself around the Tribal First Foods and released the *Umatilla River Vision*. Water, salmon, deer, couse, and huckleberry are the First Foods, ecologically related categories that in traditional meals are served in the same order that they appear in the Tribal creation story. They “constitute the minimum ecological products necessary to sustain CTUIR culture” (CTUIR 2008) and require a holistically functioning and healthy river system, intact not only along its length but also from upland to upland. This framework for natural resource management seeks to reflect the unique tribal values associated with natural resources. The *River Vision* provides the connections to the First Foods for the CTUIR Fisheries programs to create “a dynamic river ecosystem that incorporates and expresses ecological processes that support the continued natural production of First Foods and utilization by the CTUIR community” (CTUIR 2008: 4). There are five touchstones – hydrology, connectivity, geomorphology, riparian vegetation, and aquatic biota – that connect to Primary Limiting Factors, basin and subbasin planning, and ultimately to concrete project objectives, actions, and monitoring.

The Walla Walla Habitat Project planning process begins with the *River Vision*’s touchstones. We then intersect those with Primary Limiting Factors from the 2008 Fish Accords, Mid-Columbia Recovery Planning, the Walla Walla Subbasin Plan, TMDL reports, and local assessments and strategies (e.g. “Upper Walla Walla River Habitat Restoration Action Plan,” CTUIR 2010). We focus on designated high priority areas, with a preference for ecologically connected or contiguous project locations.

Environmental Clearances:

Habitat projects require a variety of environmental clearances that are all coordinated through BPA Environmental Group. Most of the NOAA Fisheries and USFWS clearances fall under the programmatic BPA HIP III process. State removal and fill applications are applied for through the Oregon Division of State Lands and Washington Department of Fish and Wildlife. As required under the Federal National Historic Preservation Act (NHPA), the project also coordinates as necessary with the CTUIR Cultural Resource Protection Program (CRPP) at proposed habitat enhancement sites involving ground disturbance. CRPP staff conducts file and literature searches, pedestrian surveys and/or archeological excavations to determine if cultural resources potentially eligible for inclusion to the National Register of Historic Places are present at proposed enhancement sites. Final reports documenting their findings are prepared, submitted to the State Historic Preservation Office, and coordinated with the BPA. Various other permits such as such those required from the Oregon State Forestry, Oregon Department of Environmental Quality, city, county, etc., are obtained as needed.

Landowner Conservation Easements:

Approximately seven miles of stream corridor habitat is currently protected in long-term (15-years) conservation easements between private landowners and the CTUIR under this project. Project areas are located within Couse Creek, Blue Creek, Patit Creek, the mainstem Walla Walla, and the South Fork of the Walla Walla (Figure 2).

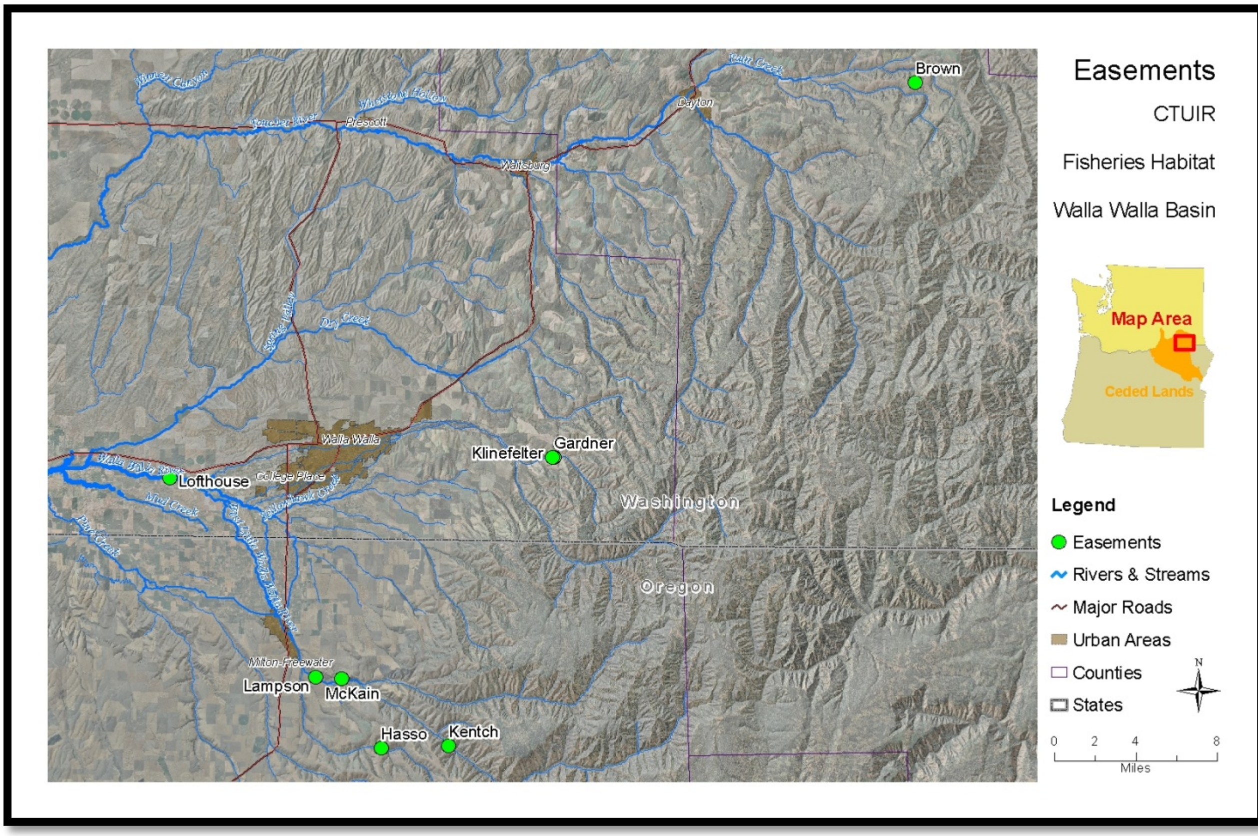


Figure 2: Long-term habitat conservation easements between the CTUIR and private landowners in the Walla Walla River Basin.

Restoration actions implemented by the project include various types of adult and juvenile passage improvements, riparian and upland enhancements, and stream channel modifications. Projects requiring the use of heavy equipment (bulldozers, excavators, dump trucks, etc.) are subcontracted to qualified independent private contractors selected through a competitive bidding process.

To protect sensitive riparian vegetation, some project areas require the construction of livestock exclusion fences. The majority of fencing projects are subcontracted to qualified private contractors. The fence construction design follows USDA specifications in an effort to protect livestock and migrating wildlife. Small fencing projects, routine maintenance, and livestock water gaps are completed by project technicians.

Riparian planting remains an integral part of all stream habitat improvements. Only plants native to the region are used for restoration of riparian and upland project areas. Nursery stock is primarily obtained through the CTUIR Native Plant Nursery. Newly planted trees and shrubs are irrigated by the project technicians through the drought months of July through September in the first two years with a truck-mounted 300-gallon water tank and sprayer.

Reestablishment of native grasses is often the first management step taken within upland areas and areas disturbed during restoration work. Grass seed is obtained from area suppliers and includes a mix of site appropriate species. Once established, grasses provide excellent cover for wildlife species, control of soil erosion and management of competitive noxious weeds.

If left uncontrolled, noxious weeds will generally out-compete native trees and shrubs. For this reason, the project annually contracts with a licensed herbicide applicator to treat noxious weeds within project areas. Additional chemical treatments and mechanical measures such as mowing are done throughout the year as needed by project technicians. All chemical weed control measures are consistent with state and federal regulations and reported annually through the BPA.

RESULTS AND DISCUSSION

Mainstem Walla Walla River (Lampson):

Activity at this site was largely confined to maintenance and weed control. Survival of rooted stock has been poor, with approximately 25 percent survival despite ongoing irrigation. Willow cuttings have done well, with excellent survival and growth, and natural propagation of willow and cottonwood has followed flooding in 2012 and 2013. Weed control has had good results, with reduced coverage of invasive species.

In 2012 and 2013 gravel removal maintenance from the entrance to the side channel was needed after high flows in order to maintain summer low flows. A site visit with BPA engineer Sean Welch occurred January 13 and design alternatives were discussed to lessen future maintenance needs. Mr Welch’s suggestion was to add an additional one or two inlets upstream of the current inlet in order to maintain flow while accounting for sediment inputs at a range of flows. The identified path of action would be to present alternatives to the landowner and then proceed with design, permitting, and construction in the usual manner.

Kentch (CTUIR Owned):

The Kentch project site is located approximately six miles east of Milton-Freewater, Oregon, on the South Fork Walla Walla River at RM 4.7. The CTUIR purchased this property from a private owner in 2003. The property is being managed in perpetuity for the benefit of native species. The 46-acre site includes approximately 0.75 miles of the SF Walla Walla River and 25 acres of floodplain habitat. The south fork Walla Walla River is a perennial stream that contains populations of native redband trout, summer steelhead, bull trout, and spring Chinook salmon.

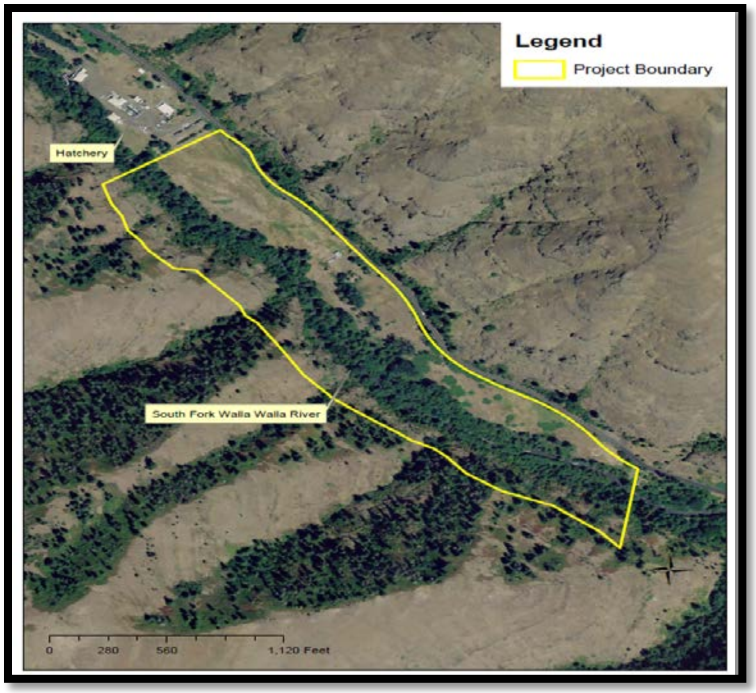


Figure 2: Aerial view of the project area on the South Fork of the Walla Walla River.

