Appendix 1: Project Area 6, 8 & 9

- Sponsor: Washington Department of Fish & Wildlife
- Landowner: Washington Department of Fish & Wildlife
- Funder: Bonneville Power Administration
- Match: Salmon Recovery Funding Board
- Design: Washington Department of Fish & Wildlife
- Program: Tucannon Habitat Programmatic, Snake River Salmon Recovery Board

Contributing Partners:
Project Back Ground

Project Area 6, 8 & 9 are three projects areas identified in the Tucannon Conceptual Restoration Plan (Anchor 2011, April) that involve a number of infrastructure recommendations surrounding the two impoundments located on the floodplain as well as setting channel complexity goals. The discussion involving the removal of the impoundments as well as the support infrastructure is proceeding as part of the WDFW lead W.T. Wooten Floodplain Management Plan initiated (Dice 2014) in 2014. The impoundments are both part of a put and take rainbow trout fishery that is isolated from the Tucannon River fish population by fish screens. The fishery was initiated as part Lower Snake River Compensation to provide fisheries in place of those lost by the construction of the lower Snake River Hydro system. The fisheries are very popular locally and receive very high fishing pressure (>87,000 angler hour/year) based on the four most popular lakes, so changes will occur incrementally over time to minimize impacts on the public. The Curl Lake impoundment is dually operated as an acclimation pond for hatchery raised spring Chinook and steelhead programs located in the Lyons Ferry and then converted to put and take fisheries during the summer. These structures will continue to play a role in the recovery of floodplain function through this reach over time.

In 2015, WDFW initiated the development of the concepts laid out in the Conceptual Restoration Plan (Anchor 2011 April) for project areas 6, 7, 8 & 9. The plan identified large woody debris, pool frequency, and floodplain connectivity as limiting in the reaches, but riparian habitat was relatively intact with mature coniferous forest. The Programmatic design review process cultured the opinion that minimizing impact to this forest would be a short term goal, with floodplain connectivity and channel complexity being more intermediate and longer term goals. The restoration treatment being a combination of ELJ as structural and long term goals and mobile log jams placed with short term goals of creating cover, pools, erosion or deposition.

To protect well established riparian forests the design was developed to be implemented using a Chinook CH-47D heavy lift helicopter to place logs and ballast for all proposed structures in the main channel. Funding limitation in the winter of 2016 and the development of project area 18 by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) lead the Programmatic to coordinated cost sharing between WDFW and CTUIR. Efficiencies were identified in two separate areas the first being the sharing of the helicopter contract between projects with the CTUIR holding the contract for helicopter time, and second we separated construction elements to enable the use of Vertol 234 air ship for light loads. Combining the two helicopter elements cut the mobilization cost in half (saving ~$40k), the less expensive Vertol reduced the helicopter line item by a 1/3 (~$200k) and the placement of the construction contract in CTUIR as a pass through contract saved estimated $180k on indirect charges. In all in 2017, the Programmatic working as an interagency effort likely saved $420k in this project reach. Over all the project is estimated to have cost ~$1.3 million including all aspects of concept and design through demobilization. A final cost summary will be completed once the project has been finalized in the summer of 2018.

Conceptual Treatment Action Targets:
• Increase LWD key pieces (>6 m long & 0.3 m dia) from pre-project 112 to post project 672 (>2pieces/bankfull width).
• Increase side channel connection on >0.25 miles
• Reduce Confinement to < 30% unnatural confinement
• Increase pool frequency >15%

Environmental long term goals include reducing summer high temperature and winter low temperatures.
Project Goals and Objectives

**Goal:** Return a roughly 1.96 miles within project areas 6, 8 & 9 identified in the Tucannon Conceptual Restoration Plan (Anchor 2011 April) located within WDFW’s WT Wooten Wildlife Area closer to its historic, naturally functioning state, and increase fish habitat quantity and quality.

