

Tucannon River Programmatic

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Annual Report

(Reporting Period January 2011 to January 2012)

Contractor

Snake River Salmon Recovery Board

Contract Number 551166

Steve Martin, Director

Kris Buelow, Project Manager

Contact Information:

SRSRB Office,

410B E Main St.

Dayton, WA 99328

509-382-4115

steve@snakeriverboard.org

kris@snakeriverboard.org

Abstract:

The project 2010-007-00 provided support to complete the goals and objectives of the Tucannon River Programmatic (Programmatic) during this initial year of the Programmatic. The Snake River Salmon Recovery Board (SRSRB) worked to identify restoration actions and projects in the Tucannon River for the purpose of improving spring Chinook habitat. Tasks completed in 2010 included project identification and prioritization, partner technical support, public outreach, project and habitat data compilation and project database development. The Programmatic in coordination with project sponsors and management agencies and SRSRB partners developed restoration priorities and recommended restoration projects for funding through the program.

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Introduction: Tucannon River Programmatic Habitat

The Snake River Salmon Recovery Board (SRSRB) serves as the lead for salmon recovery in the Tucannon River guiding funding for the State of Washington Salmon Recovery Funding Board (SRFB). Beginning in 2011 the SRSRB was awarded a grant from Bonneville Power Administration (BPA) to manage the Tucannon River Programmatic (programmatic) on the Tucannon River in South East Washington. The objectives of the programmatic are to identify and prioritize habitat restoration actions in the Tucannon River which would improve spring Chinook habitat 17% over the time of the 2008 FCRPS Biological Opinion. In the initial year of the programmatic the SRSRB worked with local habitat restoration experts to prioritize, coordinate and assist in the implementation of restoration actions identified in the Salmon Recovery Plan for SE Washington (2012), and the 2008 FCRPS Biological Opinion. The SRSRB will coordinate the Programmatic to identify and recommend habitat restoration projects to BPA, and assist in the implementation of approximately \$1.3 million in habitat restoration projects annually, between 2011 and 2018.

The Tucannon River spring Chinook is a sub-population of the Snake River spring Chinook ESU which has been listed as threatened under the Endangered Species Act since 1996. The population was in decline throughout the 80's, but reached a critical low in the mid 90's when the number of wild adults dipped to as few as three individuals. The population would have been lost altogether if a brood stock population derived from the wild population had not been developed in 1985 by the Washington Department of Fish & Wildlife (WDFW). Supplemented by the hatchery brood stock, the wild population has recovered from critically low numbers over the past decade. The SRSRB works in coordination with WDFW and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to provide current population data for the Tucannon River spring Chinook, available on the SRSRB website at: <http://www.snakeriverboard.org/Salmon/WRIA35SprChinook.html>.

The SRSRB and its partners are working to improve spring Chinook productivity and survival in the Tucannon by focusing on habitat restoration actions which directly or indirectly impact habitat factors identified as limiting Chinook productivity and survival. The factors identified as limiting spring Chinook productivity and survival are listed in the 2012 Salmon Recovery Plan for South East Washington (Table 1) and the 2008 FCRPS Biological Opinion. Restoration projects are proposed by the SRSRB Tucannon Coordination Committee (TCC) and prioritized by the SRSRB Regional Technical Team (RTT) using the limiting factors outlined in Table 1.

Salmon habitat restoration began in the Tucannon as early as 1999 and considerable progress has been made in addressing fish passage and irrigation screening (imminent threats), restoring and protecting riparian habitat and implementing upland BMPs like no-till agriculture. Through the implementation of the restoration actions, improvements in temperature, reduced embeddedness and increasing woody debris are being realized, though it will take decades before full benefits are fully realized.

The RTT has considered the restoration achievements in imminent threats, riparian planting and upland BMPs and through adaptive management has refined the primary restoration focus from the early actions (previously mentioned) to projects targeting restoration of ecological function. More specifically, the focus has shifted from conducting projects which were site specific, for example bank protection or creating large holding pools, to conducting projects with large footprints targeting ecological function. The adjustment is intended to recruit the river to create and maintain habitat in areas where the space for a natural river is available. To conduct larger projects with restoring function in mind requires a higher level of assessment, coordination and design than has previously been required in the basin. This need for habitat and river function data has prompted the SRSRB to support the reach assessments and restoration planning being conducted in the basin. Initial outcomes of the assessment and restoration planning efforts conducted by the Columbia Conservation District (CCD) reinforced the need for increasing floodplain connectivity and channel complexity. Through the review and discussion of available information it was established by the RTT that adequate spawning and rearing habitat and more specifically juvenile spring Chinook winter rearing habitat is likely to be the weak life history link in the Tucannon. The SRSRB and its partners have adopted the assessment and restoration planning approach developed in Anchor 2011a and 2011b for the purpose of applying limited restoration funding to restoration projects which will have the greatest impact to habitat over both the short term as well as considering processes which take decades to develop.

As a direct result of the need to focus on improving and creating juvenile spring Chinook habitat, the primary focus of restoration activities will focus on improving floodplain function and river channel complexity, largely through removing river levees and infrastructure from low-lying floodplain and placing large wood instream. By targeting river function over large reaches the SRSRB anticipates the river to express itself in the development of new channels, side channels and other critical off channel habitats. As channel shape changes from the existing over straightened incised single thread channel to a longer anabranch system, hyporheic exchange will improve increasing groundwater influence, cooling summer base flows and warming winter base flows. Improvements in floodplain connectivity will enhance riparian forests by depositing fines on the floodplain reducing embeddedness, increasing water retention and overtime leading to increased forest sustainability.

Study Area:

The Tucannon River is a Snake River tributary originating in the Blue Mountains of southeast Washington (Figure 1) and is located in Columbia and Garfield counties. The main channel is approximately 58 miles long and drains about 503 square miles before entering the Snake River approximately 3 mile upstream from Lower Monumental Dam. Several major tributaries drain into the mainstem including, Pataha Creek, Tualum Creek, Cummins Creek, Little Tucannon, and Panjab Creek. A full description of the basin has been provided in the Tucannon River Geomorphic Assessment and Habitat Restoration Study (Anchor 2011a).

The Tucannon supports populations of four threatened species including the Snake River ESU spring Chinook, Snake River fall Chinook, Snake River ESU summer steelhead, and the Columbia River bull trout. All reaches of the Tucannon River are utilized by all species during one or more seasons annually. The lower Snake River spring Chinook is currently only present in the Tucannon having been extirpated from Asotin Creek (Figure 2).

Restoration projects supported through this programmatic will focus on areas that will have a high impact on spring Chinook productivity, which is the reach upstream from the Pataha confluence to Panjab Creek (Figure 3). Currently, the river from the Pataha confluence to the Panjab confluence are known to be act as rearing habitat with the highest quality habitat being located between RM 30 and RM 50.

Implementation Approach:

The Programmatic provides for local expertise and coordination of BPA restoration funding in the Tucannon River for the purpose of improving spring Chinook habitat. The SRSRB provided project sponsor support in technical and fiscal capacities during 2011 for the purpose of identifying and prioritizing habitat restoration projects. Habitat restoration projects are conceptualized through expert opinion and validated through field assessment and restoration designs. The RTT determines a projects benefit to salmon based on impact to limiting factors, restoration objectives and the feasibility of the project being implemented. Once a project is identified as a priority by the RTT, the SRSRB works with the TCC to develop the project concept into the implementation project list. The RTT annually considered projects on the implementation list for funding as sponsors bring them forward for implementation funds. The SRSRB provides project sponsors technical support in the completion of contract applications and ongoing reporting in Pisces. This approach ensures that the projects recommended to BPA for funding by the RTT are both vetted in the local process and provide the most towards recovery. The SRSRB works throughout the process to identify matching funds to projects as they come forward.

The following sections of this report will provide a detailed description of activities conducted under the work elements outlined in the scope of work (contract number 51166). When applicable, methods, results and progress on deliverables are described for the time period from January 2011 through January 2012.

Work Element Method and Result Deliverable Reporting

Program Implementation

Work Element 119, 185, 132: Manage and Administer Project, Produce Status Reports & Annual Report:

Deliverables: 2012 SOW development, property inventory, submitted in Pisces. Coordinate the Tucannon River Programmatic and identify project matching funds. Complete periodic status reports and annual report.

During the time period February 1, 2011 through January 31, 2012 the SRSRB managed the implementation of the Programmatic (contract: 51166) and was the point of contact from its office at 410 B East Main Street, Dayton, Washington 99328. The SRSRB is the Regional Entity for salmon and steelhead restoration in southeast Washington having written the Salmon Recovery Plan for SE Washington. Supported by the SRSRB, the RTT coordinated and held meetings (on the 3rd Tuesday of each month) to prioritize restoration actions and set goals and objectives for restoration of the Tucannon watershed. The SRSRB and RTT worked to establish the program within the SRSRB framework founding the TCC, a group of project sponsors and resource experts locally involved in Tucannon watershed habitat restoration. The TCC is a subcommittee of the RTT with the purpose of identifying restoration activities which best meet the restoration objective (Table 1) and coordinating those activities over the duration of the Programmatic. The TCC meets on a monthly basis with the objective of streamline restoration and monitoring efforts. The participants of the TCC included representation from the, US Forest Service (USFS), Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Nez Pierce Tribe (NPT), Washington Department of Fish and Wildlife (WDFW), Columbia Conservation District (CCD), Pomeroy Conservation District (PCD), Tri-State Steelheaders (TSS) and SRSRB. The TCC committee's primary function in 2011 was to discuss restoration actions, identify and coordinate restoration projects into a list of projects it recommended to the RTT for approval.

In 2011, the TCC discussed restoration priorities provided by the RTT, reviewed river assessments, restoration plans, and submitted restoration projects. It is anticipated, the TCC will annually present project lists to the RTT for consideration, prioritization and funding under the Programmatic implementation funding

The Programmatic supported the development of CCD's Tucannon River Geomorphic Assessment and Habitat Restoration Study (Anchor 2011a), Conceptual Restoration Plan, Reaches 6 to 10 Tucannon River Phase II (Anchor 2012b), and the 30 Percent Design Report Project Area 14 Tucannon River Phase II (Anchor 2012c) by providing review and project prioritization. SRSRB staff and the RTT have completed a final review of the assessment and restoration projects developed in the process completed by the CCD and has prioritized and incorporated into the implementation schedule the 28 conceptual projects identified. The RTT worked with the CCD to develop the project prioritization matrix developed in Chapter 9 of the Conceptual Restoration Plan Reach 6-10 (Anchor 2011b). The matrix

was used to develop the prioritized list of 28 projects for the upper 30 miles of spring Chinook habitat in the Tucannon. The comprehensive project list is prioritized based on proximity to high use spring Chinook habitat, magnitude of the impact to the habitat, cost benefit, feasibility and the likely hood of the project being completed in the next 5-8 years. The tiered projects are incorporated into the RTT approved SRSRB implementation plan for the Tucannon River shown in Table 3. The completion of the CCDs assessments and restoration plan has developed a restoration strategy and aided in planning and sequencing of restoration actions that will increase efficiency and deliberateness in restoration activities. The reports and data compiled during the report are available from the CCD or SRSRB. With the more inclusive project list (Table 3) the SRSRB anticipates the TCC will evaluate the priorities and prepare a full project list for RTT prioritization and recommendation in 2012.

The SRSRB is also administering a SRFB grant obtained by the Walla Walla Community College for the purpose of completing the assessment and conceptual design of the 7 mile reach 5 identified in Anchor 2011a (Figure 4). Beginning in February 2012 the SRSRB will begin to advance the 30 % design on project area 14 (Anchor 2011b, Anchor 2011c) to a final design and complete two additional preliminary designs on Tier 1 projects. Projects identified in the conceptual design of reach 5 will be prioritized using the prioritization matrix outlined in chapter 9 Anchor 2011b and amended to the project list based on priority.

The preparation of the 2012 scope of work and budget was initiated in November 2011 leading to its submittal on November 17th. SRSRB staff is the primary authors of the Programmatic scope of work and compile information for status and annual reports.

Program Guidance and Create Project List

Work Element 114: Identify and Select Projects:

Deliverable: Conduct project solicitation and prioritize projects based on their merit and benefit to salmon recovery. Submit recommended projects to BPA. Provide technical support to project sponsors throughout implementation.

The approach used by the SRSRB to identify and prioritize projects is an adaptive process based on the restoration goals and objectives outlined in the 2012 Salmon Recovery Plan for South East Washington and the 2008 FCRPS Biological Opinion. The priority habitat restoration actions focused on increasing spring Chinook winter rearing habitat in the mainstem Tucannon. The RTT has identified the priority project actions as actions which improving channel complexity, floodplain/riparian function and reduced channel condiment. The RTT believes that restoring floodplain and channel complexity will lead to the development of habitat niches juvenile Chinook need to increasing winter survival including off channel and side channel habitats. The TCC works to identify and develop projects in coordination with the SRSRB which they feel best meet the objectives and actions developed by the RTT. The TCC also works to identify the appropriate sequence of implementation while identifying project sponsorship. Projects proposed as ready to move to implementation by the TCC are prioritized

by the RTT and recommended to BPA for funding under the Programmatic. Once projects are identified and the prioritized list is submitted to BPA for consideration, the SRSRB works with project sponsors to develop a proposal in Pieces. The SRSRB will continue to be an integral part of project implementation in the form of aiding in permitting, maintaining public support and guiding monitoring.

During the 2011 project solicitation and prioritization process the projects identified during the Programmatic application process (Table 2) were considered for funding based on RTT priority, and sponsor readiness. Of the projects considered by the TCC (Table 2) four were discussed by the RTT for inclusion in the 2011 project list provided to BPA. The relocation the power line and relocating the Tucannon River Road out of the floodplain at the USFS Ranger Station were not able to progress to the point of completing an application in 2011. The RTT recommended matching funding to a partially SRFB funded WDFW project placing large wood on a two mile reach in the heart of spring Chinook spawning and rearing (Figure 5). The WDFW project was able to complete an application and it was awarded funding in 2011. This project was also identified in Anchor 2011b as a high priority tier one project. Additionally, an opportunity to enlarge a floodplain area on the WDFW Wooten Wildlife Area (Hartsock Unit) was funded which involved the removal of infrastructure from low-lying floodplain (Figure 5).

The two projects recommended to BPA CTOR for funding in the 2011 fiscal year were imbedded in the contract titled 2010-077-00 EXP WDFW LWD and will focus on increase stream channel complexity and floodplain connectivity on a two mile reach upstream from the Beaver & Watson impoundments (Figure 5) and removing infrastructure from the low-lying floodplain at the Hartsock (Figure 5).

The Large Wood Project is funded nearly 40% SRFB, 50% BPA Programmatic, 7% USFS and 3% WDFW and is planned to move to implementation in the summer of 2012. The main objectives are to increase channel complexity and floodplain connectivity by the placement of oversized trees with root wads attached (Figure 6). It is planned to use a helicopter to transport and place 220 trees in a two mile project reach which was selected based on its degraded condition. The reach is currently over straightened and incised with several miles of disconnected side channel meanders and low floodplain. It is the intention of the design team to use the oversized wood to encourage deposition within the reach, reducing the incision, to capture some of the side channels and historic meanders. In addition, remnant river levees are present in the reach which will be removed/perforated during construction to maximize-available floodplain. The project is currently in the design phase and will be in permitting in January February 2012.

The infrastructure project will be implemented beginning in 2012 and will involve the removal of two buildings from the low-lying floodplain adjacent to well established and expanding riparian and off channel habitat. The project will also remove all other infrastructure from the floodplain allowing for expanded channel meander potential (Figure 7). The project was prioritized by the RTT because the development of high flow channels which encircled the structures over the past few high water events

(Figure 7) are developing the type of floodplain required by spring Chinook. Since the building were positioned in what is increasingly becoming low floodplain it made sense to remove the building rather than building setback levees to protect the structure.

Develop Effectiveness Monitoring Plan

Work Element 156: Develop RM&E Methods and Designs

Deliverable: Development of a monitoring plan

The SRSRB staff worked to draft a habitat monitoring plan for the purpose of defining and guiding monitoring activities in the Tucannon River. Due to the complexities in the development of the plan and the partners involved in the plan it was not completed in 2012 and remains in a draft form. The SRSRB will continue to work with its partners to finalize a draft plan in 2012. The draft is available at the SRSRB office but will not been made publicly available until it is completed and had RTT review.

The objective of the plan will be to organize and outline a strategy for the SRSRB and its partners to observe long term trends in the habitat parameters identified as the limiting factors to salmon recovery. The environmental parameters identified as measuring progress toward the limiting factors are identified in Table 4. The SRSRB as a habitat restoration program, has not traditionally collected or maintained environmental data sets for the purpose of reporting habitat conditions in the Tucannon, but has relied on its partners and the resource agencies to collect validate and maintain monitoring datasets. The reliance of the SRSRB on partners to collect the necessary data for adaptive management, in some cases has led to gaps in the data necessary to making informed management decisions. The monitoring plan will set protocol for what data will be used to monitor progress on each given limiting factor. The plan will identify data gaps and will describe the nature of the data needed. The current known data gaps are identified in Table 5 as well as existing data (duration and replication). Opportunities for filling the gaps will be outlined in the monitoring plan including the methods used to collect the data.