Within the Kentch property boundary, the South Fork Walla Walla River is a single thread, straightened channel with very low sinuosity. Over the entire project reach, the channel flows remain along the left side of the valley floor, which is fortified by a low elevation levee along the right bank. The channel is entirely disconnected from the floodplain and exhibits a narrow riparian corridor adjacent to the active channel. Pre-project habitat surveys determined that the channel has an average bankfull width of 67 feet. Nearly 87% of the stream channel is riffle habitat, 12% run habitat, and less than 1% pool habitat. Only two primary pools were found in 0.75 stream miles. Approximately 36% of the channel was determined to be either “good or fair” for spring chinook spawning but this is compromised by the lack of pool habitat and cover. At all flows, more than 99% of the stream channel is considered “poor” habitat for juveniles primarily because of high velocities and lack of channel complexity. What little juvenile habitat is present can only be found in the pool areas and along the stream margins during low flows.

Figure 3: Looking downstream within the Kentch Project reach in June of 2011.

In June of 2012, the project developed a detailed RFP for an aggressive stream and floodplain restoration plan and retained GeoEngineers to begin the process. The assessment and design was completed in 2013 and construction began in 2014, with the second phase planned for 2015. The restoration work encompasses approximately 0.75 river miles of the South Fork and include a mixture of levee removal, dramatic changes to the floodplain and channel form that more closely resemble historic condition, development of multiple side channels, and expansion of the riparian forest.

The assessment and design process resulted in the following objectives:

1. Increase channel complexity with channel form closer to historical condition
2. Enhance instream habitat quality and quantity
3. Improve sediment sorting and routing
4. Increase stream velocity diversity at high and low flows
5. Increase stream temperature diversity
6. Increase floodplain connectivity and frequency of inundation
7. Increase riparian width, function, and diversity
8. Increase locations suitable for adult spawning and juvenile rearing

The assessment among other things included a topographic and bathymetric survey, geomorphic assessment, riparian vegetation survey, fish habitat inventory, subsurface soil investigation, habitat analysis, review of hydrologic analysis, watershed conditions, and hydraulic modeling. A portion of the assessment data and draft design drawings are presented below.

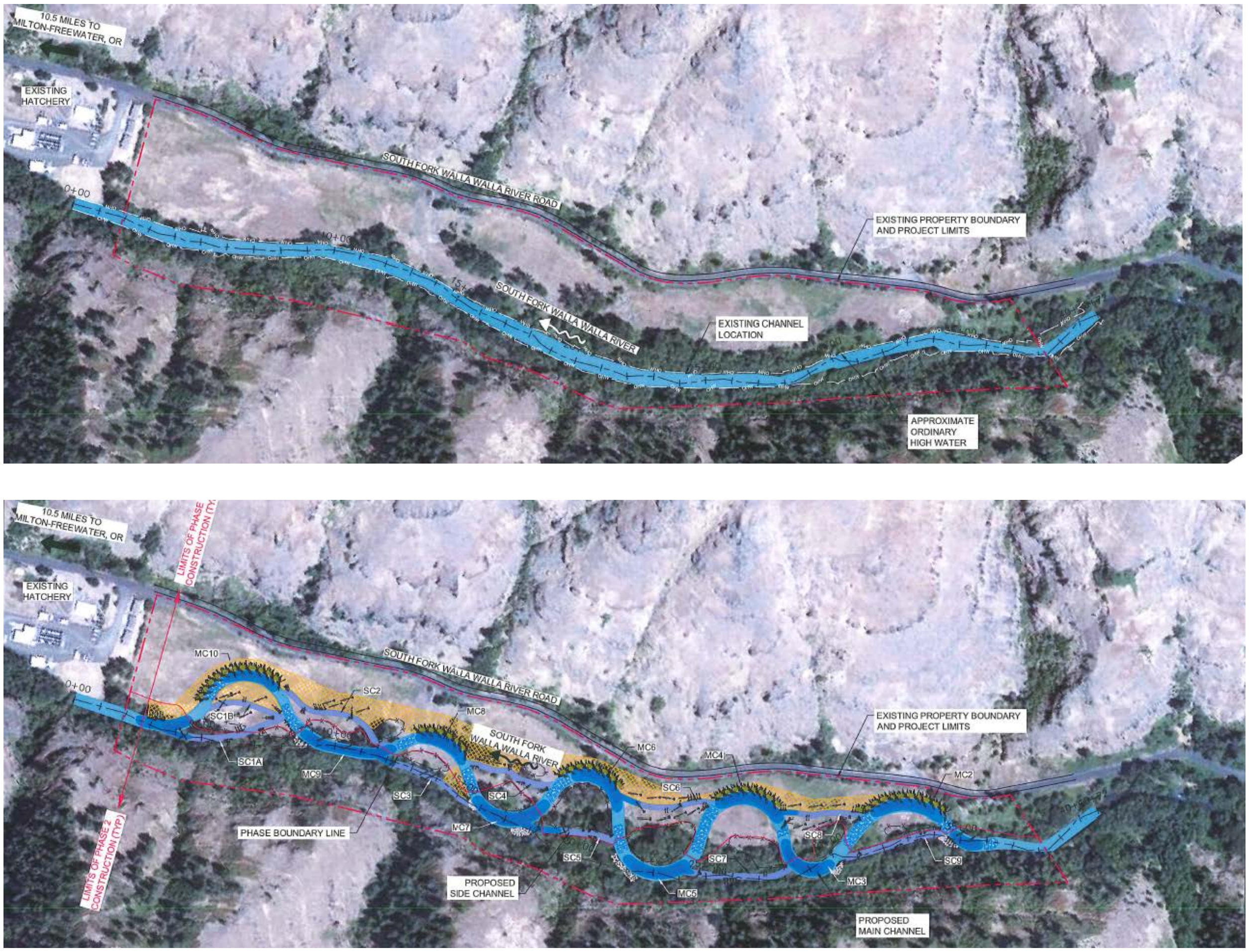


Figure 4: Existing site condition shown in the top photo and proposed condition shown below.

Table 1: Summary of channel geometry under existing and proposed condition

Parameter	Existing Condition	Proposed Condition
Side Channel Length (ft)	156	3,500
Sinuosity	1.07	1.36
Bankfull Width (ft)	67.7	44.6
Mean Riffle Depth (ft)	2.2	2.2
Cross Sectional Area (ft^2)	155	91
Width/Depth Ratio	32.8	20.0
Radius of Curvature* (ft)	2,200	155
Flood Prone Width (exclusive of berm sections) (ft)	150	180
Entrenchment Ratio	2.4 (Avg.)	3.3
Meander Belt Width (ft)	0	300
Meander Width Ratio	0	6
Meander Length (ft)	0	429
No. of Pools	2	11
Riffle Bed Material D_{84} (mm)	201	195

Table 2: Riverbed grain size (mm) from pebble counts

Grain-size Statistic	DS bar	Riffle 1	Run 1	Riffle 2	Riffle 3	Run 2	Run 3	US bar
D_{95}	192	337	325	299	275	164	281	218
D_{84}	117	238	228	205	145	133	161	134
D_{75}	97	193	149	160	89	107	126	107
D_{50}	63	111	59	84	70	74	71	68
D_{25}	48	52	35	56	47	49	43	50
D_{16}	42	40	28	46	37	40	36	45
D_{5}	33	23	17	11	23	28	25	33
D_{g}	68	102	72	93	72	73	75	74
S_{g}	1.69	2.35	2.64	2.38	2.05	1.77	2.09	1.75

Note:
Sampling locations are listed in the column headings (left to right) from downstream to upstream.

Table 3: Summary of peak flow hydraulic results

Discharge Event	Discharge (cfs)	Statistic	Velocity (cfs)	Hydraulic Depth (cfs)	Average Shear Stress (lb/ft²)	Stream Power (lb/ft•s)
1.25-Year	568	Min.	3.1	1.4	0.7	2.7
		Ave.	4.6	2.0	1.8	8.4
		Max.	5.8	3.0	3.6	17.4
1.5-Year	675	Min.	3.2	1.5	0.8	3.4
		Ave.	5.0	2.2	2.0	9.9
		Max.	6.2	3.1	3.8	18.7
2-Year	819	Min.	3.5	1.6	0.9	4.4
		Ave.	5.4	2.4	2.2	11.9
		Max.	6.8	3.3	3.6	20.5
5-Year	1,226	Min.	4.1	1.9	1.3	7.8
		Ave.	6.6	2.8	2.6	17.4
		Max.	8.4	3.5	4.3	31.3
10-Year	1,536	Min.	4.6	2.1	1.5	10.1
		Ave.	7.4	2.9	2.9	21.5
		Max.	9.6	3.7	4.6	40.0

Table 4: Habitat quality rating and availability for spring chinook spawning and juvenile rearing under existing conditions.

Habitat Quality Rating	Spring Chinook Spawning (118 cfs)		Juvenile Rearing (118 cfs)		Juvenile Rearing (568 cfs)	
	Habitat Units	Percent Habitat Area	Habitat Units	Percent Habitat Area	Habitat Units	Percent Habitat Area
Poor	110,186	64%	172,644	>99%	215,343	>99%
Fair	28,804	17%	312	<1%	252	<1%
Good	33,966	19%	0	0%	0	0%

Baseline (pre-project) temperature monitoring (this section provided by Scott O'Daniel, CTUIR):

In order to assess changes in stream temperature and velocities we have designed a monitoring network using Forward Looking InfraRed (FLIR), field temperature loggers, stream velocities and geomorphic characterization. Baseline information from one season of field data collection of water (n=6), air (n=1) and soil (n=2) temperature we show that water temperatures at the reach scale (10^{1}-10^{10}m) are explained by linear increases, while at site scales (10^{-1}-10^{1}m) water temperature variation shows complex temperature responses. Data collection to obtain water velocities and a geomorphic characterization continued in 2011 and 2012. Illegal activities and theft of instruments from this site continue to pose extra-scientific challenges to monitoring.