**Objectives:**

i. Installing LWD structures within the bank full channel that create pool habitat, instream cover habitat, channel complexity, substrate sorting, increased channel migration and floodplain connectivity.
   
   i. Place ~96 log jams
   
   ii. Added 660 key LWD pieces (> 6 m long & 0.3 m dia.) with the long term goal to maintain > 2 key pieces beyond 10 years.
   
   iii. Increase pool frequency and volume > 30%

ii. Place LWD structure strategically to reconnect the floodplain and increases fish habitat and accessibility to the Hixion Creek channel that runs along the east side of the valley floor;

   i. 25 ft of pilot channel cut to reconnect channel feeding into lower Hixion Creek connecting 0.22 mi of high flow channel.

   ii. Placed one Apex jams and channel spanning jams in the main channel to locally increase 1.5 yr flood height and increase flows into pilot cut. Anticipated a 50% increase side channels within the first 10 yrs.

iii. Planting to restore a floodplain and upland terrace forest

   i. 500 of trees interstitially planted

   ii. 1 acres of new cover trees planted
Summary of Implementation:

In mid-July 2017, after nearly 2 years of planning, design, permitting and fund raising, PA-6-9 was implemented in with support from CTUIR and the SRSRB in < 3.5 days. Implementation went off without incident thanks to the hard work and dedication of those involved. Construction was well visited with representatives from state and federal agencies, tribes, counties and the public came to the spectacle of the Chinook Heavy Lift airship do its work. Since project completion the work site has been visited by a number of agency and public tour to help spread awareness of large scale habitat restoration.

The project received funding support from the BPA funded Tucannon Programmatic ($866k) and the Salmon Recovery Funding Board ($400k). During implementation 116 LWD structures were constructed within the 1.96 mi perennial channel were treated with LWD key pieces totaling 660 pieces (> 6 m long & 0.3 m dia.). The relative cost of conducting a helicopter based LWD construction based on our past for project has averaged about $510k/mile of treated area. This project ran a little higher due to the size of material placed in the project reach by the more costly Chinook. As a comparison of cost in using a helicopter to implement compared to convention equipment we averaged the cost of projects per mile and found them to be a bit higher at around $750k/mi. This is a rough estimate, and is not an effort to disqualify or promote one approach over another, but a reflection that the costs are not that overwhelmingly different. The Chinook airship and crew cost $250/minute to operate on the construction site and it is very important to be well prepared before the ship arrives. A detailed account of some of the things to consider when preparing are out lined in Tucannon Programmatic Annual Report 2017 (Buelow 2018).

The placement of LWD structures using a helicopter is a less invasive approach to restoration, however it also can be slower to respond and develop the habitat units desired based on flood flows and local conditions as might structures placed using conventional equipment. The reasons for this vary but are mostly related to LWD members making contact with the stream bed and the character of helicopter structures being more flow through which require high flows to help settle the structure down to the stream bed. In 2017, we tried to combat this by adding a high degree of racking and smaller unanchored material that will move into the structures and reduce the porous nature of the structures in the first year, which should help in slowing flow and pushing flows to generate localized scour and deposition desired to drive habitat improvement.

The following data summary are drawn from the results of pre and post project rapid habitat surveys conducted for the propose of implementation monitoring in 2017.

• In 2017, the entire 1.96 miles of the project areas was treated with LWD increasing the key piece/ bank full with 390% from a pre-project average of 0.87 to a post project average of 4.5 bring the key pieces/bank full width (>6 m long & 0.3 m dia.).
• Built 116 LWD structures increasing pool frequency by 93% and pool area by 287%.
• Increased all side channels by 240% and over all perennial length by 36%