Effectiveness Monitoring

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

Deliverable: Data report

During the time period February 1, 2011 through January 31, 2012 the SRSRB coordinated and supported its partners in the collection of datasets including stream temperature, flow, turbidity and channel complexity. The SRSRB supported and reviewed the analysis of the 2010 LIDAR and orthographic image dataset, and assisted in the development of stream channel complexity monitoring being conducted under the CHaMP program. The funding identified in the programmatic to collect and analyze field data was not utilized during the work period, though the SRSRB worked to identify how it would conduct implementation validation monitoring beginning in 2012. During the development of the draft monitoring plan it was identified that a better understanding of the habitat response precipitated from restoration efforts conducted under the Programmatic, would require consistent pre and post

project implementation monitoring. The SRSRB has adopted the CHaMP method and protocol for implementation monitoring so the changes made through restoration could be directly compared to the watershed wide scale changes.

The SRSRB coordinated with the Tucannon River CHaMP monitoring program to prioritize monitoring sites in the mainstem Tucannon based on proposed restoration sites. The SRSRBs coordination with the CHaMP site selection enabled planners to stratify site selection in relation to planned restoration reaches, which allowed for the placement of control reaches within the basin that are at a minimum risk of being altered by restoration. The managers of both programs saw this as necessary due to the magnitude of planned restoration in the basin. The SRSRB believes adopting this approach will enable the RTT to make comparisons between its restoration sites and the ambient changes in the watershed feeding its adaptive management loop and leading to on the fly refinements maximizing project effectiveness over time. The SRSRB also worked closely with CHaMP managers to acquire permission to private lands to conduct monitoring.

The SRSRB worked with its partners to ensure the long term datasets on stream flow and temperature were continued, primarily through coordination with WDOE to maintain the stream flow and temperature gage at Marengo. Gages all over the region have been at risk for discontinuation under WDOE funding.

In April 2010, the CCD sponsored the collection of a LIDAR and orthographic image data set which cover the Tucannon River from its confluence with the Snake River upstream 50 miles in the mainstem. The dataset is the baseline for determining riparian condition, stream channel confinement, existing disconnected and connected low-lying floodplain and existing infrastructure. The LIDAR dataset has been used extensively in the CCDs assessments to develop several digital elevation models (DEM) including the bare Earth model DEM, the first return or canopy model DEM and the channel meander width model. The bare earth model was used in conjunction with ground surveys to identify river channel confinement, and low-lying floodplain. The canopy model was used to identify riparian coverage, stand height and may be used to estimate approximate trajectory of riparian growth/composition. It is anticipated that this data set would be repeated in April 2015 at which time a direct comparison on riparian area and stand growth will be determined.

The following sections are developed to reported data collected from the programmatic partners in a manner which describes the approach or protocol used followed by the results. In some cases results are followed by a brief discussed.

Approach - Stream Flow and Temperature Monitoring: The Snake River Salmon Recovery Board compiled stream flow and temperature data from a number of agencies including Washington Department of Ecology, US Geological Survey, Washington Department of Fish and Wildlife and Ecological Inc. In 2011, stream flow was monitored continuously at two stream gages (DOE Marengo

gage, USGS Starbuck gage) on the Tucannon (Figure 8). Water temperature was monitored at one long term gage (DOE Marengo gage) and several temporary water temperature loggers maintained throughout the drainage by WDFW and Ecological (Figure 8).

Due to its relative position in the watershed and the number of years of operation (Table 5), the Marengo gage has been adopted as the gage of record for flow and temperature for the purpose of monitoring conditions on the Chinook spawning and rearing habitat. This decision was made by the RTT and was based on the location being located below most of the habitat used for Chinook rearing. The logic being the site would be measuring the poorest conditions present on the spawning and rearing areas providing a conservative estimate of conditions. Beginning in 2011, stream temperature was also measured by the CHaMP program at Territorial Bridge approximately 9 miles downstream from the Marengo gage and positioned at the known absolute bottom of Chinook summer rearing (Figure 8). In the future Territorial Bridge temperatures will be compared to the Marengo dataset to determine temperature gain over the lower 9 RM and determine if the Marengo gage can be extrapolated to the entire Chinook rearing reach (Figure 3).

The gage located at Starbuck has a long period of record for flow beginning in 1985 to present, with a data gap from 1990 through 1993. Additionally, two historic periods of data are available beginning in October 1914 through September 1917 and October 1928 through September 1931 (this dataset is available at http://waterwatch.usgs.gov/new/index.php?r=wa&id=ww_current) and in the future be available from the SRSRB. The Starbuck gage will be used as the gage of record in relation to fish passage flows and long-term basin flow trends. Unfortunately the USGS gage is not accompanied by a temperature gage. The SRSRB is investigating using the WDFW temperature monitoring dataset collected in conjunction with WDFW fish trapping efforts downstream from the USGS gage, as the record of temperature for the lower river. Beginning in 2012, the SRSRB will install and maintain a temperature logger near the USGS flow gage for the duration of the Programmatic.

To answer questions regarding spawning ground stream temperatures the SRSRB has acquired ten temperature data loggers which will be placed instream at the historic WDFW temperature monitoring points so that comparison can be made to historical data where available. This monitoring will begin in the spring of 2012 and continue through the duration of the programmatic. The methods for data collection and analysis for partners and the SRSRB will be described in the 2012 monitoring plan.

Result – Stream Flow: Stream flow at the Marengo and Starbuck gage for the 2011 water year are displayed in Figure 9 & 10 for the time period October 1, 2010 through September 30th 2011. The instantaneous minimum flows recorded at the Marengo gage for the time period were observed during October and November at 57 and 41 cfs respectively. Flow during the critical seasonally hot months of July, August and September did not recede below 60 cfs at the Marengo gage. Flow at the Starbuck gage remained at or above the minimum flow objective set at 77 cfs with the exception of a single event in November when flows dipped to 58 cfs (Figure 9). The November low flow corresponds to the

Marengo low flow in November (Figure 9) and also to a rapid drop in water temperature (Figure 11) which may have been related to an early cold front and freezing in the head waters.

Daily mean stream flow recorded by the USGS at the Starbuck flow gage for the time period 1914-1917, 1928-1931, 1958-1989 and 1994-2011 have been obtained from the USGS and plotted for each time period in Appendix A. The flow time series illustrates the long variation in stream flow in the Tucannon. To view stream flow data over time and to make comparisons through time flow data has been bracketed into 3 year bins for 1995-1997, 2003-2005, 2006-2008 & 2009-2011 (Figure 12). The plot indicates high variability in peak flow, flow duration and flow volume. To better understand variability in flow the mean monthly snow water equivalent for the Blue Mountains was plotted (Figure 13). Though no conclusions are being drawn from the data at this time the SRSRB plans on reviewing this information in the future. The SRSRB will continue to update this data set on an annual basis and report it as an appendix of the annual report.

Result – Stream Temperature: Stream temperature was monitored in 2011 at the WDOE stream gage located at Marengo and original data can be obtained at <https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=35P050> . Stream temperature is presented as daily mean temperature (°C) (Figure 11). During the reporting period the instantaneous high temperatures did not exceed 20°C/68°F, which is 4°F below the restoration objective set in the recovery plan. Stream temperature data collected at the WDOE Marengo stream gage has been binned into three year brackets and plotted to illustrate variation in stream temperature for the time period beginning in 2003 through 2011. An additional time period was extracted from the WDFW Tucannon River Temperature Study (2003 WDFW). The results of these plots can be viewed in Figure 14. At the moment the SRSRB is not extracting inference from this plot but will continue to review the available data to identify trends in stream temperature over time.

Approach – Floodplain Confinement and Riparian Canopy Monitoring (LiDAR Dataset): In April 2010, the CCD acquired a LIDAR and orthographic image data set for the Tucannon River valley floor from its confluence with the Snake River upstream to RM 60 (Figure 15). The LIDAR dataset was used to determine area of connected and disconnected low-lying floodplain, potential side channels and riparian enhancement needs for the river from RM 20 to RM 50, data is provided in Anchor 2011b (Table 6).

The LIDAR data set was used to develop a riparian canopy DEM which was used to estimate riparian height and density illustrated in Appendix B (Anchor 2011a). Riparian maturity and growth can be determined from this base layer by replicating the LIDAR monitoring dataset effort in the future and directly comparing the difference in total height between the two DEMs. It is the recommendation of the draft monitoring plan to repeat the LIDAR surveys on a 5 yr interval to allow for measurable change to occur between data point being in 2015.

Results – Floodplain Confinement and Riparian Canopy Monitoring: River channel confinement in the Tucannon River was found to be approximately 80% (40 miles) of the total 50 miles surveyed as part of the Tucannon River Assessment and Restoration Planning report completed by the CCD (Anchor 2011a, 2011b). The Tucannon River has been impacted by confinement greater than was initially estimated from earlier available data. The restoration objectives outlined in the restoration plan (Table 1) recommend restoring channel confinement length to a maximum of 25%-50% confined. When the maximum confinement range is applied to the data provided in Anchor 2011b (Table 7) the restoration goal for confinement equals 23.1 miles of habitat restoration needed to reach 75% unconfined. The 23.1 miles restoration objective has been developed by applying a 25% maximum to river reach 10-6 (Panjab-King Grade) and the 50% maximum for river reach 5-1 (King Grade to Mouth). The length of confined habitat by river reach is identified in Anchor (2011a) can be viewed in Table 7. This approach was used so that the majority of confinement work would be applied to areas where impacts to fish would be greatest. Additionally, the majority of confinement projects would be completed on public lands minimizing impacts to private infrastructure and minimizing cost.

Riparian habitat and available low lying floodplain were calculated in Anchor 2011a to be 1.6 miles of side channels, 115 acres of low lying floodplain and plant 115 acres of riparian habitat (Table 6). These values are estimates of the habitat that could be immediately created through the implementation of the conceptual restoration projects listed in Anchor 2011b.

The LIDAR dataset was used to produce a riparian canopy layer for the entire floodplain, a visual example of the data layer is illustrated in Figure 16. The data set was collected during the leaf off time period in the Tucannon for the purpose of acquiring the best ground layer information possible. Riparian height and density was estimated in Anchor 2011a and are displayed in Appendix B of this report.

As part of the LIDAR acquisition orthographic aerial images were obtained that have extremely high resolution (Figure 17). The images have been crucial in the development of habitat restoration plans and determine existing condition. The SRSRB will use the images as a baseline for much of the work it plans to conduct over the next 7 years.

Approach – Habitat Complexity and Channel Complexity Monitoring: One of the largest data gaps present at the initiation of work on the Tucannon River is instream channel habitat complexity, including channel shape, off channel habitat, and LWD abundance. The assessment work completed under Anchor 2011a and Anchor 2011b have filled some of the gaps pertaining to available off channel habitat and LWD deficiency though the objective of the assessments was not to collect monitoring data but to describe existing conditions. The CHaMP effectiveness monitoring efforts began in the winter and spring of 2011 and through coordination with the SRSRB, CHaMP managers were able to consider planned Programmatic restoration actions in designating treatment sites and control monitoring sites (Figure 18). This effort will help the CHaMP project avoid losing control sites due to planned habitat

restoration and will help identify changes in habitat due to restoration. Annually, 25 control and treatment sites (Figure 19) will be monitored over the long term with 12 continuous sites and 13 rotating sites. CHaMP protocol uses high resolution topographic survey data to develop a DEM for the monitoring reach. The DEM is then used as a measure of channel shape and complexity in which a direct comparison of channel shape can be made over time. Monitoring also measures LWD, substrate type and size, fish cover, bank conditions and riparian cover and condition.

Through the work completed in the Tucannon River Assessment (Anchor 2011a), restoration planning and conceptual design (Anchor 2011b), the upper 30 miles of river habitat was measured for LWD presence or absence. The river reaches not meeting the LWD objective for restoration of 1 key piece per channel width were noted and in total 21 miles of the 30 miles surveyed did not meet the objective (Table 6). It is estimated to achieve the restoration objective set for the Tucannon a minimum of 2,200 LWD key pieces will need to be placed throughout the upper 30 miles of river. CHaMP monitoring would be the mechanism of determining if the placement of wood is creating the stream channel complexity needed to provide adequate winter rearing habitat for spring Chinook.

Community Involvement and Education'

Work Element 99: Outreach and Education

Deliverable: Conduct one project tour, present program accomplishments to regional agency personnel and LE Board. Develop outreach materials.

The SRSRB conducted outreach activities in 2011 by attending public habitat restoration conferences, coordinating and hosting public tours, posting its completed and planned projects on the Washington State Habitat Work Schedule (<http://hws.ekosystem.us/>) and initiated the development of a salmon restoration video clip. Additionally, SRSRB staff attends local public meetings where they lead discussions on the restoration and protection of salmon habitat in the Tucannon. The SRSRB operates highly visible office in downtown Dayton which is highly accessible to the public, providing opportunity for individuals to meet with the SRSRB Director and staff.

On April 26th & 27th the SRSRB Executive Director presented LWD restoration in the Tucannon River at the 2011 Lead Entity Conference. The conference, Building Better Habitat Projects, was attended by more than 300 people.

The 2011 Tucannon River public tour was held on May 5th and was attended by 30 individuals and included site visits of restoration and monitoring activities throughout the basin. The tour agenda and the full tour guide book can be viewed on the SRSRB website (<http://www.snakeriverboard.org/leadentity/documents/SRFB%2012th%20Grant%20Rnd%20Project%20Tour%20Booklet.pdf>).

The SRSRB in 2011 had intended to coordinate with WDFW to hire field technician to observe angling in the Tucannon River during the months of June, July and August to interviewing and inform anglers and campers on fishing and recreation in the spring Chinook spawning reach. This task was thought to be needed in 2010 when low angler compliance with fishing regulation was observed during a WDFW enforcement detail. The technician was not utilized in 2011 due to an early report from WDFW enforcement which indicated significant improvement in compliance. It had become apparent that outreach had circulated and individuals had become aware of spring Chinook protection. The SRSRB will continue to work with WDFW enforcement to continue the special focus details in the Tucannon to inform individuals and make a showing in the watershed. In future years if it becomes necessary to put someone on the ground to shepherd spring Chinook the SRSRB will do so at that time.

In 2011, the SRSRB has produced a newsletter highlighting the development of the Tucannon River Programmatic and the projects active and planed in the watershed. The intended audience for the newsletter was the landowners and recreationists of the Tucannon Basin. The letter will be circulated through the mail to landowners and be distributed from local businesses through the spring 2012. Program and project outreach is coordinated by the SRSRB for the purpose of informing both private and public landowners.

Data Management

Work Element 160: Create/Manage/ Maintain Database

Deliverable: Enter project and monitoring data into Pisces and the Habitat Work Schedule

The SRSRB manages and maintains the Habitat Work Schedule supported by RCO for tracking salmon restoration statewide and is designed to track projects from a concept to completion while recording restoration metrics. As part of the programmatic effort, the SRSRB has amended its project data base to include the projects identified through the Tucannon River Programmatic. The purpose of the database is to track habitat restoration projects from concept to completion. The database is set up to track and rollup project metrics from on the ground project level to the watershed level with the current metrics being displayed in Table 5. The SRSRB is currently tracking the metrics which directly or indirectly address the restoration objectives outlined in the recovery plan (Table 1). The metrics currently tracked include riparian restoration river length and area, confinement in river length, and LWD in river length which meets the minimum objective.

Conduct Environmental Compliance

Work Element 165: Produce Environmental Compliance Documents

Deliverable: Complete environmental compliance documentation

Environmental compliance was completed for the work element 29 and was not required for work element 156 or 157 during this grant cycle. Compliance related to work element 29 involved the

identification of material storage sites in the Tucannon River on the WDFW Wildlife Area. The SRSRB worked with WDFW staff to identify disturbed areas used as log landings during the School Fire salvage logging. These areas were identified and selected because WDFW had completed environmental compliance on the sites as part of the post fire logging efforts. The sites will be used to stage logs in the basin for restoration efforts to begin in 2012. With the completion of restoration efforts in the basin areas will be re-vegetated with native grasses.

Transport and Store LWD for Future Project Needs

Work Element 29: Increase Instream Habitat Complexity and Stabilization

Deliverable: LWD protocol and tracking spreadsheet.

Increasingly, large woody debris has been identified as one of the primary objectives for habitat restoration in the Tucannon River. The restoration of the Tucannon River will require the placement of 100s of large trees per year to meet the one key piece per channel width called for in recovery planning. Often the supply and cost of large trees is in flux depending on timing. The SRSRB has had opportunities in the past to acquire large sums of trees with root wads attached at the cost of transport and storage, but did not have a funding mechanism in place to pay for such activities. Through this work element funds were made available for the SRSRB to take advantage of opportunities as they occur through a revolving account for acquisition and transport of wood.

During the 2011 calendar year the SRSRB worked to identify several landing sites in the Tucannon River watershed where wood could be transported and stored for placement in projects. Two sites were identified which had gone through environmental and historical clearance as part of the Washington Department of Fish and Wildlife logging operations completed after the forest fires on state and federal lands. In 2011, a cost effective supply of LWD was not identified though much effort to secure a wood supply mechanism was applied. The effort will continue in 2012 until a mechanism is identified.

Citations

2011a Anchor QEA, LLC. Tucannon River Geomorphic Assessment and Habitat Restoration Study. Prepared for Columbia Conservation District, Dayton WA. By Anchor QEA Bellingham WA.

2011b Anchor QEA, LLC. Conceptual Restoration Plan, Reach 6 To 10 Tucannon River Phase II. Prepared for Columbia Conservation District, Dayton WA. By Anchor QEA Bellingham WA.