FLIR:

Forward looking Infrared (FLIR) imagery is used to depict the distribution of water temperatures at high resolution along rivers. These data provide a synoptic view of stream temperature that is complimentary to traditional ground-based monitoring techniques. FLIR imagery shows steadily increasing water temperatures as the river moves downstream (Figure 1). Unlike the Umatilla or Grand Ronde Rivers, the water temperature profile has no strong reversals. Also, unlike the John Day River there are not obvious tributary influences that alter the downstream profile. Stream temperature data was collected in the late summer to capture the greatest contrast in stream temperatures.

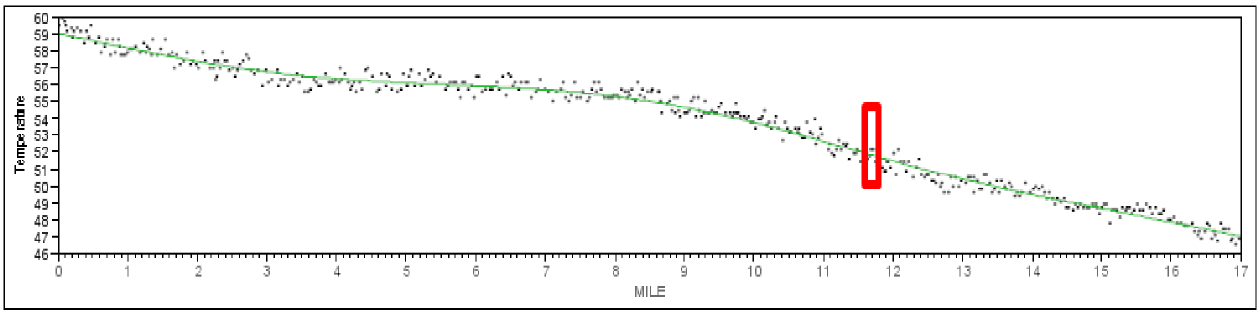


Figure 5: Longitudinal thermal profile of the South Fork of the Walla Walla River collected on August 8 2012. The red rectangle represents the area of the study site.

Temperature loggers:

Our goal in locating temperature loggers on the study site was to characterize the late summer temperature conditions, typically, the warmest part of the year. We placed Hobo Pendant temperature loggers in the stream channel, soil profile and air on the study site. Temperature loggers were placed at varying depths on the streambed by wrapping average size substrate with wire and attaching the logger with a zip-tie to allow the logger to freely move in the stream. Depths that loggers were placed at, below the water surface, were 9.5”, 15.5”, 21”, 23” and 53”. These depths span the range of stream depths across the Kentch site additionally; we placed temperature loggers in a shallow floodplain well, dry soil (1’ deep) and air (12’above the surface elevation).

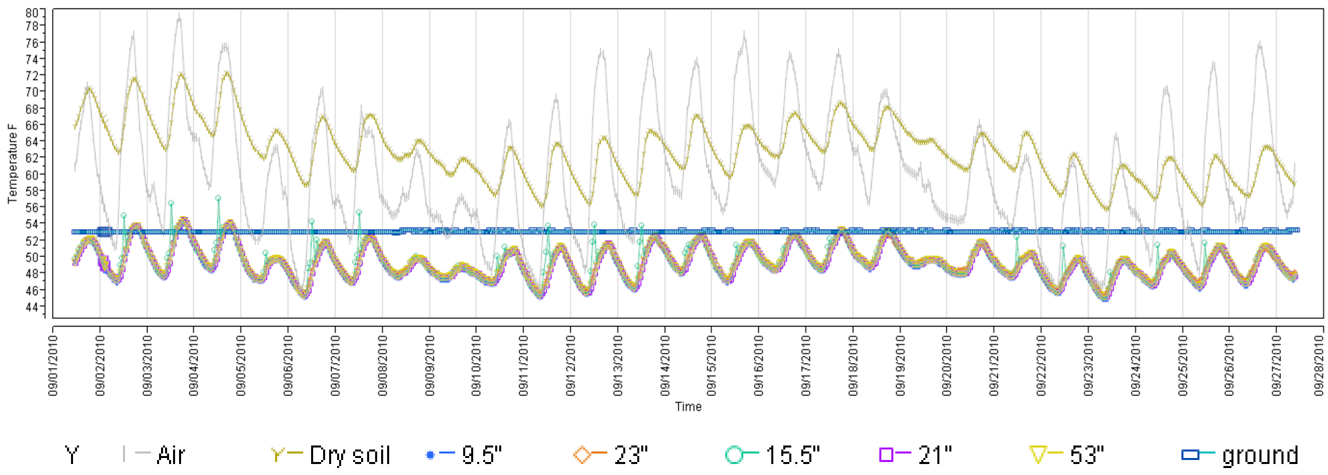


Figure 6: The figure above is a sample of a temporal profile of temperatures on the Kentch site of the SFWW River for September 2010.

Headwater springs and seeps regulate water flow and temperature keeping the SF Walla Walla River stable during late summer. Intermittently, the SFWW channels are exposed to full sun, and consequently have higher daily maximum temperatures, suggesting that more recently created side channel lacking riparian vegetation are likely to have slightly higher water temperatures and higher productivity. We have initiated additional temperature monitoring of saturated soils and the very top of the alluvial water table that may provide additional data to understand the behavior of the alluvial aquifer budget on this site. We do not expect changes in the longitudinal temperature profile as a result of this restoration activity; however, we do expect to change the distribution of water temperatures on the Kentch site.

Design and Permitting:

At the beginning of the 2014 contract year the design reached the 90 percent level, with all construction planned for 2014. However, a combination of contracting delays and an extended permitting timeline meant that it would no longer be possible to achieve an early spring start to the construction. Consequently, it was necessary to extend the GeoEngineers design contract in order to rework the design (as well as permitting submissions) for a phased construction approach, with floodplain and new channel construction in the first phase for 2014 and instream work and channel reconnection in the second phase for 2015. GeoEngineers provided construction oversight and engineering support during construction.

Permitting for the project went through the new HIP3 programmatic permit process, as well as the usual local, state, and federal permits and coordination. Cultural surveying and construction monitoring were provided by CTUIR Cultural Resource staff. Based on surveys and looking at the construction plans, Cultural Resources defined a high priority area centered on the old house site where cultural monitoring was required during any excavation. Outside of that area monitors were not required. CTUIR Cultural Resources prepared an Incidental Discovery plan that was distributed to all CTUIR, GeoEngineers, and Partney Construction Inc staff. When items were found, all staff followed the required procedures, removing equipment from that area, notifying CTUIR and Cultural Resources staff, and staying out of the flagged area until clearance was received to continue work in that area.

The HIP3 programmatic permitting process provided invaluable technical review and feedback and was overall a value-added part of the project planning and design process. However, it was a slow and resource-intensive process, with extensive submittals required, at times extensive delays and difficulties in coordinating feedback from review team members, and required much more time and resources from CTUIR and GeoEngineers staff than had been originally estimated. Additionally, the timeline and incremental nature of some review feedback led to a design process with many more iterations than the traditional 30/60/90 format – the outcome for project success of this was likely positive, but the work required exceeded expectations.

The timeline below shows the key milestones in the HIP3 review process for the Kentch project:

- 3.12.13 – CTUIR sent 30% design alternative design index sheet and site boundary to start cultural resource process.
- 07.30.13 - RRT Initiation letter sent out.
- 8.5.13 – First set of design plans (60%) received by RRT.
- 08.19.13 - Site visit with RRT, NMFS, USFWS, USACE and project sponsor. Project at 60% completion.
- 09.24.13 - RRT 60% design comments submitted to project proponent with input from NMFS and USFWS.
- 01.22.14 - 90% plans and response to 60% RRT comments submitted for RRT review.
- 3.5.2014 - NMFS Hydro Approval Received
- 3.24.2014 - RRT review 2 (90% design) comments submitted to CTUIR with GPDSR and Conservation Measures.
- 6.3.2014 - RRT lead and BPA engineer (Welch) conducted technical review and approved. USFWS RRT approval from John Stevenson.
- 6.4.2014 - USFWS approval from Janine Castro.
- 6.9.2014 - NMFS RRT approval from Rebecca Dittmann.
- 6.9.2014 – RRT recommendation sent to NMFS branch chief and USFWS field supervisor for approval. NMFS approval received.
- 6.10.2014 - USFWS approval received. PNF submitted.
- 2015 RRT Approval Pending - The RRT will be reconvened prior to the 2015 work to review the updated Monitoring and Adaptive Management Plan and any design changes or changes to the existing conditions. Approval will again be sought from the services.

The overall timeline was close to the diagram below from the HIP3 review handbook for the stepwise review of high risk projects, though final approval of the updated Monitoring and Adaptive Management Plan is still pending as of the time of this writing. As described below under the construction section, design alterations during Phase One construction were routed to the RRT for review and feedback was immediate, providing both helpful and timely input during construction.