Environmental variables are measured through a variety of projects and programs

• Improved water temperature is a long term objective of the Programmatic and it is anticipated that the project over a 10 yr period will positively improve summer high temperatures and winter low temperatures. Temperature is measured at the watershed scale at the lower end of the management unit by the Washington Department of Ecology stream gage at Marengo.
• Riparian quantity and quality is being monitoring through the watershed using remote sensing technology in the form of available LiDAR data 2010 data and 2017 data.
Appendix 1– Slide 4: Project reaches 6 (0.6 mile), 8 (0.6 mile) and 9 (0.7 mile) progress downstream from south to north and are located on the WDFW Wooten Wildlife Area. The yellow lines represent the project reaches treated with LWD in 2017. The light blue lines represent the existing channel of Hixxon Creek and side channels. The green line is the side channel that has connected >1,000' of channel to lower Hixxon by breaching a small spoil berm along the Tucannon and placing a LWD structure in channel. The red lines in the upper left indicate the position of the Big-4 impoundment and its protective levee being targeted for decommissioning in the WT Wooten Floodplain Management Plan sponsored by WDFW. The red triangle is the diversion point for the impoundment. The gap in stream work labeled by the PA-7 pin indicates an infrastructure heavy reach located on the USFS ownership which is being reviewed for appropriate actions in upcoming projects. Currently the gap dose not represent threats to fish survival beyond it providing low channel complexity, no floodplain connectivity and little habitat value.
Appendix 1 – Slide 5: PA-6-9 structure locations as proposed distributed across all three project areas. There is not a CHaMP sites located within the project areas, but one is located in PA-7 indicated by the orange polygon. Future treatment of PA-7 is pending assessment by the USFS. Project reaches 6, 8 and 9 were binned together into one work window due to the similarity in the habitat deficiency and the relative intact nature of riparian habitats. Wood loading using a helicopter will help meet the LWD objective of 2 pieces per bank full width with out impacting the existing trees and over time increase channel length, pool frequency and complexity.
Appendix 1 – Slide 6: Example of design detail produced by WDFW for all 96 multi log and single log structures. In total the project placed >600 logs instream using a helicopter to minimize impacts to the river reaches riparian habitat. Note the small excavation required to connect historic flow paths and low lying floodplain.
Appendix 1 — Slide 7: The above maps illustrate pre/post project condition on the 0.6 mi project area 6 portion of the larger WDFW PA 6-9. The upper map illustrates the pre-project LWD structures (estimated at < 0.52 pieces per bank full width), pool frequency and channel extant, the lower map illustrates the as-built for the same attributes. Wood loading using a helicopter will help meet the LWD objective of 2 pieces per bank full width with out impacting the existing trees, however requires time for flows high enough to activate bed load and intergrate LWD materials. We anticipate it could take up to 10 years to reach pool and channel connectivity goals within this reach. The data provided in this illustration was generated from the rapid habitat surveys collected by the SRSRB in 2017. There is not CHaMP sites located within these project areas so the Programmatic will continue to collect project effectiveness data related to structures placed, pool frequency and floodplain connectivity.
Appendix 1 – Slide 8: The above maps illustrate pre/post project condition of the 0.6 mi project area 8 portion of the larger WDFW PA 6-9. The upper map illustrates the pre-project LWD structures (estimated at < 1.4 pieces per bank full width), pool frequency and channel extant, and the lower map illustrates the as-built for the same attributes. Wood loading using a helicopter will help meet the LWD objective of 2 pieces per bank full width with out impacting the existing trees, however requires time for flows high enough to activate bed load and integrate LWD materials. We anticipate it could take up to 10 years to reach pool and channel connectivity goals within this reach. The data provided in this illustration was generated from the rapid habitat surveys collected by the SRSRB in 2017. There is not CHaMP sites located within these project areas so the Programmatic will continue to collect project effectiveness data related to structures placed, pool frequency and floodplain connectivity. Channel confining features remain within the project area reducing the available floodplain and peak potential within the area, Curl Lake and its diversion point, is a Chinook and steelhead hatchery pond used to acclimate the both hatchery stocks reared out of basin at Lyons Ferry Hatchery on the Snake River. The pond is then used as a put and take rainbow trout fishery in the off season. The small levee (gravel berm) adjacent to the Curl Lake impoundment was none essential in protecting the lake so LWD was placed to cause flows to go around it seasonally creating a forested island, and over time through erosion return to the river.
Appendix 1 – Slide 9: The above maps illustrate pre and post project condition of the 0.7 mi project area 9 portion of the larger WDFW PA 6-9. The upper map illustrates the pre-project LWD structures (estimated at < 0.9 pieces per bank full width), pool frequency and channel extant, and the lower map illustrates the as-built for the same attributes. Wood loading using a helicopter will help meet the LWD objective of > 2 key pieces per bank full width without impacting the existing trees, however requires more time for channel process to occur, depending on flood frequency. We anticipate it could take > 10 years to reach pool and channel connectivity goals set within this reach. The data provided in this illustration was generated from the rapid habitat surveys collected by the SRSRB in 2017. There is not CHaMP sites located within these project areas so the Programmatic will continue to collect project effectiveness data related to structures placed, pool frequency and floodplain connectivity. Channel confining features remain within the project area reducing the available floodplain and peak potential within the area, Big 4 Lake and its diversion point remain in the floodplain and is used as a put and take rainbow trout fishery during the cooler months. The purpose and benefit of the impoundment is being reviewed as part of WDFW floodplain management activities and is being considered for decommissioning which would greatly increase available floodplain within the reach. The Programmatic will continue to work with WDFW as the plan is developed to maximize fish benefit to the reach.