2010 Watershed Sciences. LiDAR Remote Sensing Data Collection: Tucannon River, Tucannon Headwaters, and Cummins Creek, WA. 517 SW 2nd St Suite 400 Corvallis, OR

2008 Grout, Del. Dowdy, B. Cobble Embeddedness and Percent Fins Project Tucannon River and Tributaries. USFS Pomeroy Ranger District.

2012 Salmon Recovery Plan for South East Washington. Snake River Salmon Recovery Board Dayton Washington

2003 WDFW. Summary of Water Temperature Data for Tucannon River, Washington Department of Fish and Wildlife, January 2003, 248 pp.

Table 1: Habitat restoration objectives as they are list in the Salmon Recovery Plan for South Eastern Washington for the Tucannon River. The objectives are listed by level of priority as identified in the 2012 plan. Imminent threats are always considered the highest priority when identified in project rounds.

Upper Tucannon River MSA (from Pataha Creek upstream to Tucannon headwaters)	
Imminent Threats: Fish Screens, Low Stream Flows	
I.	Riparian: > 40 to 75% of maximum
II.	Large Woody Debris: >1 key piece per channel width
III.	Channel Confinement: < 25 to 50% of stream bank length
IV.	Temperature: < 4 days > 72°F
Lower Tucannon River mSA (from Pataha Creek downstream to Tucannon mouth)	
Imminent Threats: Fish Passage Barriers, Screens, Low Stream Flows	
I.	Temperature: < 4 days > 72°F
II.	Embeddedness: < 20%
III.	Large Woody Debris: > 1 key piece per channel width
IV.	Riparian: >40 to 75% of maximum
V	Channel Confinement: < 25 to 50% of stream bank length

Table 2: Habitat restoration project list for the 2010 Tucannon River Programmatic. Many of these projects were listed in the Programmatic application submitted in 2010. This list is excerpt from the 2010 SRSRB 3 Year Implementation Plan.

HWS Number	Project Name	Location	Priority	Status	Cost Range	Start Date	End Date
10-1633 09-1742 09-1596	Tucannon River Off-Set Dike Design and Implementation	Tucannon MSA	1	Funded	III	1/5/10	6/28/13
32-00548 10-1832	Tucannon LWD Stream Habitat Restoration	Tucannon MSA	1	Funded	II	8/25/10	1/21/13
32-00549 10-1831	Tucannon River Geo Assessment/Design HWY 12 to Cummins Cr	Tucannon MSA	1	Funded	II	1/3/11	12/19/12
35-00069	Beaver Watson In Stream Complexity & Connectivity Reach Restoration	Tucannon MSA	1	Conceptual	III	6/6/08	1/30/11
35-00070	Lower Wooten River Dike Removal and Riparian Restoration	Tucannon MSA	1	Conceptual	II	1/1/09	6/30/11
35-00110	Habitat Complexity Marengo to King Grade	Tucannon MSA	1	Conceptual	II	1/1/10	6/28/13
35-00111	Instream Habitat Complexity Cow Camp	Tucannon MSA	1	Conceptual	II	1/1/10	6/28/13
35-00156	Relocate the Tucannon River Road Behind USFS Guard Station	Tucannon MSA	1	Conceptual	II	1/1/10	1/1/18
35-00409	Tucannon River Power Line Right of Way	Tucannon MSA	1	Conceptual	III	2/27/09	12/30/11
35-00172	Tucannon River 10 Year CREP Extensions	Tucannon MSA	1	Conceptual	II	2/27/09	12/30/11
35-00189	Donahue Channel Complexity	Tucannon MSA	1	Conceptual	II	1/6/10	1/2/15
35-00191	Camp Wooten River Dike Removal	Tucannon MSA	1	Conceptual	II	1/6/10	1/2/15
35-00410	Tucannon Lakes Restoration	Tucannon MSA	1	Conceptual	III	2/26/09	12/30/11
35-00181	Lower Tucannon Channel Work (Starbuck to Powers Bridge)	Tucannon mSA	1	Conceptual	II	12/22/10	12/31/13
35-00185	BLC Channel Complexity	Tucannon MSA	1	Conceptual	II	1/6/10	1/2/15
35-00187	Donahue Floodplain Reconnection	Tucannon MSA	1	Conceptual	II	1/6/10	1/2/15
35-00182	Tucannon River Assessments and Designs	Tucannon MSA & mSA	1	Conceptual	II	1/7/11	1/2/14
35-00186	Non-CREP Easements in the Tucannon River	Tucannon MSA & mSA	1	Conceptual	II	1/6/10	1/2/15
35-00298	Tucannon River Noxious Weed Control (Indigo Bush)	Tucannon MSA & mSA	1	Conceptual	II	2/26/09	12/30/11
35-00188	Deer Lake Confinement Reduction	Tucannon MSA	1	Conceptual	III	1/6/10	1/2/15

Table 3 The Tucannon River habitat restoration project list modified to include the results of Anchor 2011b. The project number listed in the first column is a hot link to the full project description in the Habitat Work Schedule Database. The estimated budget I = < \$100k, II = \$100k to \$500k & III =>\$500k.

Number	Name	Priority		Status	Date		Sponsor	Estimated Budget
		SRSRB	Chinook		Start	End		
35-00549 10-1831	Tucannon River Geo Assessment/Design HWY 12 to Cummins Cr	1	1	Active	12/10/10	1/10/13	Walla Walla Community College	251,225
35-00467	Tucannon River, RM 11, Design Construct	1	1	Conceptual	2/1/12	2/29/16		II
35-00466	Reach 2 Project 1 through 6 (Tucannon Ranch Final Design Restoration)	1	1	Conceptual	1/1/12	1/1/16	Columbia Conservation Dist	III
35-00462	Project # 28 King Grade Down to RM 20	1	1	Conceptual	12/18/11	12/31/18		II
35-00461	Project # 27 Upstream from King Grade Bridge	1	1	Conceptual	12/18/11	12/31/18		II
35-00460	Project # 25 Protection and Restoration	1	1	Conceptual	12/18/11	12/31/18		II
35-00459	Project # 20 Riparian Easement	1	1	Conceptual	12/18/11	12/31/18		II
35-00458	Project # 19 (WDFW Sediment Basin)	1	1	Conceptual	12/18/11	12/31/18		II
35-00457	Project #16 Last Resort Community	1	1	Conceptual	12/18/11	12/31/18		III
35-00456	Project # 9 Big Four Lake Modification and LWD	1	1	Conceptual	12/18/11	12/31/18		III
35-00455	Project #6 Camp Ground Removal	1	1	Conceptual	12/18/11	12/31/18		II
35-00454	Project #23 Floodplain Golf Course	1	1	Conceptual	12/18/11	12/31/18		II
35-00453	Project #22 Levee Setback and Complexity	1	1	Conceptual	12/18/11	12/31/18		II
35-00452	Project #21 Tucannon Restoration	1	1	Conceptual	12/18/11	12/31/18		II
35-00451	Tucannon Project #8 Curl Lake Levee Set Back	1	1	Conceptual	12/11/11	12/31/18		II
35-00450	Tucannon Project #3 Above Camp Wooten	1	1	Conceptual	12/11/11	12/28/18	Umatilla Confederated Tribe, US Forest Service, Nez Pierce Tribe	II
35-00449	Tucannon Project #1 Little Tuc to Panjab Bridge, RM 49-50, Design/Implementation	1	1	Conceptual	12/12/11	12/31/18	CTUIR, US Forest Service, Nez Pierce Tribe	II
35-00448	Project 17 LWD and Riparian Planting Below Last Resort	1	1	Conceptual	11/22/11	6/30/16		II
35-00447	Project 15 Russell Spring Cr Reach LWD Placement	1	1	Conceptual	11/22/11	12/31/15		400,000

Table 3 (continued from previous page)

Number	Name	Priority		Status	Date		Sponsor	Estimated Budget
		SRSRB	Chinook		Start	End		
35-00446	Project #12 Deer Lake Side Channel Large Wood Augmentation	1	1	Conceptual	11/21/11	1/1/14		60,000
35-00445	Project Area 13 Rainbow Lake Reach Levees and LWD	1	1	Conceptual	11/21/11	11/21/16		II
35-00444 10-1832	Tucannon LWD Restoration (Post Card to Dear Lake)	1	1	Active	8/25/10	1/21/13	Washington Department of Fish and Wildlife, Tri-State Steelheaders Inc, Umatilla Confederated Tribe	850,000
35-00443	Project #5 Camp Wooten Road Relocation Floodplain Expansion Project	1	1	Conceptual	8/15/11	9/30/16	Washington Department of Fish and Wildlife	II
35-00410	Tucannon River Impoundment Lakes Restoration	1	1	Conceptual	2/26/09	12/30/11	Washington Department of Fish and Wildlife	1,000,000
35-00409	Tucannon River Power Line Right of Way	1	1	Conceptual	2/27/09	12/30/11		III
35-00292	Prj 24 Increase Hab Complexity Through LWD/Floodplain Expansion	1	1	Conceptual	2/26/09	12/31/16	Columbia Conservation Dist	400,000
35-00220	Project #14 Hatchery Bridge to Cummins Cr Complexity	1	1	Conceptual	11/21/11	12/31/15	Washington Department of Fish and Wildlife	300,000
35-00191	Project #4 Camp Wooten River Dike Set Back	1	1	Conceptual	1/3/11	1/2/15	Washington Department of Fish and Wildlife	1,000,000
35-00181	Tucannon Ranch Channel Work (Starbuck to Powers Bridge)	1	2	Conceptual	1/3/11	1/6/16	Columbia Conservation Dist	800,000
35-00156	Project #8 USFS Road Relocate Out of Floodplain	1	1	Conceptual	1/1/10	1/1/18		500,000
35-00132	CREP Tucannon River Restoration and Protection Reach	1	1	Active	1/1/96	6/30/20	Columbia Conservation Dist	N/A
35-00115	Tucannon River Sediment Basin Modification	1		Conceptual	1/1/10	6/28/13		II
35-00111	Instream Habitat Complexity Cow Camp	1		Conceptual	1/1/10	6/28/13	Washington Department of Fish and Wildlife	200,000

Table 3 (continued from previous page)

Number	Name	Priority		Status	Date		Sponsor	Estimated Budget
		SRSRB	Chinook		Start	End		
35-00110	Habitat Complexity Marengo to King Grade	1	1	Conceptual	1/1/10	12/30/16	Columbia Conservation Dist	400,000
35-00071	Small Tucannon River Tributary LWD Placement	1	1	Conceptual	2/2/09	9/30/16	WDFW	200,000
35-00070	Project #18 Wooten (Hartsock) Floodplain & Complexity Restoration	1	1	Proposed	1/1/09	6/30/11	Washington Department of Fish and Wildlife	80,000
10-1633 09-1742 09-1596	Tucannon River Off-Set Dike Design and Implementation	1	1	Active	1/5/10	6/28/13	Columbia Conservation Dist	694,260
35-00298	Tucannon River Noxious Weed Control (Indigo Bush)	1	2	Conceptual	2/26/09	12/30/16	Columbia Conservation Dist, Columbia County Weed Board	250,000
35-00197 08-2030	Columbia County false indigo bush removal	1	2	Active	12/11/08	5/15/13	Columbia County Weed Board	112,000
35-00186	Non-CREP Easements in the Tucannon River	1	1	Conceptual	1/6/11	1/2/15		600,000
35-00163	Upland BMP Implementation Tucannon	1	1	Active	11/10/97	1/1/03	Columbia Conservation Dist	I
35-00153	Tucannon River Irrigation Efficiency Projects	1	1	Active	1/1/96	6/28/24	Columbia Conservation Dist, Pomeroy Conservation Dist	1,418,108

Table 4. The Tucannon River habitat restoration objectives for salmon and steelhead as identified in the 2012 Salmon Recovery Plan for Southeastern Washington. Each restoration objective has several habitat metrics being used to measure progress towards meeting the restoration objective. The table lists the total available/current know habitat, the restoration goal of the objective and the current status toward meeting the goal.

Restoration Objective	Metric Description	Metric	Units
Riparian Restoration Objective – Restore to >40 to 75% of maximum	Reach Length	51	miles
	Length Public Lands (24%)	12.34	miles
	Restoration Goal Length	29-54	miles
	Current Status	33.85	miles
	Total Reach Area at 180 ft Buffer	2618	acres
	Area Planted Goal	1963.5	acres
	Restoration Status	1008.6	acres
Remove All Imminent Threats (Migration Barriers, Unscreened Diversions)	Screen Estimated Total	60	count
	Screen Status	54	count
	Barrier Estimated Total	5	count
	Barrier Status	5	count
Large Woody Debris Restore to > 1 Key Piece per Channel Width	Reach Length (reach 6-10)	30	miles
	LWD Restoration Goal	21	miles
	LWD Goal # of Key Pieces (50 ft average bank width)	2218	count
	LWD Status # of Key Pieces	220	count
Channel Confinement: Restore to < 25 to 50% of Bank Length	Reach 6-10 Total Length	30	miles
	Reach 6-10 Goal Length	18	miles
	Reach 2-5 Total Length	20	miles
	Reach 2-5 Goal Length	5	miles

Table 5. Tucannon River monitoring parameters and available data produced as part of the Tucannon River Monitoring Plan Outline. The table lists the available data in the Tucannon River indicating the time period and where the data is being housed.

Component	Parameters	Data Source	Time Period	Data Location	Interval	Comments
Hydrology	Flow	1. DOE gage at Marengo, 2. USGS gage at Starbuck	1. 6/1/2003 –present 2. 1997-present	1. SRSRB or WDOE 2. SRSRB or USGS	Annual	1. The Marengo gage will be the flow point for the MSA and monitoring spawning and rearing flows. 2. The USGS gage will be the flow point for the mSA and passage.
	Hydrograph	Anchor 2011a	Developed in 2011	SRSRB and CCD	Once	The model was developed as part of the Geo Assessment report completed for the CCD
	Bed load	Anchor 2011a	2010 Baseline	CCD/SRSRB	Once	
Water Quality	Temperature	WDOE Marengo gage WDFW/USFS temperature logger	2003 to present	SRSRB/ WDOE	Annual	The Marengo gage will be used as a surrogate for the MSA. Additional data points will be used or developed to considered based on need
	Turbidity/fines	USFS/CCD turbidity ISCOS			Annual	
	Embeddedness	CCD Field Assessment reports			Periodic	
Riparian	Riparian Cover	Remote sensing images Orthos and 2010 LIDAR	1994, 1996, 2003, 2005, 2006, 2009, 2010, 2011	USGS, USDA, SRSRB	2yr	94 data is USGS and covers Bridge below Last Chance Resort to below Little Tucannon. 2010 data is SRSRB data. The rest is USDA
	Maturity/Com position	LIDAR canopy height and field surveys	April 2010 Baseline	SRSRB or CCD	5yr	LIDAR was acquired in April 2010 and analysis will be finalized in 2012
Channel Habitat Complexity	Channel Type	Anchor 2011a	2010	CCD	5yr	The channel type is descried in report
	Pools/Channel Shape	1. CHaMP 2. Historic USFS Surveys 3. Pre/post restoration monitoring	1. 2011 Baseline 2. 1999-etc 3. 2012 Baseline	1. CHaMP 2. USFS 3. SRSRB	Annual & Periodic	1. CHaMP is conducting a main stem w/25 sites visited each year 2. 3. The pre/post monitoring sites would be at restoration sites (use CHaMP protocol)
	Key LWD Pieces	1. CHaMP 2. Anchor 2011b	1. 2011 Baseline 2. 2011 Baseline	1. CHaMP 2. SRSRB	1. Annual 2. Once	1. CHaMP will measure change in LWD 2. Anchor Report provided and estimate of river length meeting the # of LWD/Channel width.
	Off Channel Habitat	1. CHaMP 2. Anchor 2011b	CHaMP 2011 Baseline Anchor 2010 only	1. CHaMP 2. SRSRB	Annual & 5yr	Channel length calculations will be extracted from the 5 yr LIDAR flights
Channel Confinement	Floodplain	Anchor 2011b	2010 baseline??? unless there is more	SRSRB	5 yr	Floodplain can be updated by 5yr LIDAR data
	Channel Length	Anchor 201a)	1954, 1974, 1996, 2010 Aerial Images & 2010 LIDAR	SRSRB	5 yr	The Time series will be extended by additional yrs and would be updated by the 5 yr LIDAR

Table 6. This table is reproduced from Anchor 2011b and lists the approximate habitat quantities for restoration projects produced during the conceptual restoration plan. The table list the restoration actions for reaches 6-10 of the restoration .