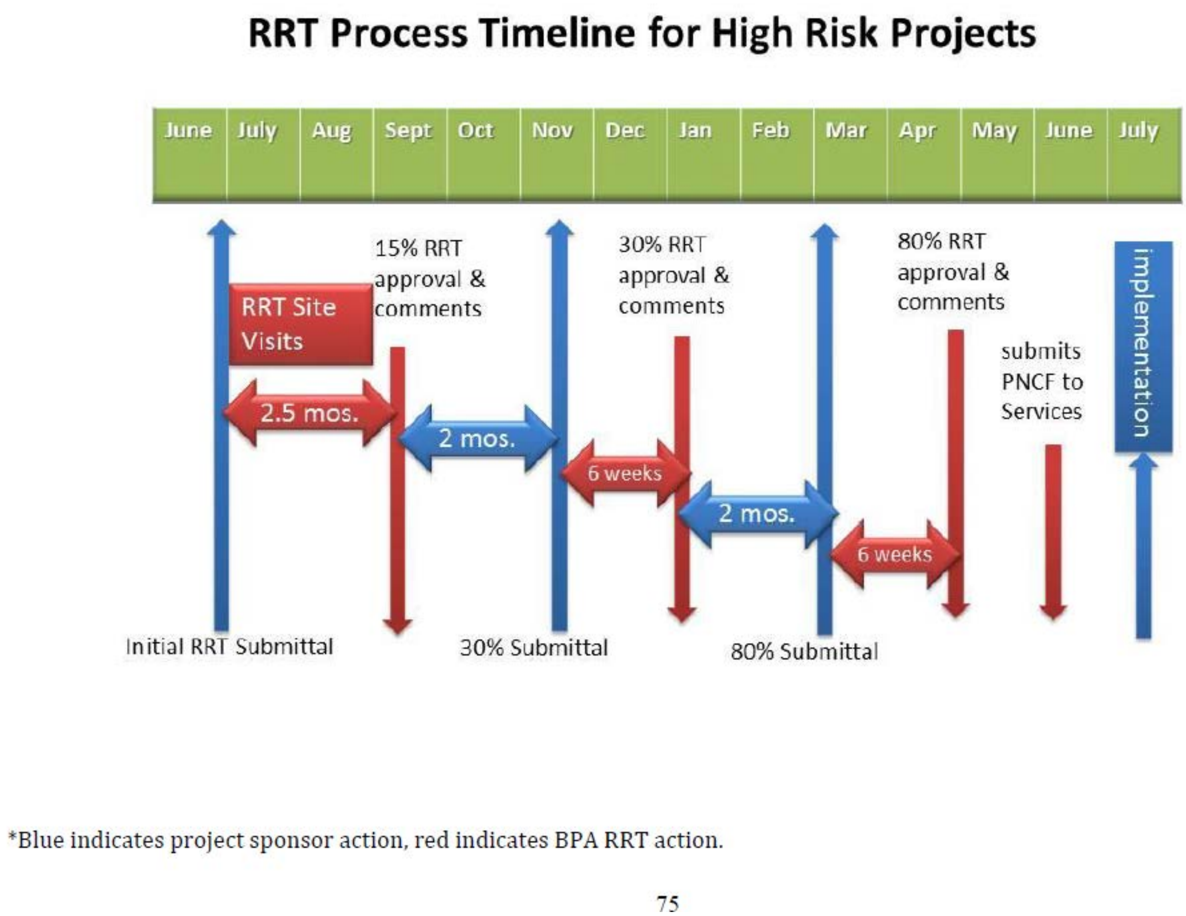


Figure 7: RRT Process Timeline.

Hatchery hydraulic review:

In February of 2014 we were notified that design work was underway for the SF WW Hatchery, which occupies the property immediately downstream from the Kentch site. At that time construction was anticipated for the summer of 2014. To better understand the impact of the Kentch restoration design on hydraulic and sediment conditions on the hatchery reach, and to gain habitat modeling data for that reach in anticipation of future instream work, we cooperated with Sean Welch at BPA in the preparation of a scope of work for a hydraulic, sediment, and habitat review of the hatchery reach and the planned conditions on the Kentch site. The work was performed by TetraTech, an initial kickoff meeting occurred in the spring of 2014, and survey work occurred during the summer of 2014. As of the writing of this report, the hydraulic report remains in draft form.

Site visits to discuss the draft report occurred in January of 2014 with Sean Welch, CTUIR staff, and GeoEngineers staff. Data and conclusions were discussed, and some relatively minor design alterations were considered, including selective side channel inlet control and additional roughness in the side channels that will be constructed in Phase Two. As of the time of this writing, a full engineering response is anticipated from BPA, at which point CTUIR and GeoEngineers will make final decisions about possible design adjustments.

Figure 8: Aerial image of Kentch construction.

Construction and design alterations:

In the spring of 2014 a competitive bidding process was conducted for both phases of the project. A mandatory bid tour was held by CTUIR staff with support from GeoEngineers, and multiple qualified contractors attended and bid on the project. Partney Construction Inc was unanimously selected by the review committee as the highest qualified contractor. During contract negotiations some minor changes were made to the contracted work, including doubling of the willow plantings, and work commenced in the summer of 2014.

Figure 9: Kentch site on first day of construction, looking towards the hatchery.

Construction proceeded smoothly according to plan and without significant incident. No change orders were generated nor were changed or unanticipated conditions encountered. Work predominantly proceeded from the downstream end of the project in an upstream direction, though because of necessary coordination with Cultural Resources it was necessary to leapfrog past the monitored area and then return when cultural monitoring staff were available. Mass excavation of the floodplain and channels occurred first, followed by installation of rock and wood structures. After final excavation work completed and the weather was cold enough for plant dormancy, approximately 35,000 willows were trenched and stung across all exposed floodplain and bank areas. The final action was the seeding of approximately 16 acres of exposed area using an NRCS-suggested mix of native grass seed.

Figure 9: Kentch construction looking upstream

During the construction process, several design modifications were undertaken to preserve mature vegetation, adjust to site conditions, and improve the design based on ongoing input and review. In every case, the process for the design modifications was the same: CTUIR staff coordinated an on-site discussion with GeoEngineers, who then prepared a design response memo summarizing the proposed changes and their expected outcomes, and then BPA engineering was consulted for the larger changes as required by the HIP3 permitting process. The design changes were:

- Cross sections at the point bars and adjacent pools, at each meander bend constructed in Phase 1 were modified. The modified cross section provided a narrower low flow channel, a wider bankfull width and a reduced side slope on the inside bank of the meander.
- The vegetated soil lift detail on the outside of the meander bends was modified during construction to accommodate construction logistics. This original detail was included in the construction plans as detail HS-12 on Sheet 7.9. The revised structure detail added two 10-foot poles, designed to provide resistance to horizontal motion. The revised detail removed slash material from the original design. PCI installed the modified vegetated soil lift structure at all outside meander bends in Phase 1. GeoEngineers modified the vegetated soil lift detail for the outside meander between approximate stations 40+75 and 43+75 to fit the structure between the main channel and the existing county road. This revised detail included additional ballast and two footer logs.

- Because of the modifications to the meander structures, approximately 70 additional pieces of large wood were available, and were used for additional sidechannel and floodplain structures for increased habitat value and roughness.
- An infiltration swale at the outlet of an existing culvert that conveys storm runoff from the north side of the county road was added to intercept storm discharge and infiltrate it rather than allowing it to discharge directly into the relocated main channel.
- In an effort to retain existing mature vegetation on the site, the location of Side Channel 4 (SC 4) was adjusted. The revised alignment involved moving the upstream inlet approximately 20 feet upstream of the originally planned location and moving the downstream outlet approximately 50 feet downstream of the originally planned location.
- In an effort to preserve existing trees at approximate station 26+25, the main channel width was reduced from the designed dimension of 44 feet to a modified dimension of approximately 35 feet. To help mitigate for the width reduction, the number of boulders, within the riffle at and downstream of this location, was increased from 30 to 40. The width of Side Channel 5 (SC 5) was increased from the designed 22 feet to 27 feet to increase SC 5 conveyance and therefore, to reduce the potential velocities and shear stress within the main channel at this location.

Technical memoranda were prepared for these design modifications and were provided to BPA as part of the ongoing review involvement. A sample design modification drawing is provided below:

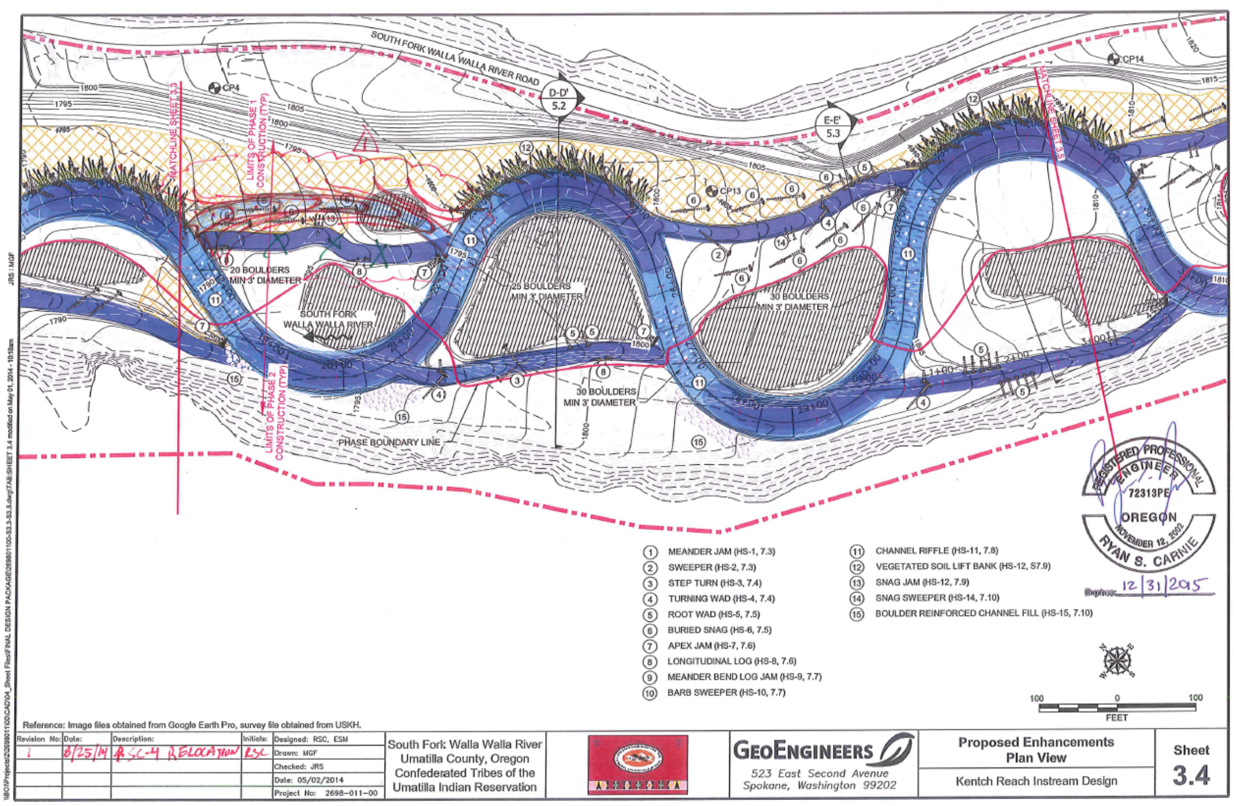


Figure 10: Design modification drawing.