Appendix 1 – Slide 10: Upper left illustrates example of PA-6 channel structure placed in the 1990’s to increase pool holding habitat while maintaining channel alignment near the Tucannon Campground. Upper right looks at the approximate position of the side channel excavation and beginning of LWD structure placement implemented in 2017. Lower right is a typical example of a LWD structure prior to treatment, note the presence of LWD on the bars and along channel margins, with little interaction at < base flow. The lower left is an example of well connected natural LWD being exposed by channel migration and close to desired condition. This wood had been This desired condition rarely occurs in the Tucannon where incised plane bed conditions occur.
Appendix 1 – Slide 11: Upper two images illustrate pre (left) and post (right) for the lead structure constructed in 2017. The purpose is to backup flow beginning at the 1.5 yr flood to engage the right bank high flow channel, encourage bar deposition above and below the structure. The structure is built immediately downstream of a confined transport reach which called for placement of ballast rock to ensure longevity of the structure. The lower two images are pre/post project is a typical example of a LWD structure that has been ballasted with large boulders and secured using chain to increase longevity during flood flows. The Programmatic partners have adapted designs over the past 7 years to incorporate a combination of mobile and stable structures to help in balancing short term and long-term restoration goals.
Appendix 1 – Slide 12: Upper two images illustrate pre (left) and post (right) project ELJ placed within a long straight plane bed reach for the purpose of encouraging pool scour, bar deposition and leading toward channel migration. The structure is built immediately downstream of a moderately incised transport reach which called for placement of ballast rock to ensure longevity of the structure in meeting long term objectives. The lower two images are pre/post project is a typical example of a LWD structure that has been built without ballasted and is not expected to move in flows > bankfull but will become mobile in flows approaching a 5 year event. The mobility of this structure is accounted for in the design by the placement of a stable structures 2-3 structures downstream in a strategic location for capturing materials. This design approach has been adapted from our catchers mitt approach were we built stable elements at the bottom of a project reach to prevent materials from leaving the reach. The new approach helps to maintain distribution of jams over the project area during an event.
Appendix 1 – Slide 13: Upper four images illustrates pre (left) and post (right) project ELJ placed within a long straight plane bed reach for the purpose of encouraging pool scour, bar deposition and leading toward channel migration. The structure are built immediately downstream of a moderately incised transport reach which called for placement of ballast rock to ensure longevity of the structure in meeting long term objectives.
Appendix 1 – Slide 14: Upper four images (same structure) illustrates pre (left) and post (right) project ELJ placed within a long straight plane bed reach for the purpose of encouraging pool scour, bar deposition and leading toward channel migration. These structures are built to be large filling a large proportion of the channel in that hey will quickly lead to channel migration increasing length and generating bed load to engage with downstream structures.
Appendix 1– Slide 15: Upper four images illustrates pre (left) and post (right) project ELJ placed within a long straight plane bed reach for the purpose of encouraging pool scour, bar deposition and leading toward channel migration. The upper right image is an unanchored structure that may become mobile, designed to push the river right and generate bed load. The lower right is a set of anchored structures just downstream from the unanchored structure indicated by the yellow arrow, designed to capture sediment and aggrade the stream bed.
Appendix 1 – Slide 16: Upper two images illustrate pre (left) and post (right) project ELJ placed within a long straight plane bed reach for the purpose of encouraging pool scour, bar deposition and leading toward channel migration. The structure is built immediately downstream of a moderately incised transport reach which called for placement of ballast rock to ensure longevity of the structure in meeting long term objectives. The lower two images are pre/post project is a typical example of a LWD structure that has been built without ballasted and is not expected to move in flows > bankfull but will become mobile in flows approaching a 5 year event. Note the upper right images shows the conversion of plain bed riffle to a pool and glide in the short term, but in the longe term will generate a channel meander jam increasing channel length and better pool habitat.
Appendix 1 – Slide 17: Upper two images illustrate pre (left) and post (right) project ELIs placed within a reach with good floodplain connectivity for the purpose of maintaining connectivity, encouraging pool scour, bar deposition and increasing cover. The lower two images are pre/post project of structures placed to capture sediment and create complexity in a simplified channel. The structures series should lead to increased gravel sorting, pool and bar development.
Appendix 1 – Slide 18: Upper two images illustrate pre (left) and post (right) project LWD placed within a plane bed reach for the purpose of encouraging pool scour, bar deposition and leading toward channel migration. The lower left image is post project is a typical example of a LWD structure that has been built without ballasted and is expected to move in flows > bankfull and will become integrated into the naturally formed jams like the one in lower right formed when lose materials were place upstream in 2012.