Reach	Project Area	RM		Project Actions (in ft)								Reconnected Low Floodplain (in acres)	Riparian Enhancement (in acres)	Protection Area (RM)
				LWD Addition	Levees/Riprap		Side Channels			Roads				
		From	To		Removal	Set Back	Enhance	New	Reconnect	Remove	Realign			
10	1	50.0	48.9	6714	-	-	-	-	-	-	-	-	-	-
	2	49.1	48.7	1097	-	-	1412	203	-	-	-	-	-	-
	3	48.7	46.8	6908	377	-	-	-	-	-	-	0.59	-	-
	4	46.8	46.4	2386	1191	1028.47 ^a	1969	256	822	-	-	1.63	-	-
	5	46.4	46.0	2460	988	95	-	-	-	2327	-	10.73	-	-
	6	46.0	45.3	1134	145	-	-	-	-	-	-	-	-	45.3-45.7
	7	45.3	44.9	2443	337	-	-	-	-	2706	2468	-	-	-
	8	44.9	44.4	1504	684	329	445	-	546	-	-	1.01	-	-
	9	44.4	44.0	2970	2563	-	-	-	-	-	-	-	-	-
9	10	44.0	42.4	8174	1305	-	-	-	-	-	5.83	39.37	-	
	11	42.3	40.7	9716	1108	-	-	-	-	1540	652	1.43	39.79	-
	12	40.7	40.0	1965	-	-	-	-	-	-	-	-	17.81	40.0-40.7
8	13	40.0	39.2	3556	3192	759	-	-	-	-	-	3.91	-	-
	14	39.2	37.2	10309	162	-	-	-	-	-	-	17.77	-	-
	15	37.2	36.4	4027	865	-	-	-	-	-	-	-	-	-
	16	36.4	34.9	1708	524	-	-	1118	-	-	-	4.59	-	-
	17	34.9	34.3	2936	706	-	1614	-	-	664	724	2.25	17.26	-
	18	34.3	32.1	3558	-	-	-	-	-	-	-	-	-	33.65-34.3, 32.1-33.1
7	19	32.1	31.8	1432	639	-	-	-	-	-	-	-	-	-
	20	31.8	31.5	-	-	-	-	-	-	-	-	-	-	31.5-31.8
	21	31.5	30.3	5977	1743	2551	-	-	-	-	-	0.59	-	-
	22	30.3	29.3	5338	2945	193	-	-	-	-	-	2.45	-	-
	23	29.3	28.3	5059	2159	889	-	-	-	-	-	9.48	-	-
	24	28.3	27.5	3972	2532	2924	-	-	-	-	-	1.32	-	-
6	25	27.5	26.9	1177	-	-	-	-	-	-	-	-	-	27.15-27.5
	26	26.9	23.7	9578	8305	12218	-	-	-	-	-	29.26	-	-
	27	23.7	22.9	1257	266	2820	-	-	-	-	-	-	-	-
	28	22.9	20.0	1037	657	-	-	-	-	-	-	22.12	-	20.5-21.7, 22.1-22.8

Table 7. The following table lists the data on channel confinement produce from the LIDAR information and is reproduced from Anchor 2011a. The table lists the proportion of river channel confinement by river reach.

Reach	River Mile		Length (mi)	Degree of Confinement, Length (miles)			Degree of Confinement, (%)		
	Begin	End		Confined	Moderate	Unconfined	Confined	Moderate	Unconfined
10	50.2	44.0	6.2	1.5	4.7	0	24.2%	75.8%	0.0%
9	44.0	40.0	4.0	0	2	2	0.0%	50.0%	50.0%
8	40.0	32.1	7.9	0.9	6.4	0.6	11.4%	81.0%	7.6%
7	32.1	27.5	4.6	2.4	2.2	0	52.2%	47.8%	0.0%
6	27.5	20.0	7.5	0.4	5.1	2.1	5.3%	67.1%	27.6%
5	20.0	13.2	6.8	3.7	1.8	1.3	54.4%	26.5%	19.1%
4	13.2	8.9	4.3	0.6	1.9	1.8	14.0%	44.2%	41.9%
3	8.9	4.5	4.4	4.3	0	0.1	97.7%	0.0%	2.3%
2	4.5	0.7	3.8	0.5	1.6	1.7	13.2%	42.1%	44.7%
1	0.7	0.0	0.7	0.7	0	0	100.0%	0.0%	0.0%
			Sums	<i>15</i>	<i>25.7</i>	<i>9.6</i>	<i>29.8%</i>	<i>51.1%</i>	<i>19.1%</i>

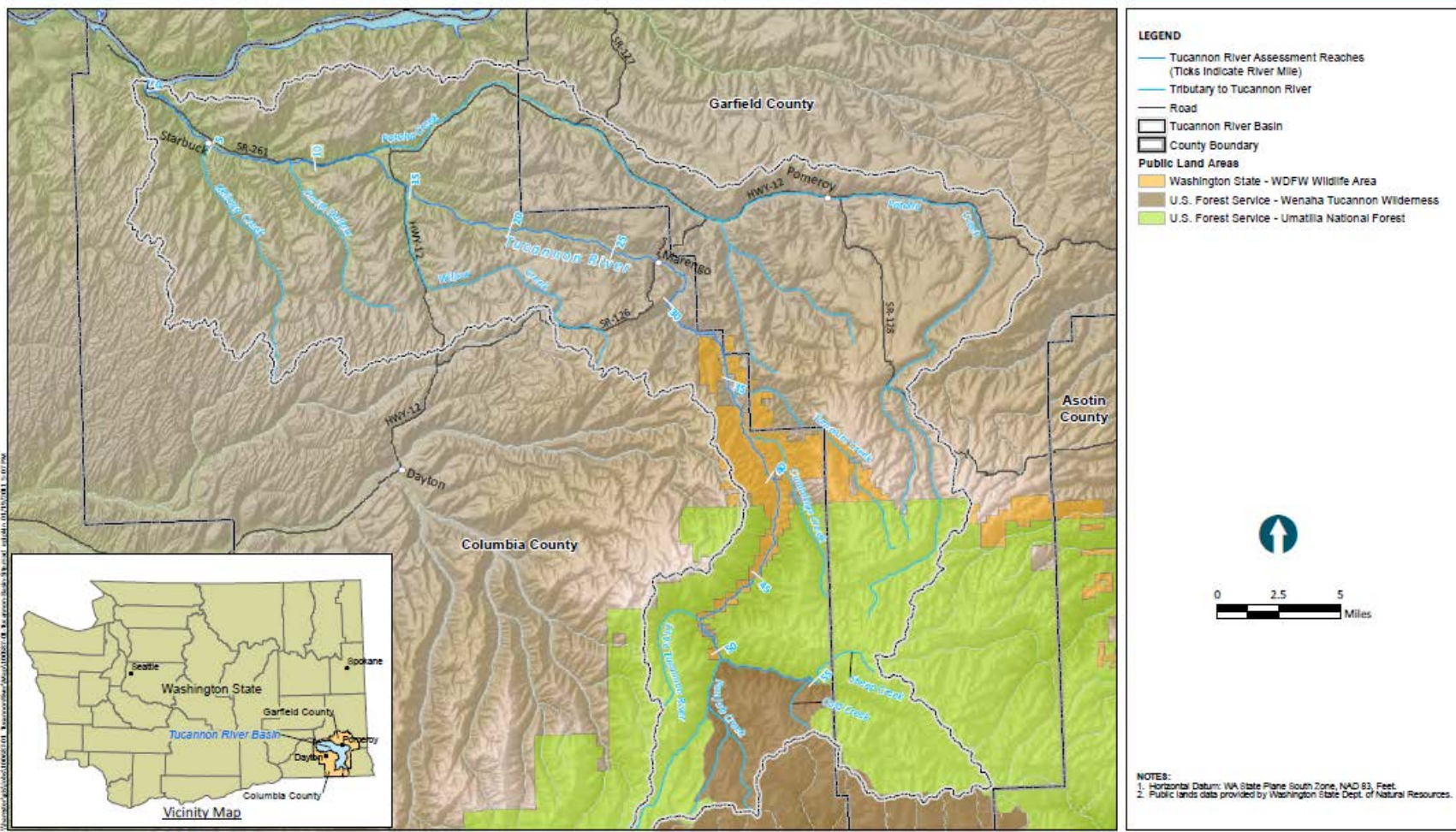


Figure 1. Tucannon River Watershed vicinity map (Anchor 2011a). The gold shaded areas indicate the Wooten Wildlife Area, the green areas the Umatilla National Forest and the darker brown headwaters of the Tucannon indicate the wilderness area.

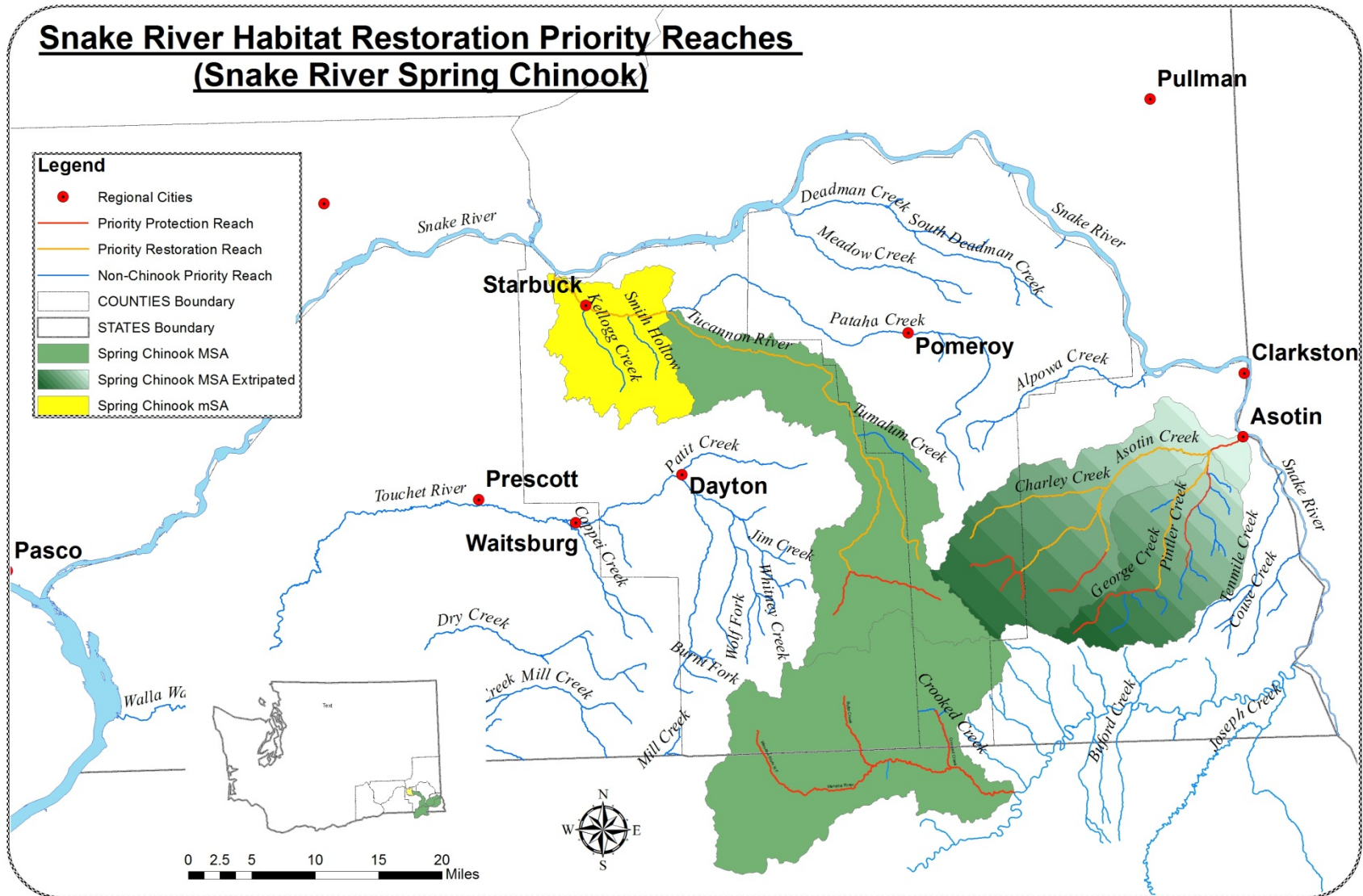


Figure 2. Snake River Salmon Recovery Plan priority areas for Snake River ESU spring Chinook. The map highlights the Tucannon, Asotin and Wenaha River basins. The green shaded areas are the major spawning areas (MSA) and the yellow area is a minor spawning area (mSA). The stream reach highlighted orange indicate the river reach where the SRSRB RTT supports stream channel restoration activities and the red reach protection type projects. The Asotin population is currently believed to have been extirpated.

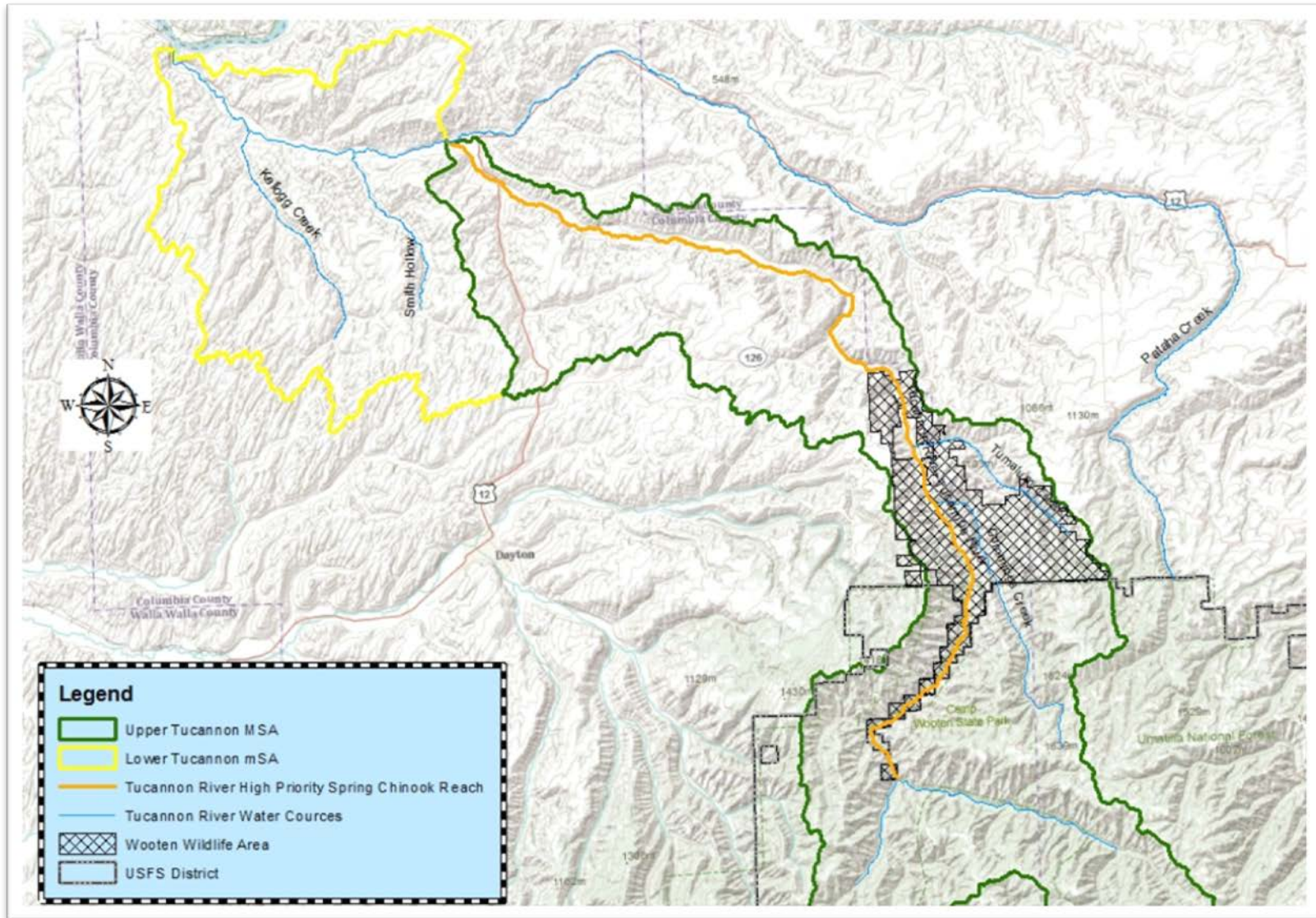


Figure 3. The Tucannon River spring Chinook priority restoration area is highlighted in orange. The Tucannon major spawning area is represented by the green polygon and the minor spawning area by the yellow polygon. See legend for additional map detail.