Approximately 25,000 cubic yards of material have been left stockpiled at the lower end of the project site at the request of the hatchery design and construction contractor, for the anticipated use for fill during hatchery construction. If additional material is needed for the hatchery or future habitat projects in the area, additional material can be removed from the river side of the berm along the road, with the benefit of creating additional floodplain area. CTUIR Habitat staff have been installing additional plantings and performing vegetation maintenance during the winter of 2014 and continuing into the 2015 season. Erosion control installed during Phase One work will need to be monitored throughout the winter and spring of 2015.

Lessons learned:

- Budgets and scopes of work for design need to account for the extra iterations created by the HIP3 review process for both the design itself and also the required submittals.
- Along with construction observation, there needs to be an allocated budget and task item for mid-project adjustments and improvements. Design changes can require technical memoranda and drawings, as well as site visits and meetings by technical staff.
- Although the cost in time and budget to comply with the HIP3 requirements was significant, the input from the review team was valuable and has continued to enhance the project.
- Close communication and cooperation with CTUIR Cultural Resources was critical to project success. Cultural Resources handled project surveys and incidental discoveries in a fast and efficient manner, and helped prepare an Incidental Discovery Plan for all project staff. They worked closely with the heavy equipment contractor to maintain production goals without compromising cultural protections and values.
- Both the Health and Safety Plan and the Cultural Incidental Discovery need to be robust and careful documents. Both plans were tested during construction (by an apparent heart attack by a subcontractor employee and with incidental discoveries), and having the plans in place proved to be critical.

Couse Creek (Hasso):

A licensed chemical applicator treated noxious weeds within the project area in May of 2014. The livestock exclusion fence and water gaps were repaired by project technicians as needed throughout the reporting period.

Walla Walla River (Lofthouse):

A licensed chemical applicator was hired to treat noxious weeds within the project site in May of 2014. The landowner maintained the irrigation system on the recently introduced native plants during the months of June through October. The project technicians assisted with noxious weed control and irrigation of native plants as needed.

Walla Walla River (McCain):

The project contracted with a licensed chemical applicator to treat noxious weeds within the project site in May of 2014. Two additional chemical treatments were applied by the project in June and July of the same year. The livestock exclusion boundary fence was repaired as needed.

Lower Walla Walla River Geomorphic Assessment and Action Plan:

The Lower Walla Walla River is a low-gradient, primarily single-channel system, which passes almost entirely through agricultural areas. Relative to historical conditions, it has been highly simplified, straightened, restricted from historical floodplains, and impacted by irrigation withdrawals. Throughout the last 15 years, projects such as irrigation improvements, diversion screens, riparian plantings, conservation easements, establishment of instream flows, and some habitat restoration and fish passage projects have been implemented to address degraded conditions in the Lower Walla Walla River. Despite these project actions, recent research by CTUIR biologists has discovered high mortalities in out-migrating fish in the lower river, with as many as 70 percent of smolts that enter the Lower Walla Walla River failing to reach McNary Dam on the Columbia River.

Direct and indirect impacts from anthropogenic alterations to the Lower Walla Walla River over the past century, including key impacts starting with beaver trapping and attempted eradication in the early 1800s, have negatively affected water quantity and quality, as well as the quantity and quality of remaining fish habitat. Various assessments and planning efforts focused on water resources, fish, wildlife, and habitat have been conducted at the Subbasin scale resulting in coordinated water, fish, wildlife, and habitat management and prioritized restoration and protection strategies in the Subbasin. The majority of restoration and enhancement efforts identified in past assessments and planning efforts have focused on the upper portion of the Subbasin, however, despite acknowledgement that the lower river areas received high rankings in those assessments. The rationale for lower prioritization of the lower portions of the Walla Walla River was based on lack of empirical data, practicality, and that the Lower Walla Walla River currently only supports a portion of the life stages for focal fish species (migration and overwinter use). More recent research has indicated that in lower portions of the Walla Walla River physical and physiological limiting factors including water quantity, quality, and temperature, along with biological factors such as predation, may be more important than previously thought. This information indicates the need to more thoroughly assess and address degraded conditions and sources of mortality in the lower basin that could be acting as a bottleneck to both important salmonid overwinter rearing habitat and overall recovery of fish species.

To preliminarily assess the degraded conditions and identify potential restoration and enhancement projects in the lower portions, the Lower Walla Walla Working Group (LWWWG) cooperated on the Lower Walla Walla River Habitat Improvement Strategy (Lewis 2012) in 2011. This strategy was an assessment- and planning-level look at the Lower Walla Walla River from approximately the town of Lowden, Washington, to the river’s confluence with the Columbia River, a stretch of approximately 27 miles. The strategy emphasized the importance of the lower river as a priority for restoration, and identified high water temperatures and channel degradation, particularly unstable cut banks, as substantial habitat problems there.
In recognition of these issues, as well local concerns about channel stability and bank erosion, the LWWWG determined the need for a detailed geomorphic assessment and action plan (GAAP). A competitive bidding process was conducted, and TetraTech was selected as the highest qualified proposal.

This GAAP builds upon the more than four decades of past research and management efforts to more fully understand the physical and biological processes and limiting factors affecting the Lower Walla Walla River (the geomorphic assessment portion), and identify and prioritize restoration and enhancement opportunities (the action plan component).

Within the Action Plan:

- Fourteen project areas were identified along with 16 types of restoration and enhancement actions to address 15 primary focal limiting factors within those areas.
- Project areas were ranked based on analysis of current and potential biological and geomorphic function information, and factor in cost/benefit and feasibility into overall scores. Project areas 5, 7, 12, 13, and 14 received the highest ranking (Tier I rankings).
- Twenty-eight types of monitoring metrics and methods were referenced that may be used to evaluate baseline riparian, floodplain, off-channel and in-channel characteristics and future impact of project actions on focal species limiting factors.
- Conceptual designs at four representative sites were provided that illustrate 12 types of project actions designed to restore and enhance habitat to its full potential, are practical to implement, and can be adapted and scaled to multiple sites.
- The last section, Section 5 (Next Steps), includes recommendations for continued research, and other items for initiating the "action" part of the Action Plan (project implementation).

Fish use, historical and current geomorphic conditions, and fish and geomorphic potential were all considered in prioritizing the reaches and in developing the conceptual designs. Comparisons of fish use relative to discharge and stream temperature were used to prioritize the life stages of fish relative to flow conditions:

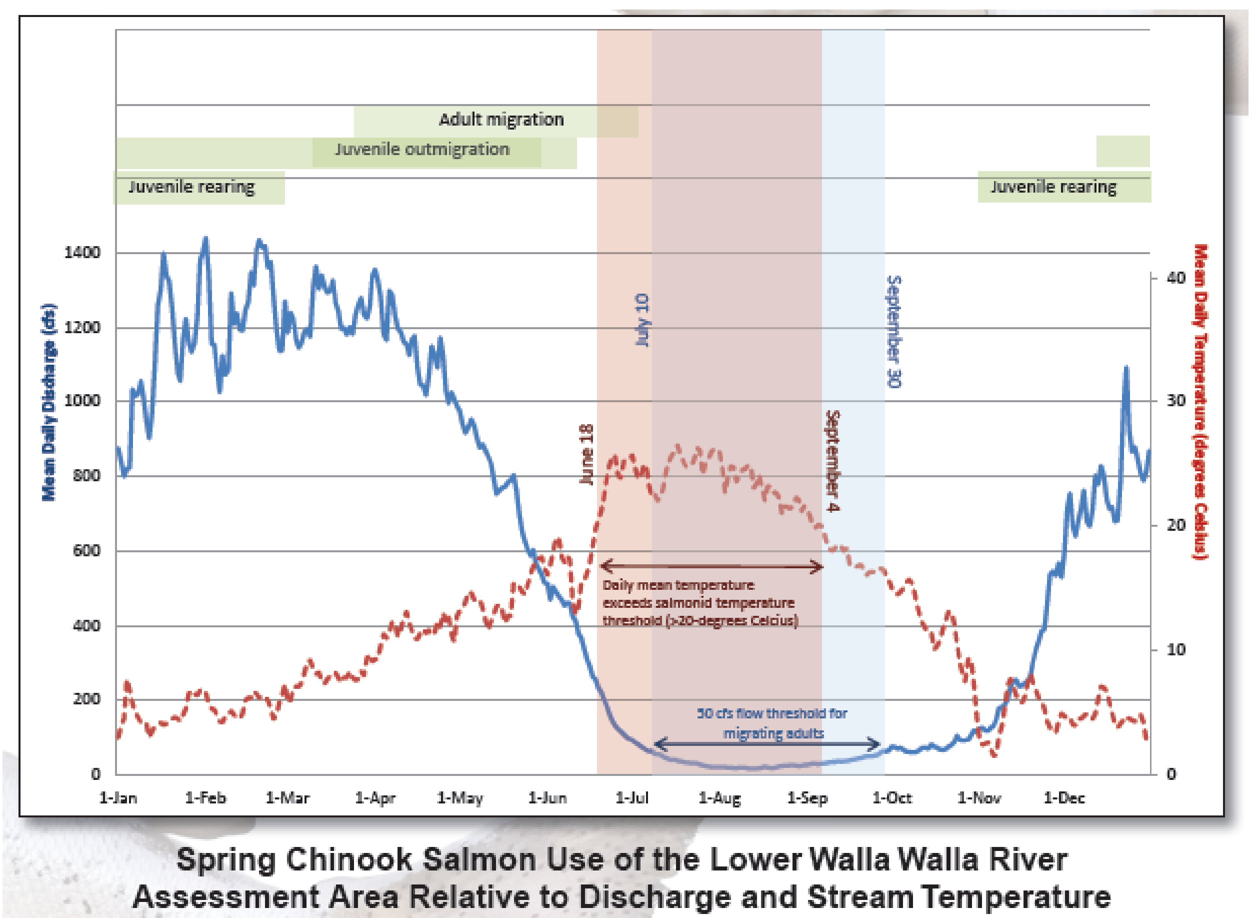


Figure 11: Fish life stages relative to flow conditions

These prioritizations and data were used to create an overall ranking of project areas and an implementation plan for enhancements throughout the lower river.

Table 4-4. Project Area Prioritization Matrix and Overall Project Area Rankings

Project Area (PA)	Location (RM)	Focal Species Utilization Potential[1/]	Focal Limiting Factors[2/]	Current Geomorphic Function[3/]	Geomorphic Potential[4/]	Cost-Benefit[5/]	Feasibility[6/]	Project Area Cumulative Score	Overall Rank (Tiers I, II, III)
PA 1	3.8–7.0	2	2	3	1	1	3	12	II
PA 2	7.0–8.6	1	1	3	1	1	3	10	III
PA 3	8.6–9.2	2	2	1	1	1	3	10	III
PA 4	9.2–10.2	2	2	1	1	1	3	10	III
PA 5	10.2–12.8	3	3	1	2	2	3	14	II
PA 6	12.8–13.0	3	1	1	1	3	3	12	II
PA 7	13.0–15.0	3	3	1	3	2	3	15	I
PA 8	15.0–17.9	2	2	1	2	2	2	11	III
PA 9	17.9–19.2	1	1	3	2	2	2	11	III
PA 10	19.2–21.6	3	3	3	3	2	2	16	I
PA 11	21.6–22.8	1	3	3	3	2	2	14	II
PA 12	22.8–25.0	3	3	1	3	2	3	15	I
PA 13	25.0 to 26.0	3	2	1	3	3	3	15	I
PA 14	26.0–27.4	2	2	2	3	3	3	15	I

1/ Focal fish species utilization potential was ranked Low (1), Medium (2), or High (3) based on existing focal fish species utilization, channel morphology, sediment characteristics, focal fish species limiting factors, BSRs, professional experience, and best professional judgment.
2/ Focal limiting factors were ranked as Low (1), Medium (2), or High (3), based on the number of limiting factors addressed in proposed activities and the rank of those limiting factors (see Table 4-1).
3/ Current geomorphic function was given a Low (1) priority ranking if the Geomorphic Assessment results indicated current function was moderate, Medium (2) if current function was low, or High (3), if the current geomorphic function was very low (see Figure 3-20).
4/ Geomorphic Potential factors were ranked as Low (1), Medium (2), or High (3), based on Geomorphic Assessment results, professional experience, and best professional judgment.
5/ The cost versus benefit was ranked as Low (1), Medium (2), or High (3) based on the relative cost as estimated based on past projects and the expected benefit as defined by measurable effect on focal limiting factors.
6/ Feasibility benefit was ranked as Low (1), Medium (2), or High (3) based on evaluating potential construction access, difficulty of restoration and enhancement actions, probability of achieving a successful outcome from project actions from professional experience, and best professional judgment.

Figure 12: Project prioritization matrix

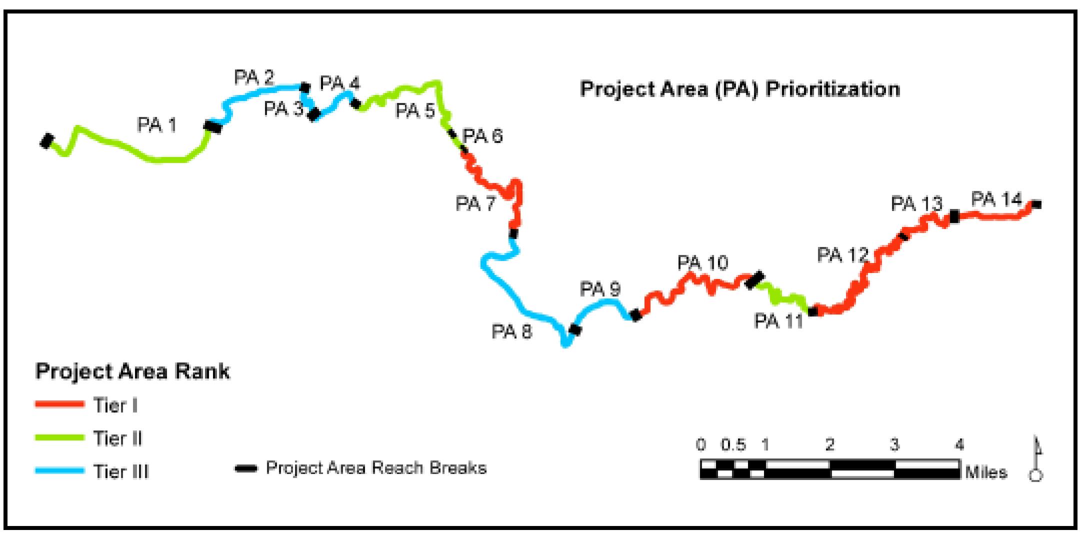


Figure 4-2. Prioritization of Project Areas for the Lower Walla Walla River

Figure 13: Project area prioritizations.

The action plan and conceptual designs were linked to stream evolution model development specific to the lower river, in order to aid in natural processes and enhance a full range of River Vision touchstones in the lower river:

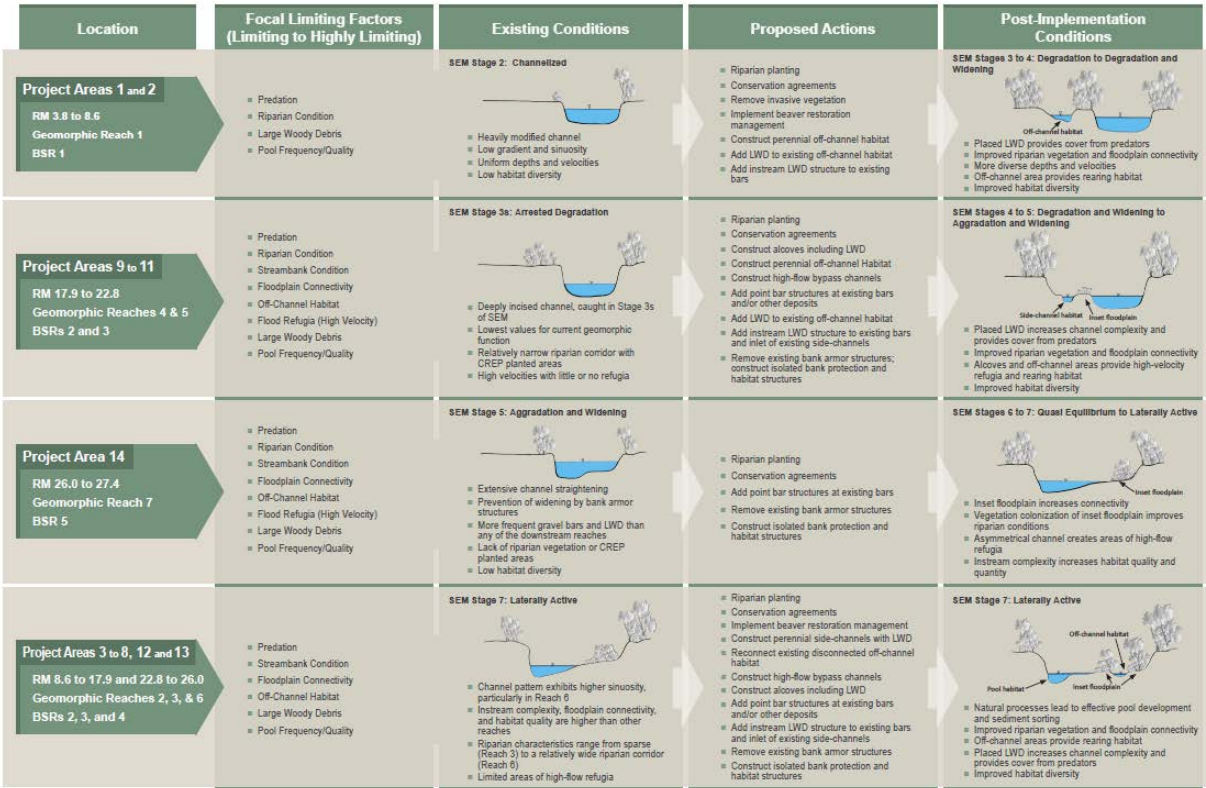
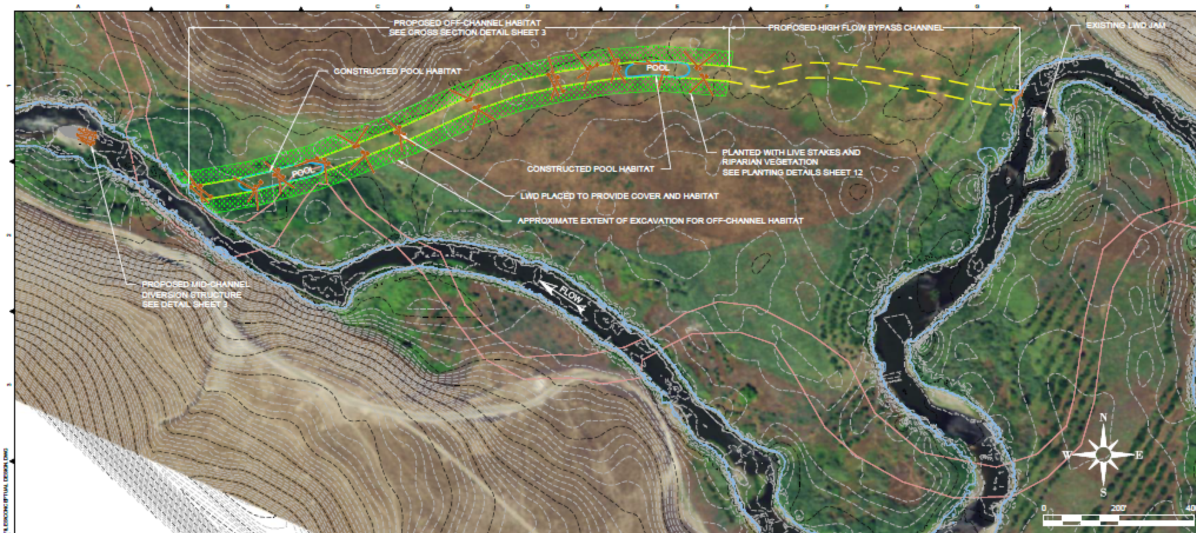


Figure 14: Stream evolution model and proposed actions by reach.