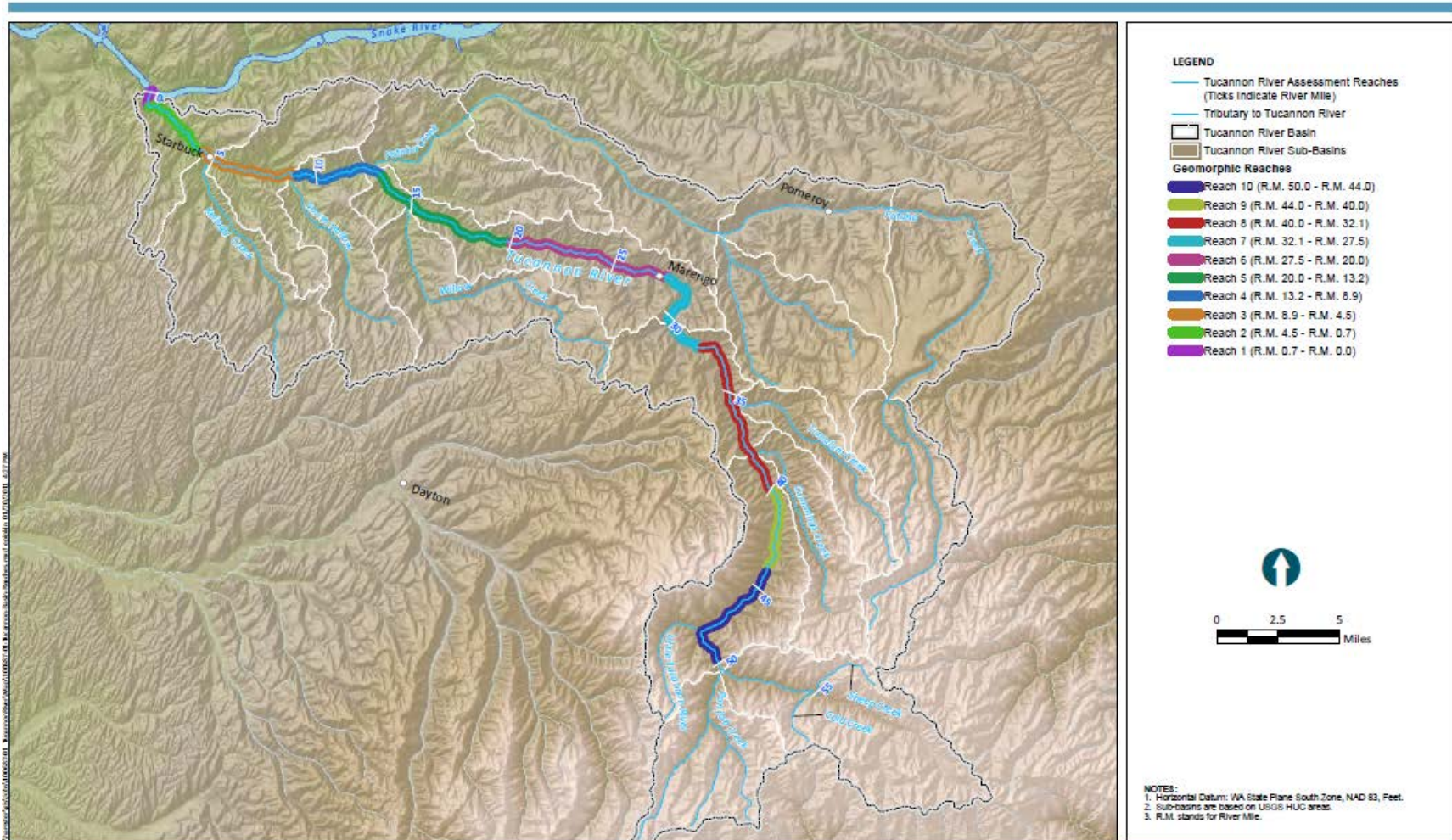


Figure 4: The habitat restoration reach delineation produced by Anchor 2010a for the purpose of guiding restoration actions in the Tucannon River. The greatest Chinook presence overlaps project reaches 10 through 6. Reach 5 will have a general assessment and conceptual design completed on it as part of the Walla Walla Community College project to conduct designs on projects identified in the Assessment and design reports completed by Anchor 2010a and 2010b.

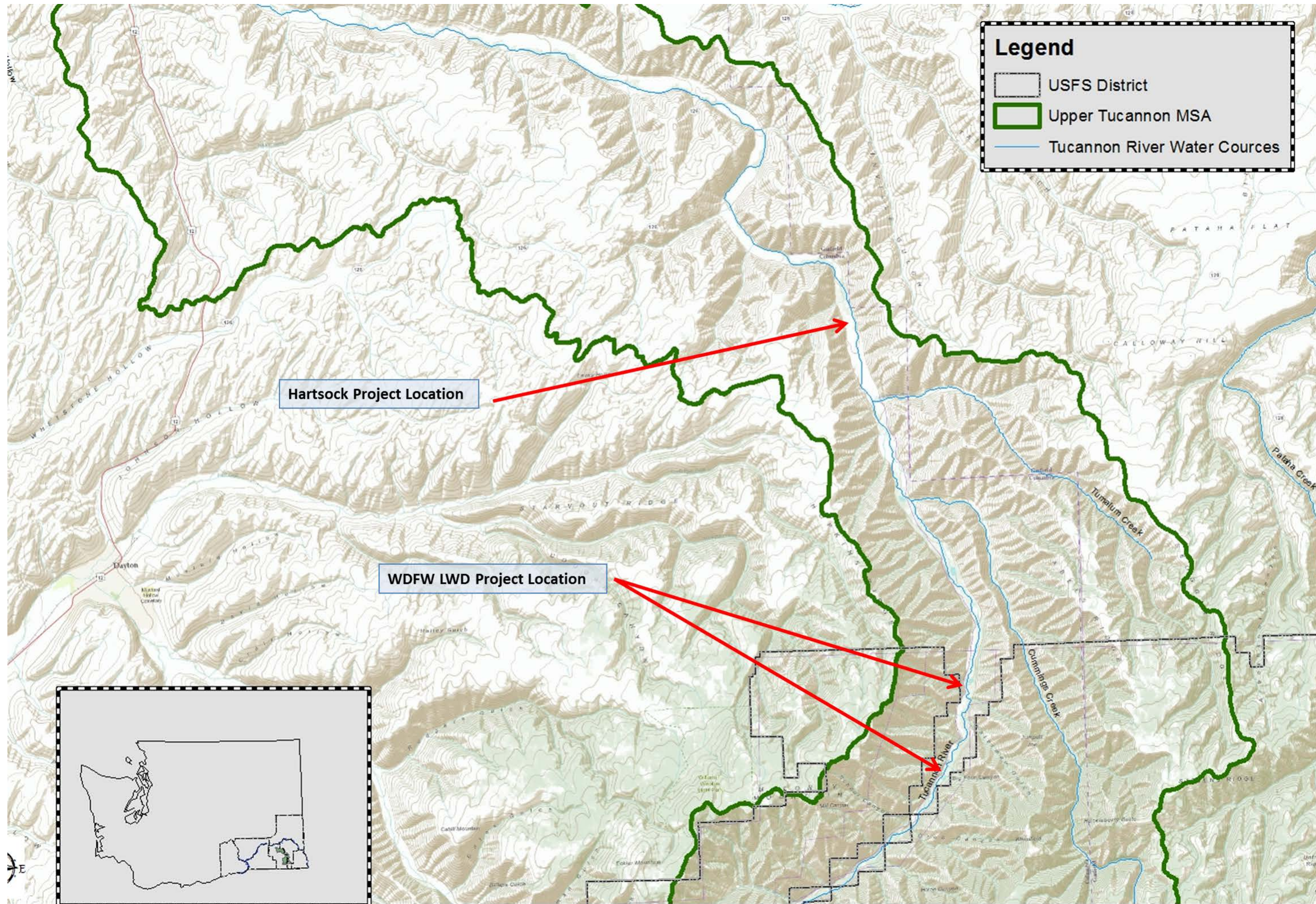


Figure 5: The restoration reach for project 2010-077-00 EXP WDFW LWD funded through BPA under the Tucannon River Programmatic in 2011. The LWD project is indicated by the double red arrows illustrating the project reach. The single red arrow indicates the location of the Hartsock infrastructure project.

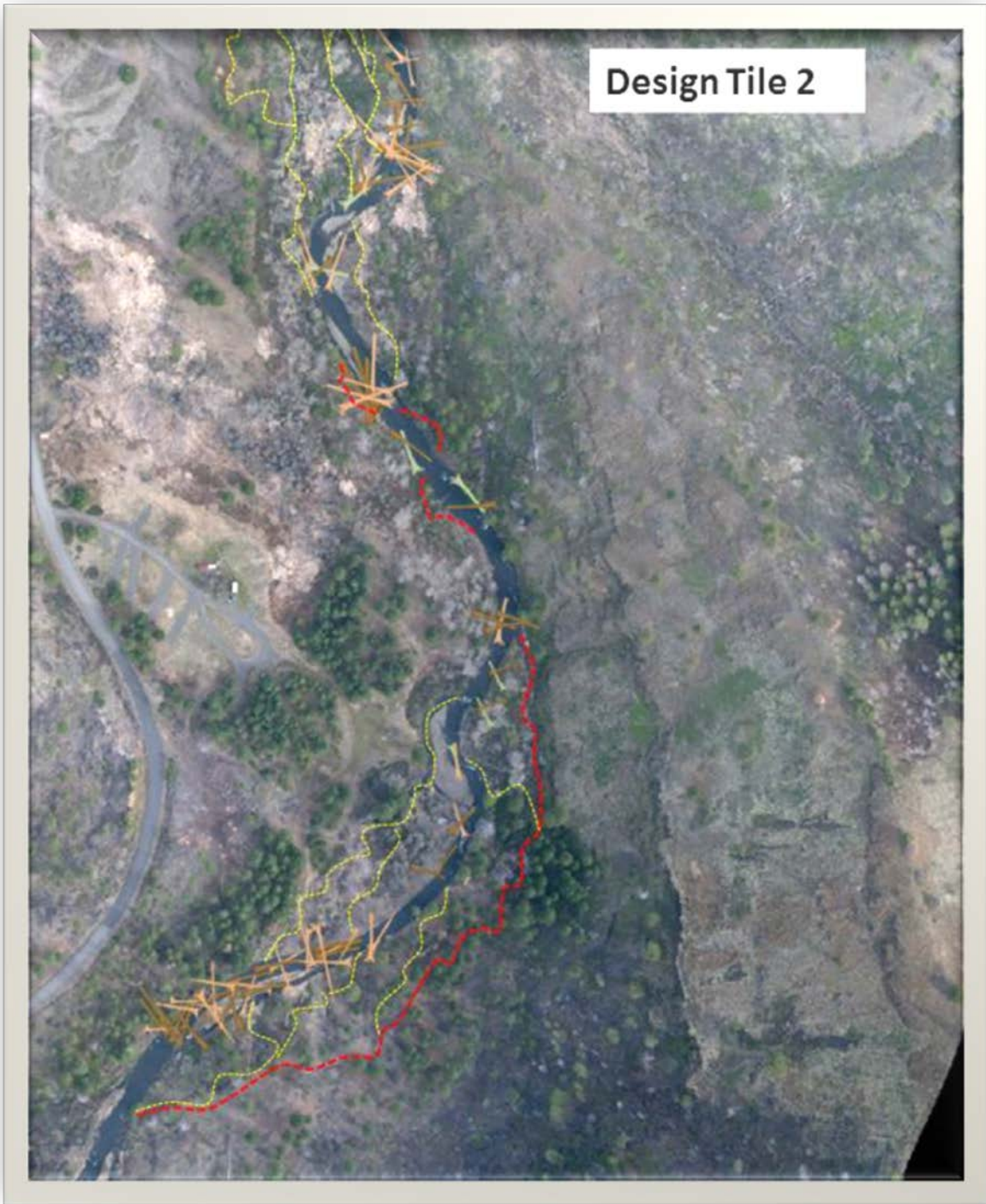


Figure 6. The illustration represents an example of the conceptual restoration design for the Tucannon River LWD projects sponsored by WDFW between Big Four Lake and Beaver Watson Lakes. The brown and tan symbols represent LWD structure and the red and yellow lines indicate anticipated side channel development.

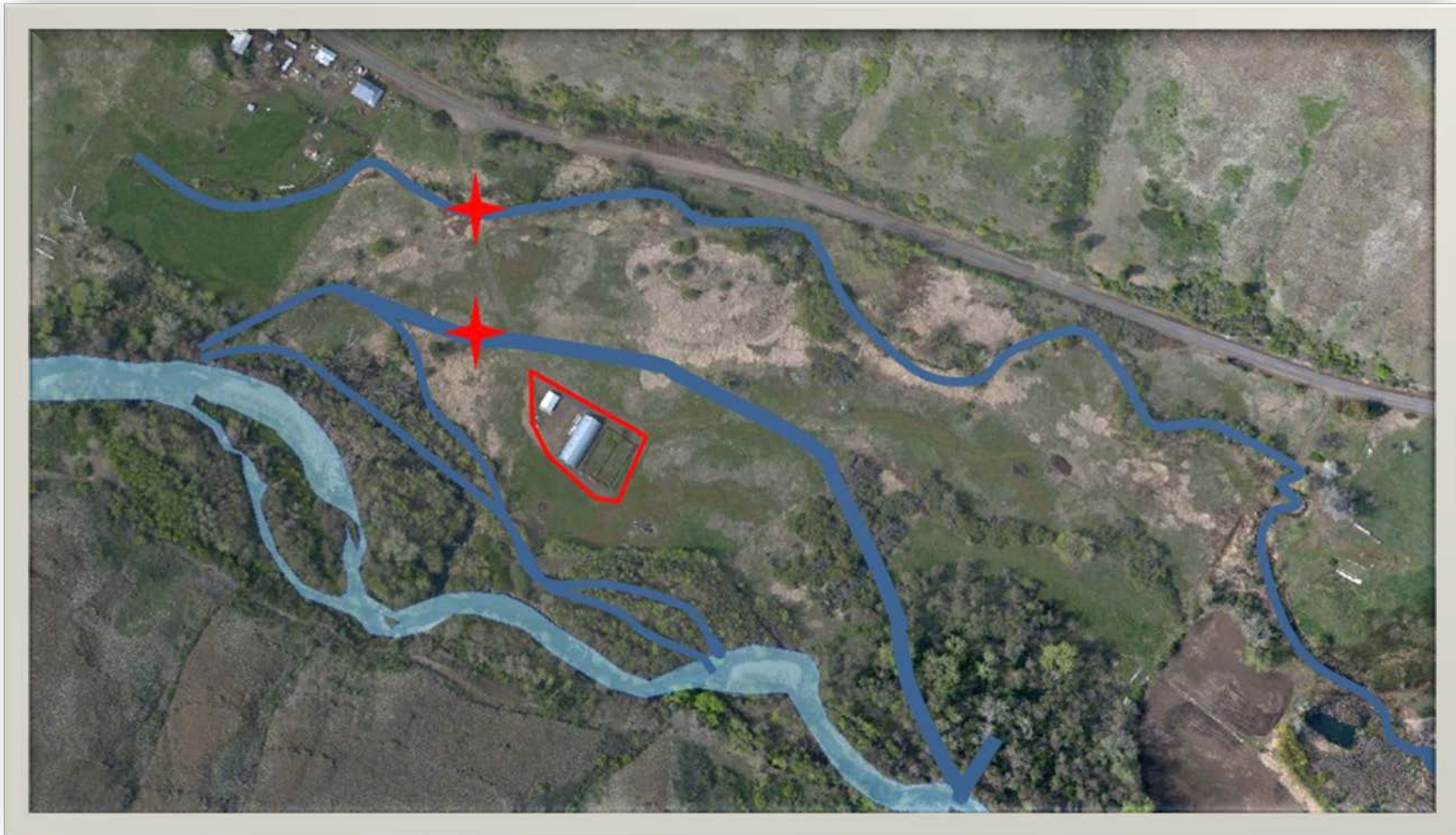


Figure 7: The illustration represents the Hartsock floodplain restoration site on WDFW property. The red stars represent culverts being proposed for removal and the red polygon envelops the infrastructure being removed from the floodplain. The light blue shaded area indicates the 2010 high flow area. The dark blue lines represent the high flow side channels which have developed since 2009.

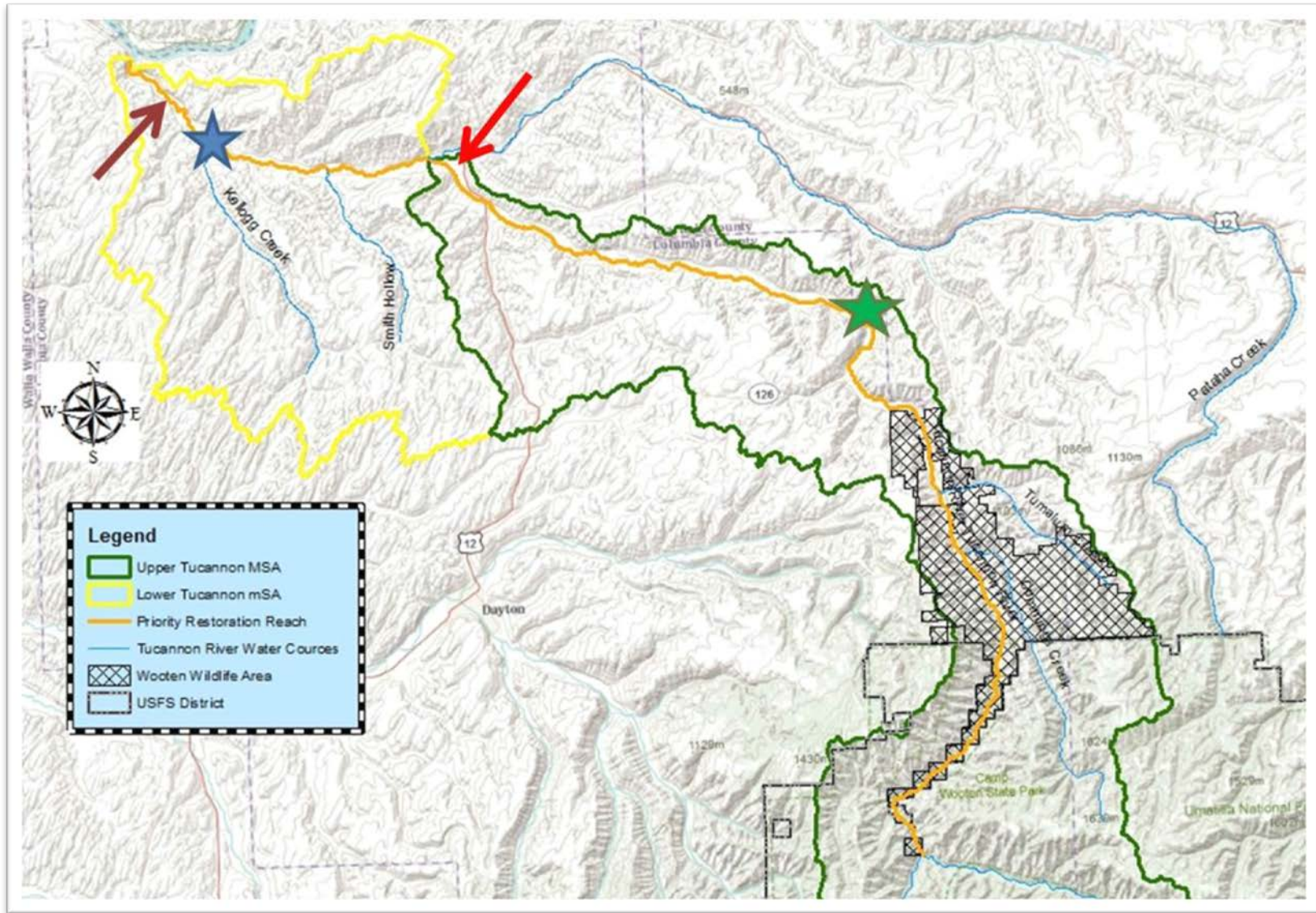


Figure 8: Stream flow and temperature monitoring stations located in the Tucannon River mainstem. The brown arrow in the upper left corner indicates the position of the WDFW temperature monitor logger. The red arrow to the right indicates the CHaMP temperature monitoring station at Territorial Rd. The blue star in the upper left corner indicates the position of the USGS flow gage near Starbuck. The green star right of center indicates the position of the DOE flow and temperature gage at Marengo.