Conceptual designs were developed for three representative reaches that incorporate geomorphic and habitat problems typical of much of the lower river, with the intention of being able to apply these conceptual designs to large stretches of the lower river. By developing these conceptual designs, our intention has been to create designs that lend themselves to programmatic permitting and will be cost effective and efficient to bring to construction-ready design and to implement.

Examples of the conceptual designs include:



NOTES:

1. NO FLOWS EXPECTED IN OFF-CHANNEL HABITAT WHEN HIGH FLOW BYPASS IS NOT CONSTRUCTED AS PART OF DESIGN.
2. WOOD INCLUDED IN DESIGN OFF-CHANNEL HABITAT TO PROVIDE COVER FOR FISH.
3. POOLS IN OFF-CHANNEL HABITAT SHALL BE A MINIMUM OF 3 FEET DEEP TO PROVIDE HABITAT FOR FISH IF OFF-CHANNEL IS TEMPORARILY DISCONNECTED FROM MAIN CHANNEL.
4. PROPOSED HIGH FLOW BYPASS CHANNEL NOT APPLICABLE IN ALL CASES.
5. LWD STRUCTURE TO BE PLACED AT INLET OF HIGH FLOW BYPASS CHANNEL TO CONTROL GRADE AND PREVENT AVULSION OF MAIN CHANNEL INTO BYPASS CHANNEL. LWD STRUCTURE TYPE AND LOCATION TO BE DEVELOPED DURING LATER STAGES OF DESIGN.
6. OFF-CHANNEL HABITAT PLANTED WITH LIVE STAKES AND RIPARIAN VEGETATION TO PROVIDE CHANNEL STABILITY. SEE PLANTING NOTES SHEET 12.
7. MID-CHANNEL DIVERSION STRUCTURE PLACED TO CREATE NEW MAIN CHANNEL SPLIT FLOW, OR TO ENHANCE EXISTING MID-CHANNEL BAR TO PROMOTE EXISTING SPLIT FLOW.

LEGEND:

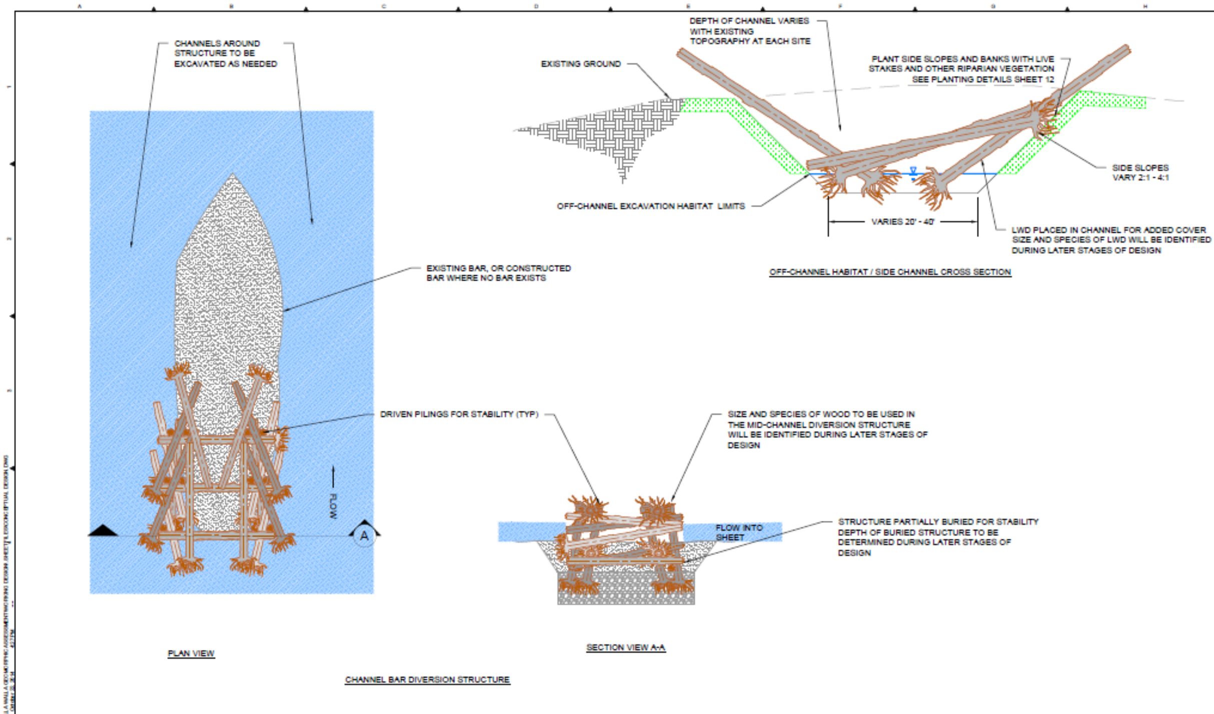
- EXISTING MAJOR CONTOUR - 5FT
- EXISTING MINOR CONTOUR - 1FT
- CURRENT BANKFULL CHANNEL
- 1939/1940 ACTIVE CHANNEL
- PROPOSED OFF-CHANNEL
- PROPOSED HIGH FLOW BYPASS CHANNEL
- LWD STRUCTURES
- ALCOVE / POOL HABITAT
- RIPARIAN PLANTING

TETRA TECH

LOWER WALLA WALLA GEOMORPHIC ASSESSMENT AND ACTION PLAN

CONCEPTUAL DESIGN CATEGORY 1 - PLAN

SHEET 2 OF 12



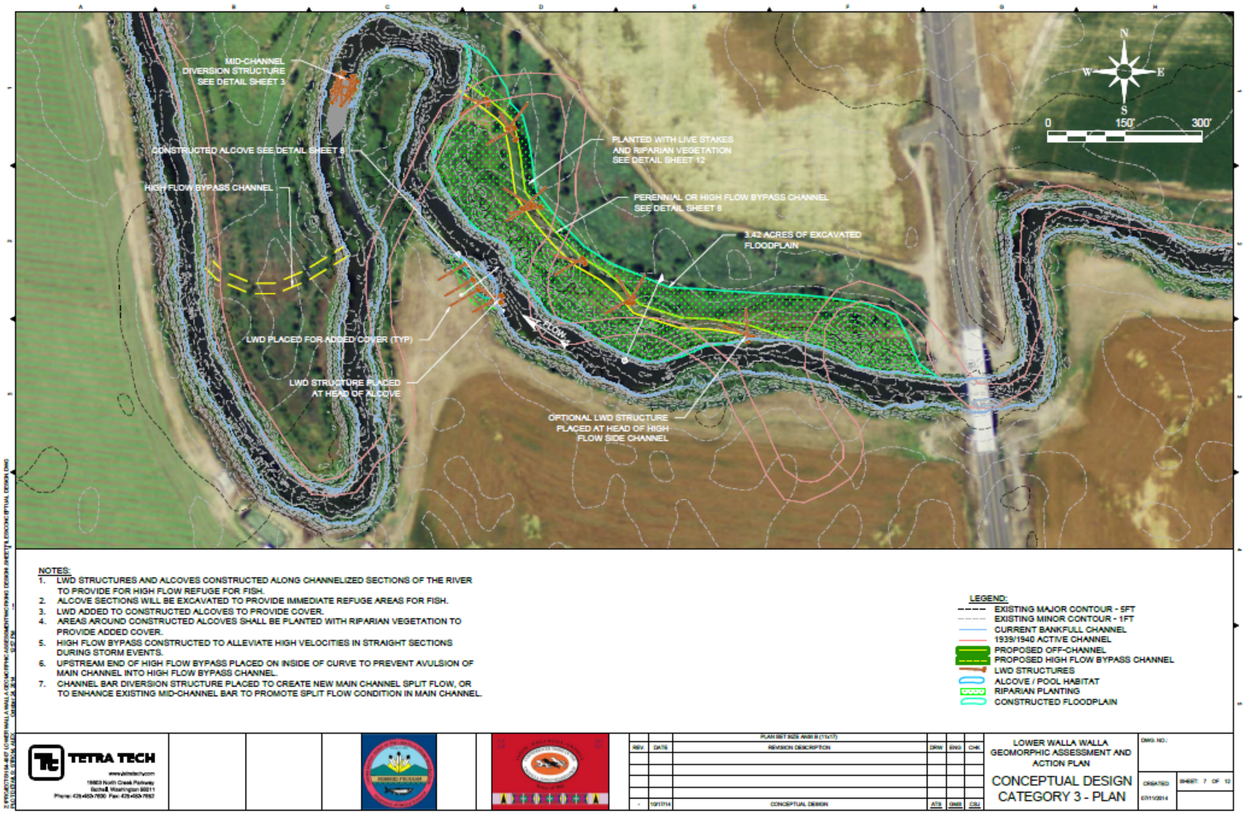
CHANNEL BAR DIVERSION STRUCTURE

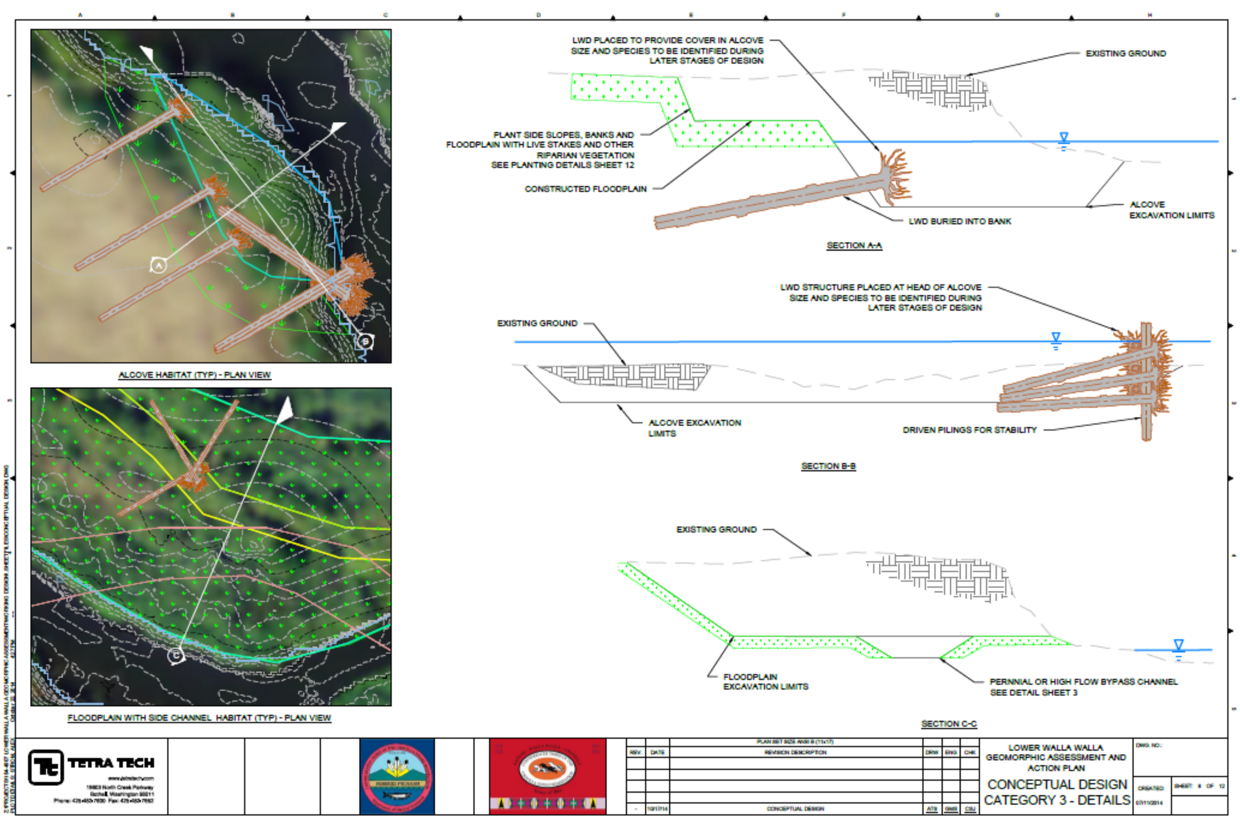
TETRA TECH

LOWER WALLA WALLA GEOMORPHIC ASSESSMENT AND ACTION PLAN

CONCEPTUAL DESIGN CATEGORY 1 - DETAILS

SHEET 3 OF 12





Figures 15-19: Conceptual design drawings.

Additionally, a landowner outreach summary version of the GAAP was prepared for use by CTUIR and LWWWG partners when working with landowners and other stakeholders for future projects in the lower river. This project was completed successfully, on schedule, and within budget. Project deliverables have been shared with project partners and our expectation is that this project will lead to significant improvements in the geomorphic and habitat characteristics of the lower river.

Lessons learned:

- Significant time was spent in the planning stages of this project, first with the LWWWG (including funding and cooperating in the 2011 study) and then with a CTUIR project team; this planning time prepared us to enter the project with carefully considered goals and objectives and a clear understanding of the project area.
- This project was phased across two budget years, and the longer time line allowed for adaptive management, incorporation of new data, and adjustments of the scope for additional analyses.
- This project was conducted as a team based approach at every stage, including a CTUIR team that included Scott O'Daniel and Mike Lambert, members of the LWWWG, and the full integration of the TetraTech staff into the project team.
- Open and clear communication, as well as frequent meetings (including at CTUIR and project team offices in Walla Walla, at the TetraTech offices in Bothell, and out in the field) were critical to project success.
- Selection of data acquisition, field data collection methods, and data analyses should be pushed later in the project process, after the data gaps analysis, in order to avoid inefficiencies and redundancies.

Nursery Bridge

CTUIR contributed cost share funds in 2012, 2013, and 2014 towards the design and construction of an emergency passage fix at Nursery Bridge, in Milton-Freewater, Oregon. At this location fish passage was being compromised due to channel confinement and incision, limiting access at some flows to the fish ladder entrances. GeoEngineers and Anderson Perry partnered for the design and engineering work, and the Milton-Freewater Water Control District provided additional design cost share. The Walla Walla Basin Watershed Council provided primary project management. CTUIR provided technical assistance, assisted with construction oversight, and has been a member of the Interagency Technical Team (and previously the Oregon Solutions group) working towards long term passage and habitat improvements at the site.

Following a competitive bidding process, Partney Construction was selected as the highest qualified contractor. Work commenced on September 22, 2014, and was completed ahead of schedule. One change order was required to address conditions different from the designed state, due in part to the two other projects proceeding in the same reach that summer. Fish salvage and handling was provided by CTUIR and ODFW, with assistance from WWBWC The full construction report will be provided by the Walla Walla Basin Watershed Council, but example construction photos are below:

Figures 20-22: Nursery Bridge construction

Lessons learned:

- The poor conditions and in some cases poor quality of work created by contractors working on the two other projects in the same reach (MFWCD levee repairs and an ACOE gabion installation) created significant difficulties and increased costs for this project. BPA engineers have expressed serious concern about channel constriction from the levee repairs, with negative implications for the longevity and success of this passage fix.
- The difficult regulatory and partnership situation at this site created increased design timelines, costs, and difficulties.
- Communication was not always smooth and open between the two design firms and between them and the project sponsors. There were also delays in creating and sustaining design consensus decisions due to the number of agencies involved in the decision making process.
- Increased attention to the scope of work and communication pathways for future design work would be beneficial.
- The selected contractor was able to put the full instream flow into a bypass pipe in order to work in the dry, and kept the water in the pipe for only eight days, less than the 14 days ODFW had permitted.

- As of the writing of this report, the passage repair appears to have handled this winter's high flows successfully.
- A long term solution for the site will need to address the underlying causes of habitat and passage impairment, rather than continuing to provide short term fixes at comparatively high cost.
- Lessons learned from Nursery Bridge should be applied to other leveed sections in the area, all of which are suffering from aging and poorly-designed levee systems that are significantly impairing fish habitat and passage.

Project Effectiveness Monitoring:

In 2013, the project developed a detailed project monitoring approach for the Kentch Project site on the South Fork of the Walla Walla River, continued in the full adaptive management and monitoring plan for the HIP3 submittal. This process linked ecological concerns such as riparian condition and channel form to project objectives to monitoring methods, and metrics collected. A lengthy set of project baseline parameters have been collected for the Kentch Project site. Some examples include Lidar Flights, pebble counts, stream habitat surveys, vegetation surveys, groundwater elevation monitoring, photo-points, topographic and bathymetric surveys, etc. Each of these parameters were collected in a way that will allow the project to repeat the methods and revisit them post project. The Kentch Project site is scheduled for Phase Two construction in 2015. A thorough examination of habitat parameters will be revisited in 2018 and provided in the Annual Report of Progress.

ADDITIONAL ACCOMPLISHMENTS

- Coordinated with participating landowners to discuss their concerns, project objectives, future tasks, etc.

- The project staff attended the Northwest River Restoration Conference in Stevenson Washington for three days in February of each reporting year.

- Implemented noxious weed subcontracts on all project sites.

- Maintained all field equipment including the tractor, various implements, and hand tools.

- Provided written/verbal comments to state, federal, and local agencies regarding various proposed instream/upland activities affecting salmonid habitat.

- Attended basin strategy, planning, and funding meetings including the Mill Creek Working Group, the Priority Projects Group, Oregon Solutions, and the Snake River Salmon Recovery technical team.

- Provided tours of project restoration areas to the NWPPC, BPA, NOAA Fisheries, WWCC, Oregon Division of State Lands, various local school groups, and others as needed.

CONCLUSION

A multitude of factors have led to the extinction of salmon and severe reduction of summer steelhead in the Walla Walla River Basin. Irrigation withdrawals, inadequate passage, and habitat destruction on private lands have been particularly damaging. In recent years, we have begun to take the first steps toward protection and restoration of habitat needed by salmonid fish in the Walla Walla Basin. With time, education, and continued funding, many of the obstacles now facing salmon in the basin may be eliminated. Stream buffers and zoning laws that protect riparian areas from further development are desperately needed. The Walla Walla Basin is rapidly losing floodplain areas to development. Once floodplain areas are developed, natural stream form and processes and the associated benefits for native fish and wildlife become impossible. City and county land management plans have established stream buffers but most are inadequate and poorly enforced. Minimum stream flows and water conservation measures must be established to protect critical spawning, rearing, and migration periods. Finally, with ever-increasing amounts of dollars invested by state and federal agencies, it is imperative that funding aimed at helping native fish be directed toward projects that will provide the greatest science-based benefit.

REFERENCES

Confederated Tribes of the Umatilla Indian Reservation. 2001. Walla Walla Subbasin Summary - Draft. Submitted to the Northwest Power Planning Council, Portland Oregon.

Mitchell, Fred. 2014. Personal Communication

Mendel, G., J. Trump, and M. Gembala. 2005. Assessment of salmonids and their habitat conditions in the Walla Walla River Basin within Washington. Washington Department of Fish and Wildlife.

Northwest Power and Conservation Council, 2004. Walla Walla Subbasin Plan. Submitted by: Walla Walla Watershed Planning Unit and Walla Walla Basin Watershed Council.

Oregon Game Commission, 1952-58. Annual Reports. Oregon State Game Commission, Fishery Division.

Swindell, E. G. 1942. Report on source, nature and extent of the fishing, hunting and miscellaneous rights of certain Indian Tribes in Washington and Oregon together with affidavits showing location of a number of usual and accustomed fishing grounds and stations. Office of Indian Affairs, Division of Forestry and Grazing, Los Angeles, CA.
Total Maximum Daily Load (TMDL) Technical Study for the Walla Walla River Basin, Draft. 2001. Department of Ecology, Pendleton Oregon.

United States Department of Agriculture. 1941. Survey United States Report for Walla Walla River. Copy of the report was found at the local NRCS office in Walla Walla, Washington.

Van Cleve, R., and Ting, R., 1960. Survey Report for Walla Walla River The condition of stocks in the John Day, Umatilla, Walla Walla, Grande Ronde, and Imnaha Rivers as reported by various fisheries agencies. Publisher unknown.