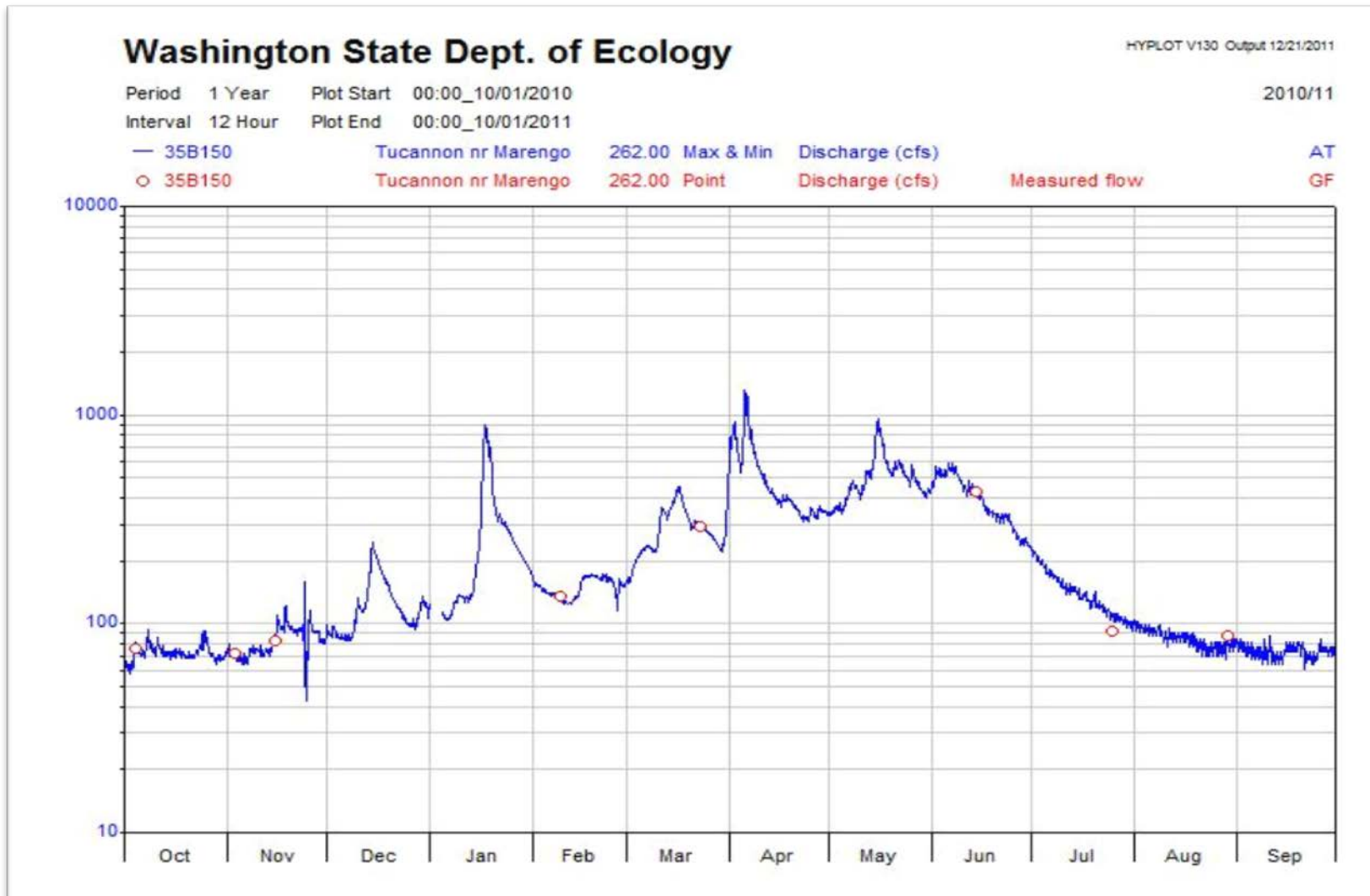


Figure 9: Stream flow observed at the Washington Department of Ecology Stream Flow Gage (Marengo Gage) during the 2011 water year which began on October 1 2010 through September 30th 2011. Flows are shown as daily means over the time period. The instantaneous minimum flow was recorded on November at 41 cfs and the second lowest instantaneous record was in October at 57 cfs. The highest instantaneous record was in April at approximately 1,300 cfs.



USGS 13344500 TUCANNON RIVER NEAR STARBUCK, WA

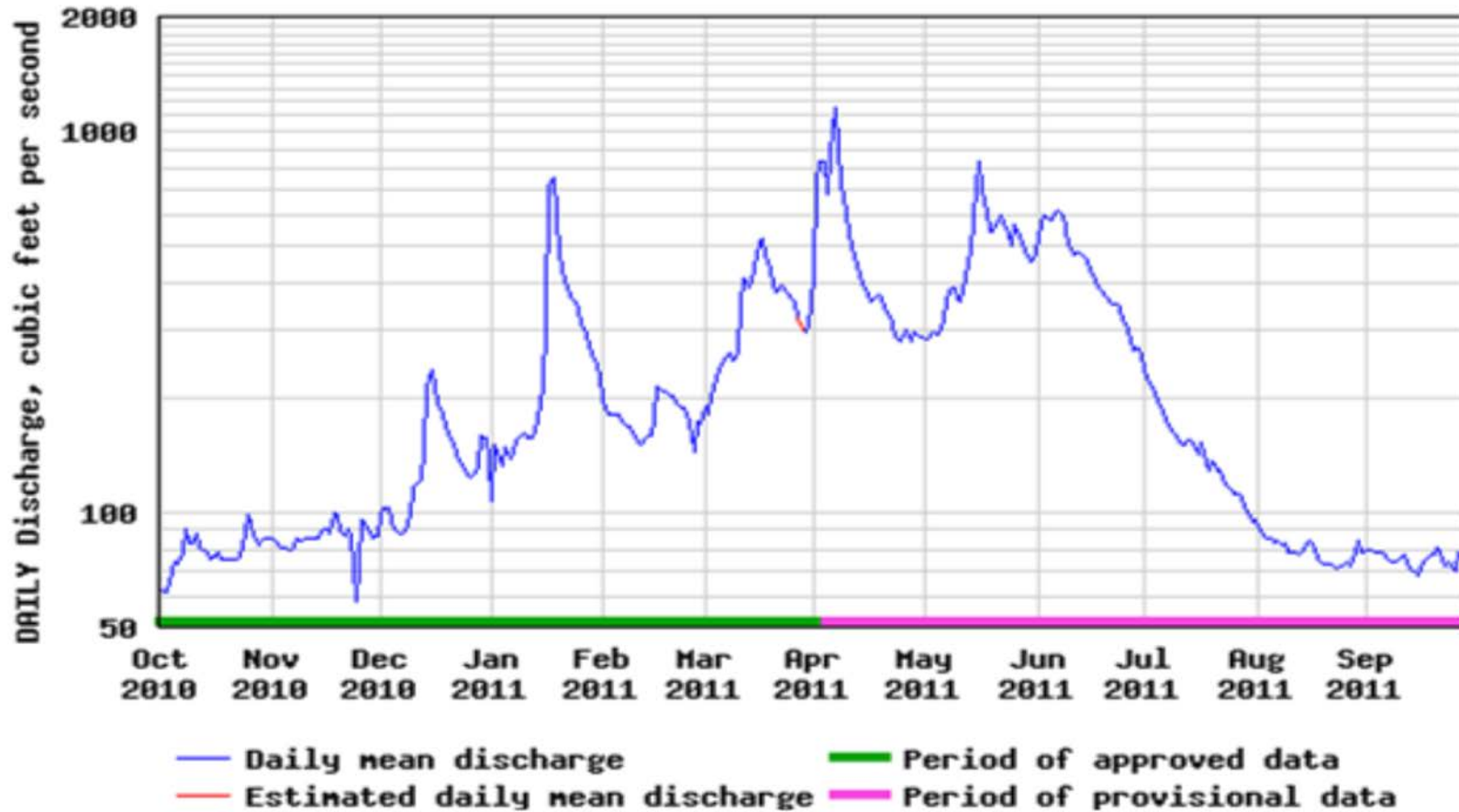


Figure 10: Tucannon River stream flows measured at the USGS Starbuck gage near the town of Starbuck for the time period of Oct 1 2010 through Sept 30, 2011. The data is displayed in daily means. For period the lowest daily mean was reported at 58 cfs on Nov 24 which corresponds to a fast drop in temperature illustrated in figure 7.

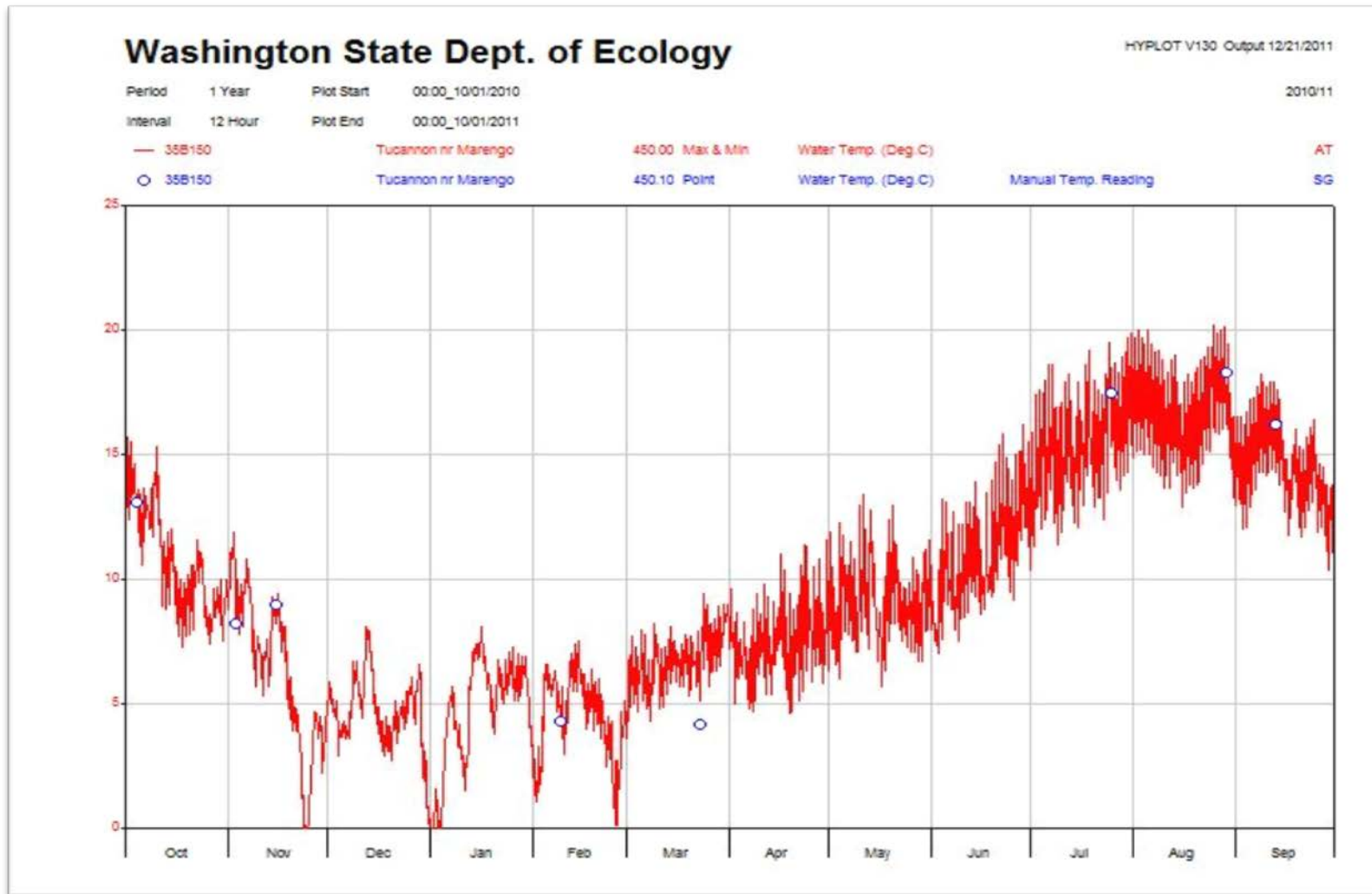


Figure 11: Water temperature measured at the DOE stream gage at Marengo in the middle Tucannon River reported as daily means. Temperature is displayed in °C. The Restoration objective for temperature in the Tucannon River is listed at 72 °F which equals 22.2 °C. The period of record is reported for the 2011 water year which began in October 1, 2010 and ran through September 30, 2011. Instantaneous maximum temperature was measured in August at 20.2°C followed by July of 19.9°C and September with 18.2°C. The maximum daily mean temperature for this time period was 18.00°C, 17.59°C and 16.27°C respectively. Water temperature for the river reach upstream from the Marengo temperature gage did not exceed the recovery objective set in the recovery plan

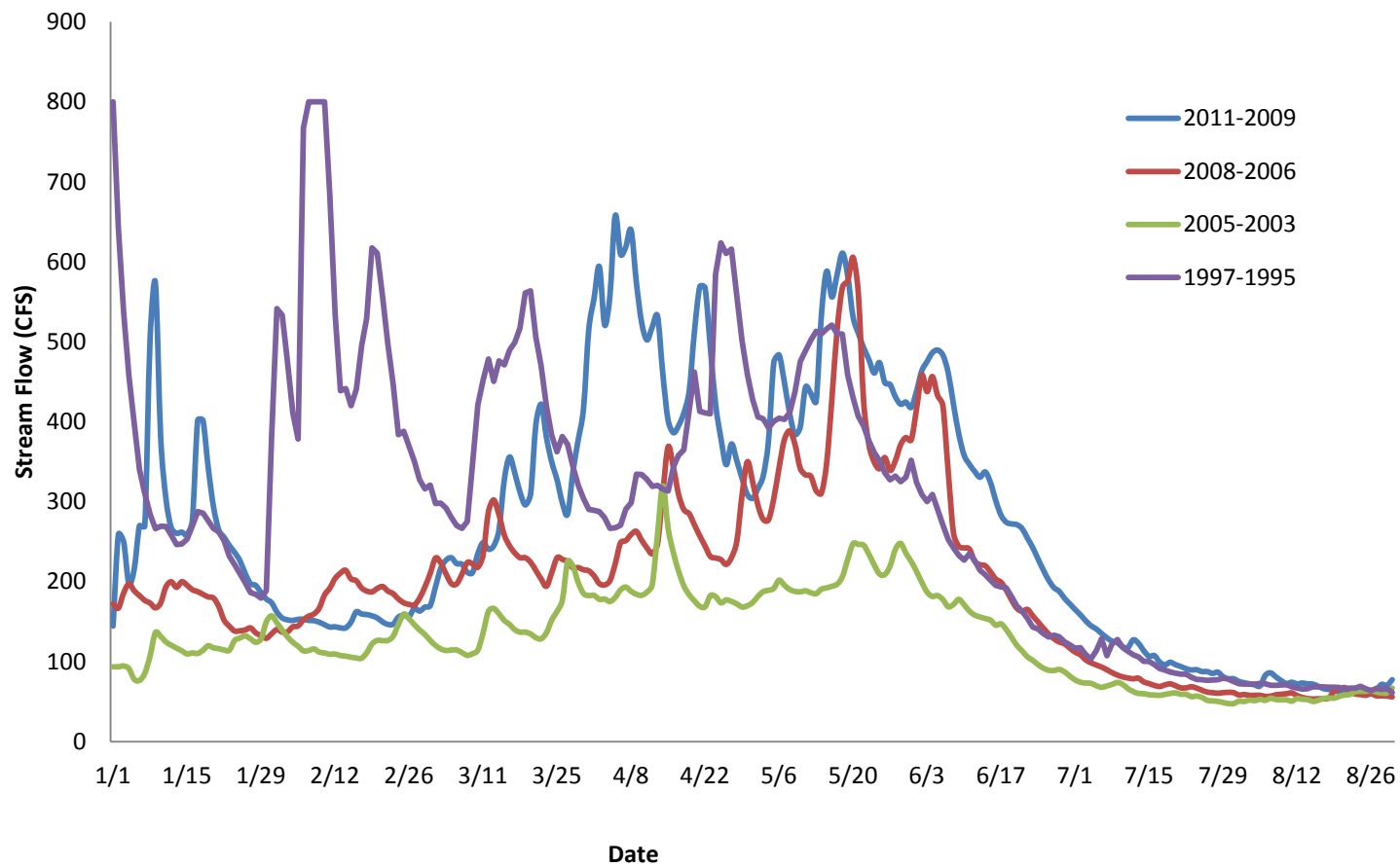


Figure 12. Mean daily river flow measured on the Tucannon River at the USGE gage at Starbuck for the time period of January through August. The flows have been binned into 3 year time periods (2011-2009, 2008-2006, 2005-2003, and 1997-1995). Due to extremely high flows in 1996-1997 the mean peak flows were truncated at 800 cfs for the purpose of display in the Graph. Mean peak flow for January, and February are 931 cfs and 1859 cfs respectively.

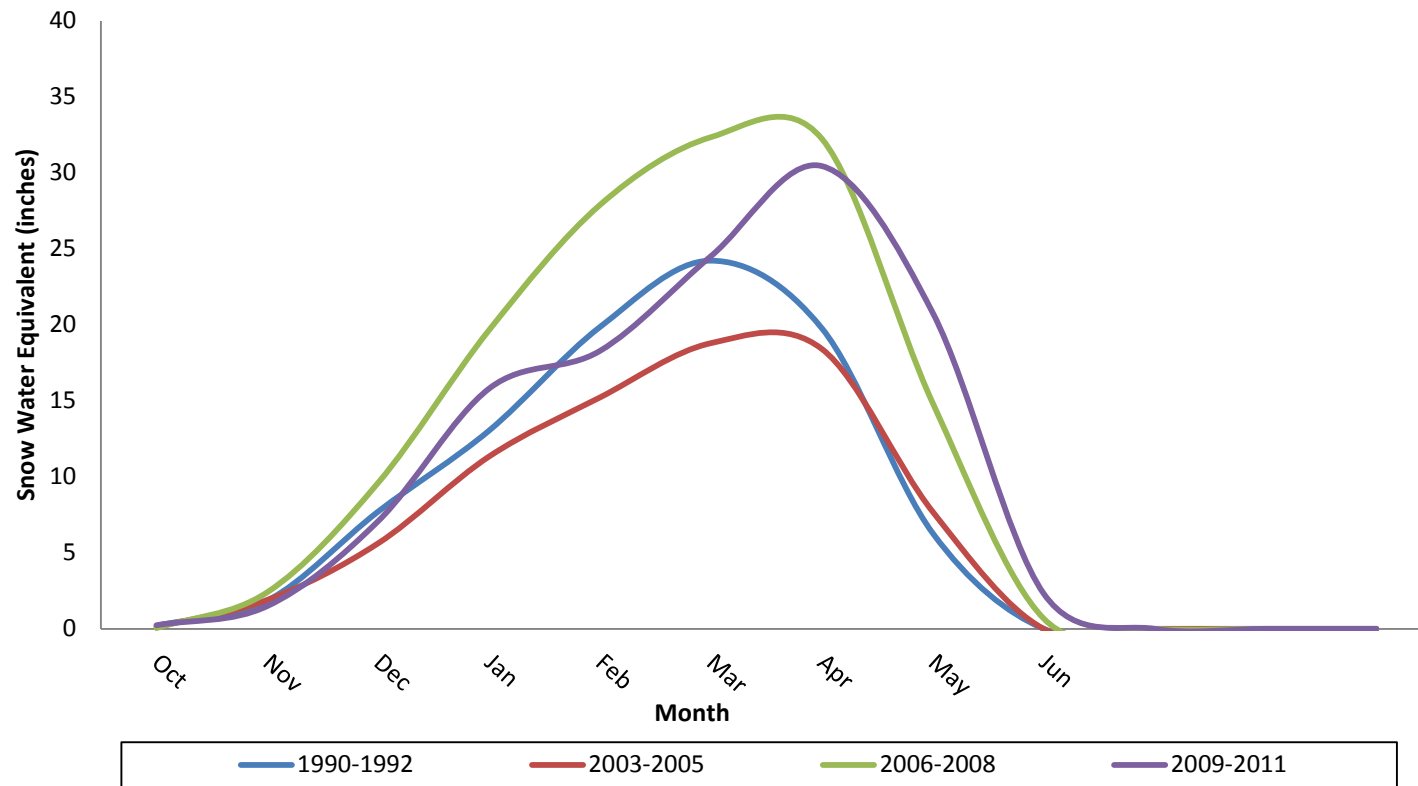


Figure 13. Monthly snow water equivalent in inches for the Blue Mountains recorded at the NRCS Snotel Touchet monitoring site.

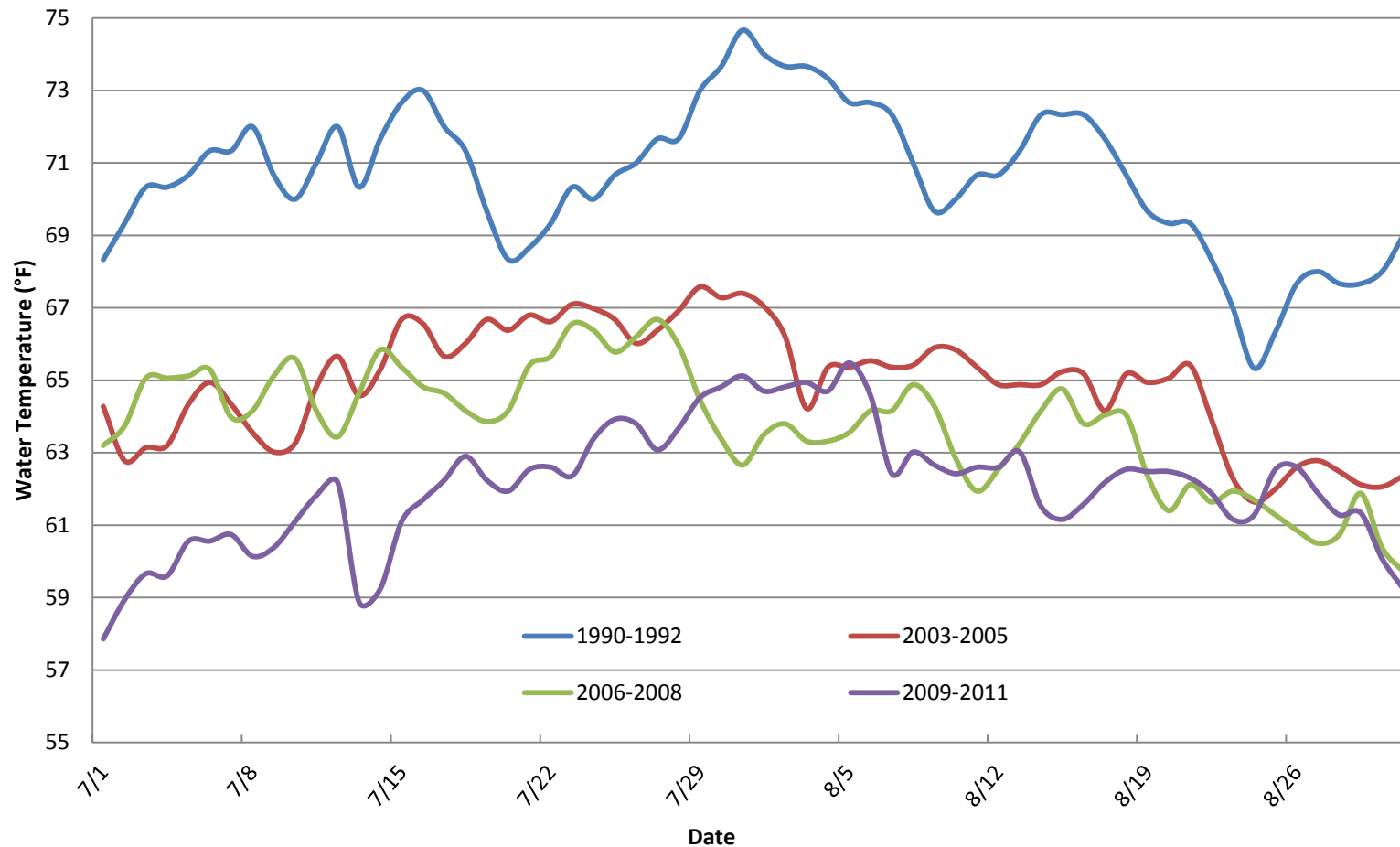


Figure14: Stream temperature reported as mean daily high temperature. Data is recorded at the Washington Department of Ecology Marengo gage on the Tucannon River 2003-2005, 2006-2008 and 2009-2011. The temperature data for 1990-1992 was recorded and reported by WDFW ([Report citation](#)). An improving trend in water temperature has been occurring since the 1990's.

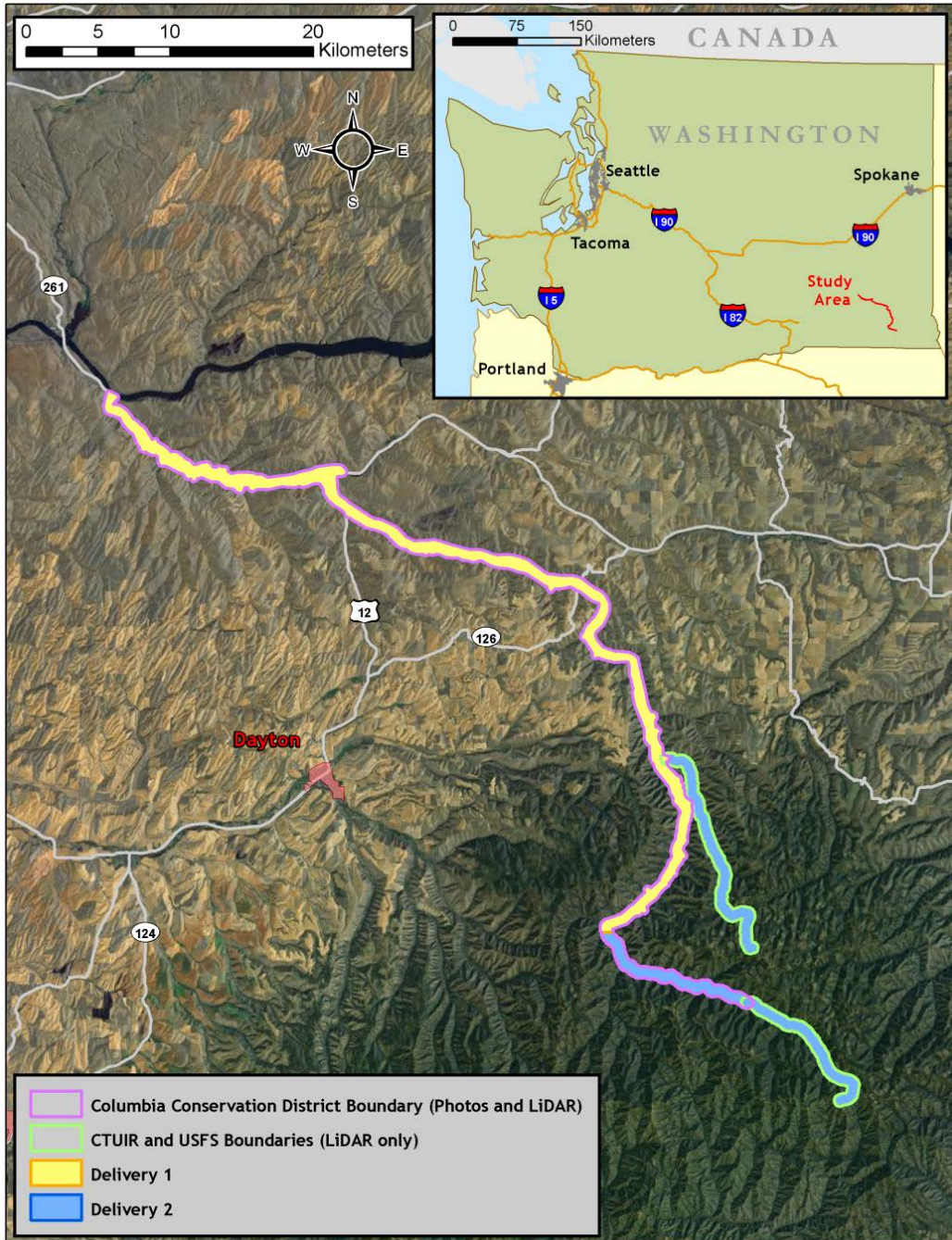


Figure 15. Tucannon River LIDAR data set foot print collected in 2010 by AeroMetric 2010. The map indicates data coverage for both the LIDAR and the orthographic photos.

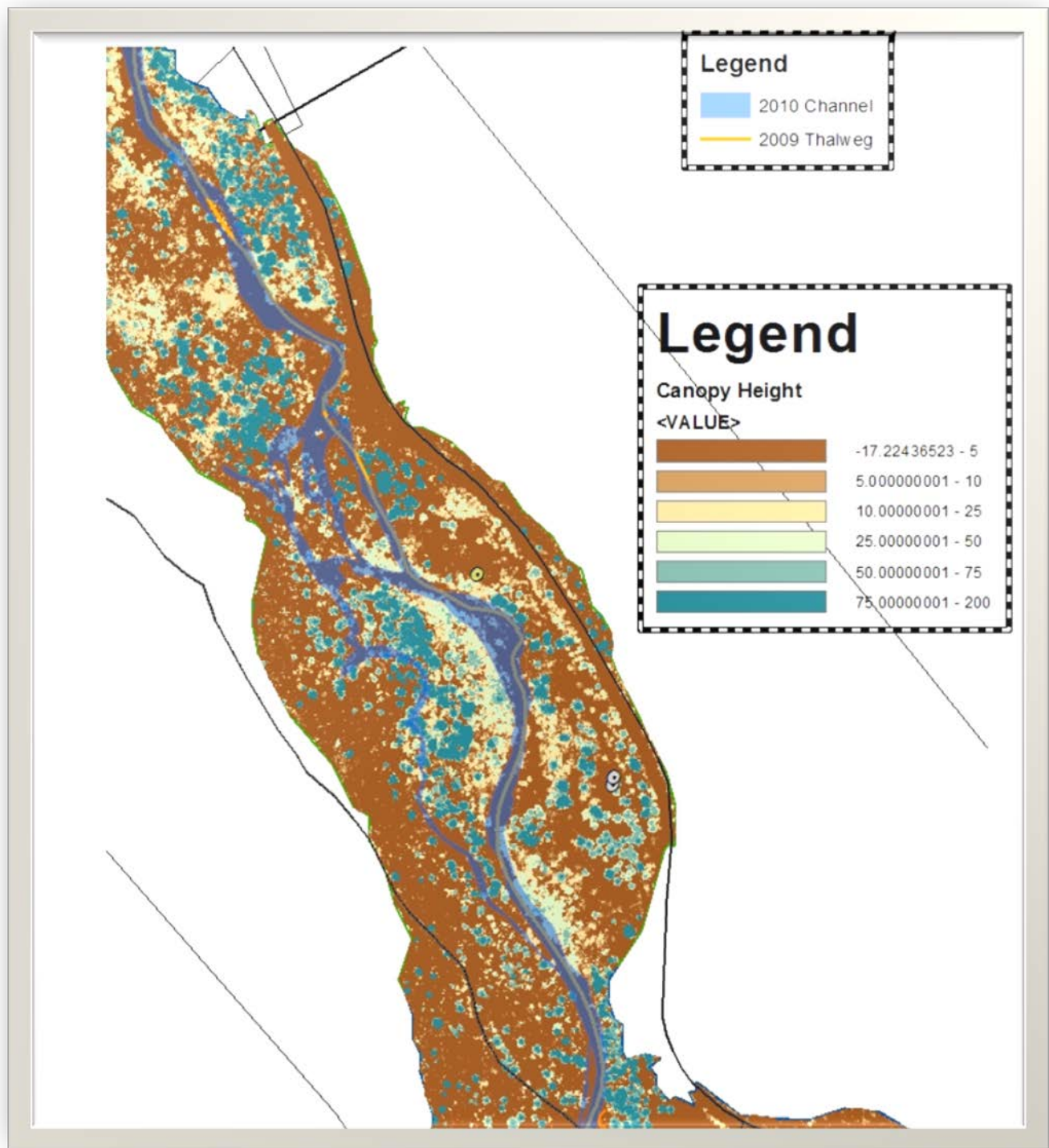


Figure 16: Example of the Riparian canopy model developed from the 2010 LIDAR date. The Canopy model has been extracted from the work completed for the Columbia Conservation District under contract with BPA.

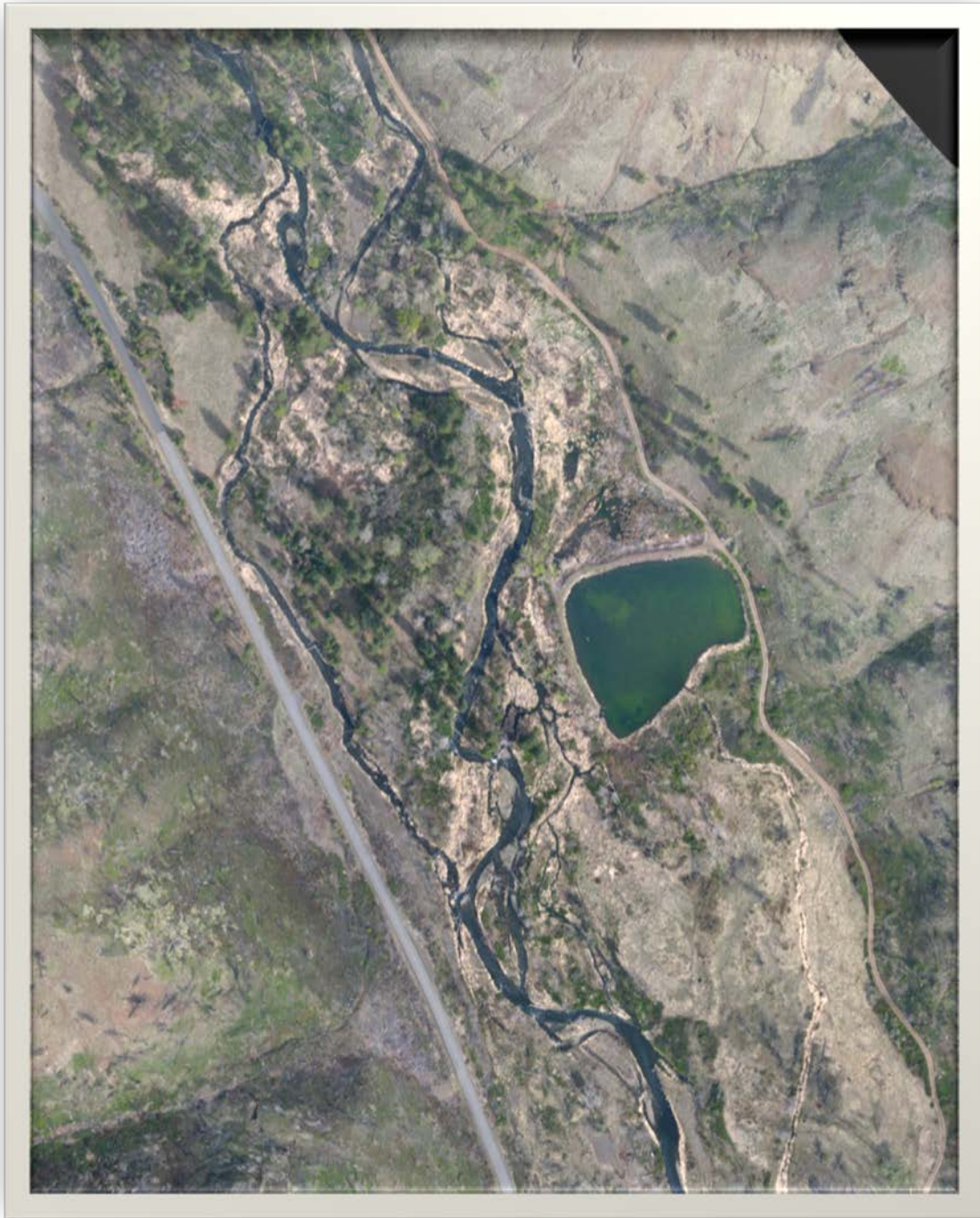


Figure 17: Deer Lake on the Tucannon River at 1:2000 scale. This photo is representative of the images recorded for the entire drainage during the April 2010 LIDAR data acquisition. Note that individual log jams and trees are clearly visible in the image.

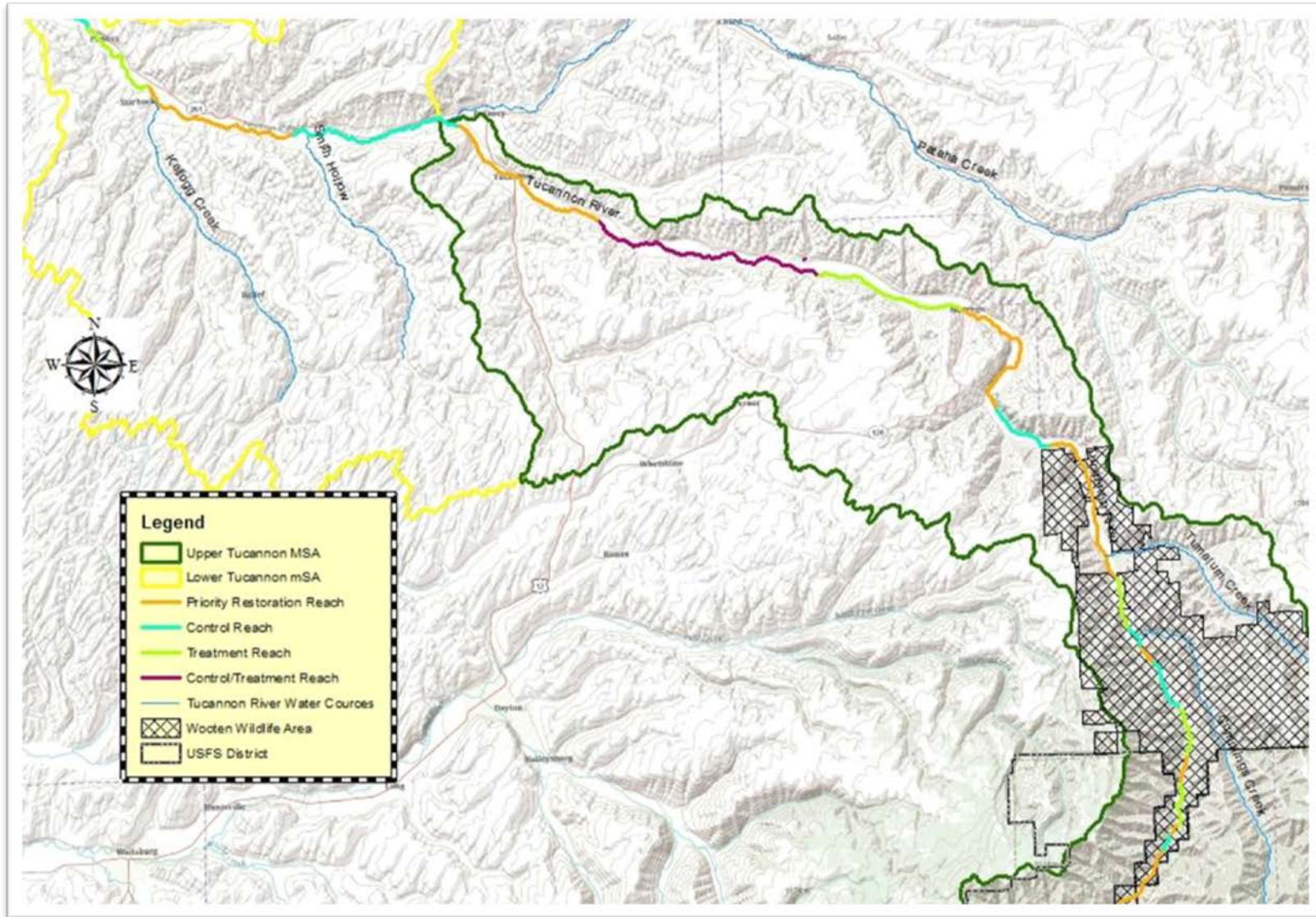
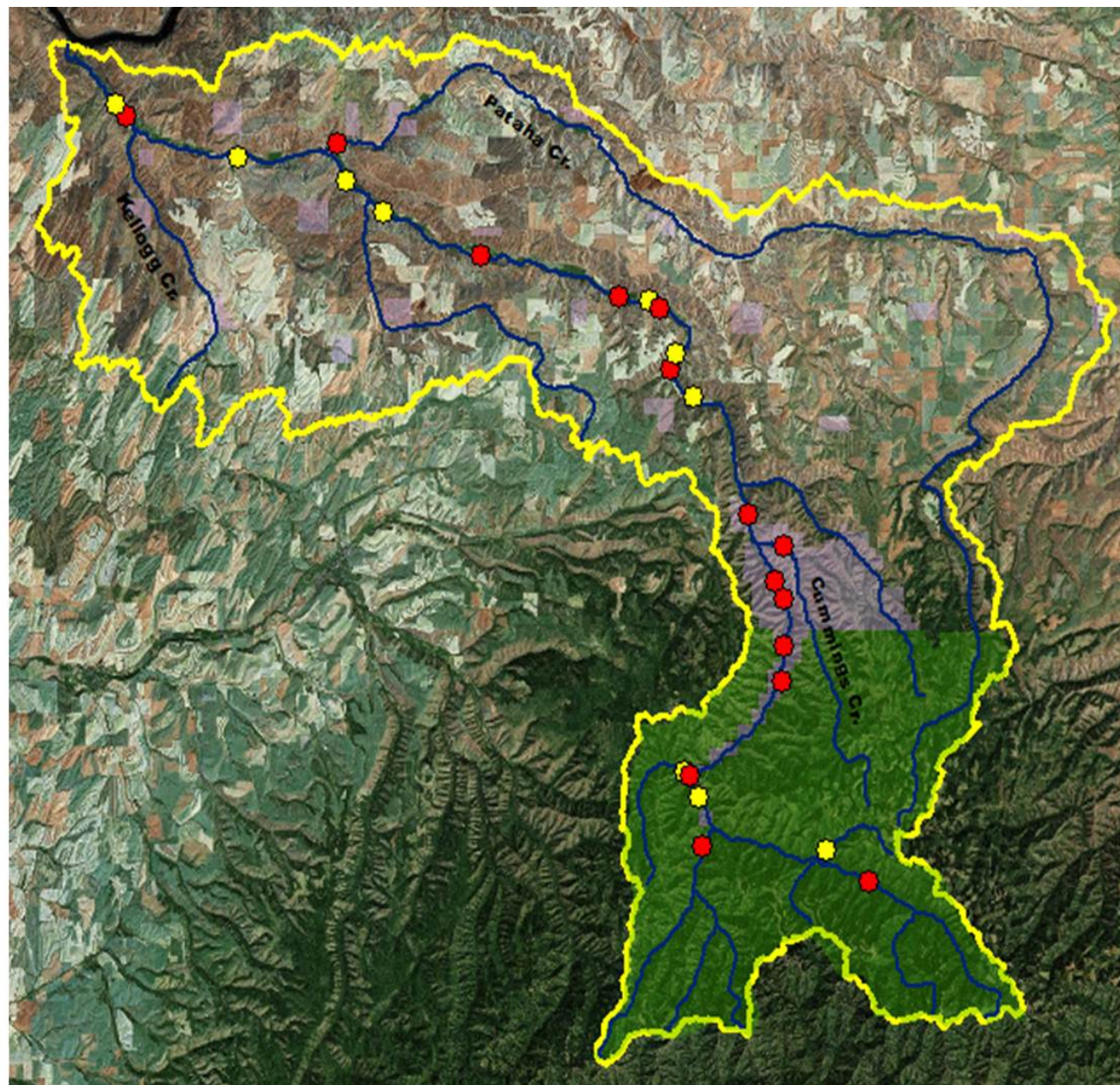


Figure19: Map illustrating stream channel complexity monitoring being completed under the CHaMP program managed by Ecologic. The stream reaches highlighted in blue indicate habitat control reaches where no restoration is anticipated, green highlights treatment reaches where habitat restoration is anticipated to be completed, and the purple highlight indicates river reaches where restoration is anticipated in the future.

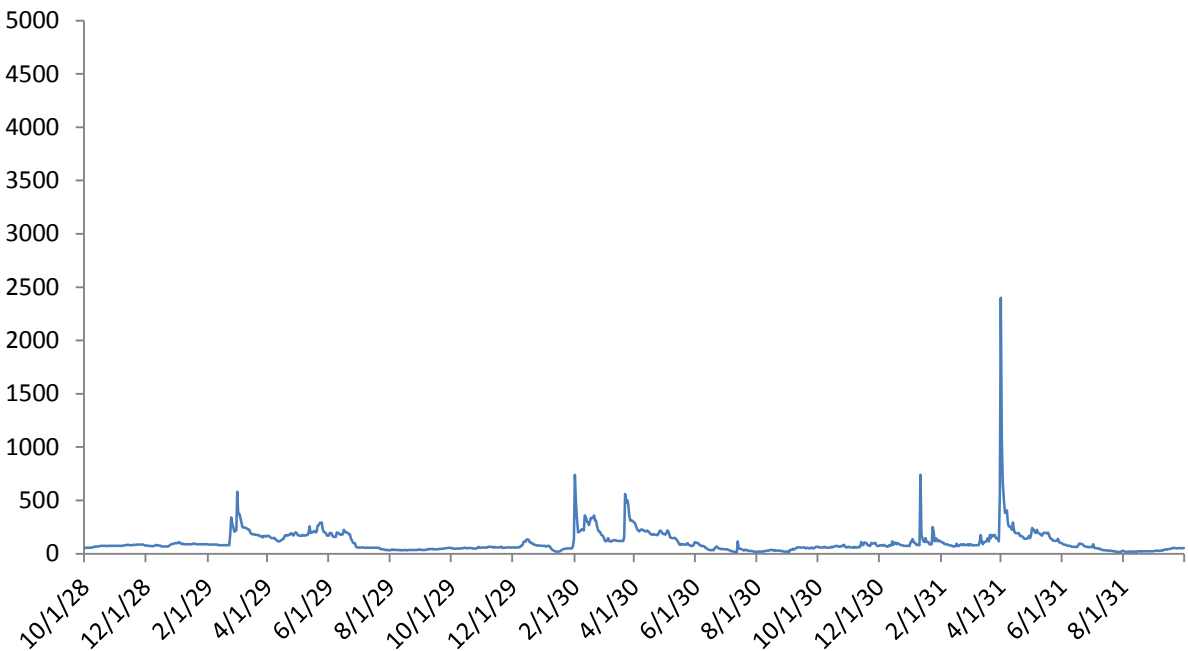
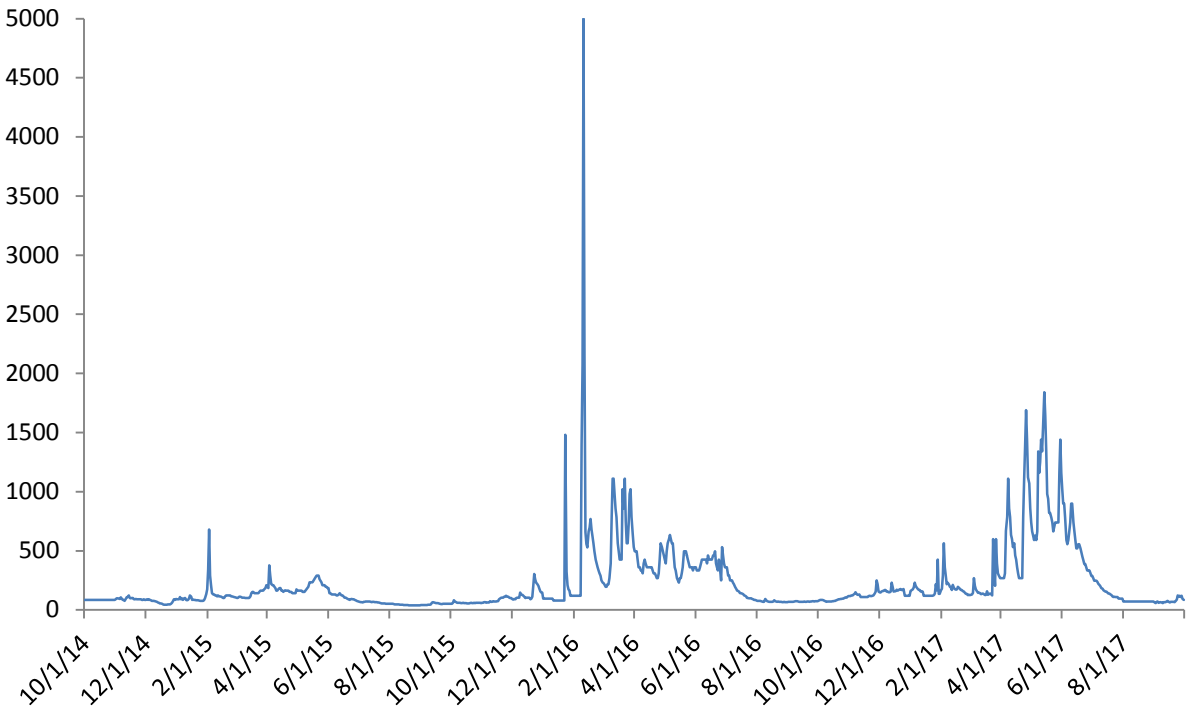
- Annual Sites
- Rotating Panel
Year 1 Sites

Figure 19: The 2011 CHaMP sampling sites located in the Tucannon River. The red dots indicate the site which will be sampled each year while the yellow dots indicate rotating sites to be sampled every 3 years. Each season 25 total sites are sampled with 15 being the annual sites and 10 on a rotating panel.

The map depicted in this figure is a modification of a slide produce by Andy Hill, Ecologic for the December 2011 RTT meeting held in Dayton.

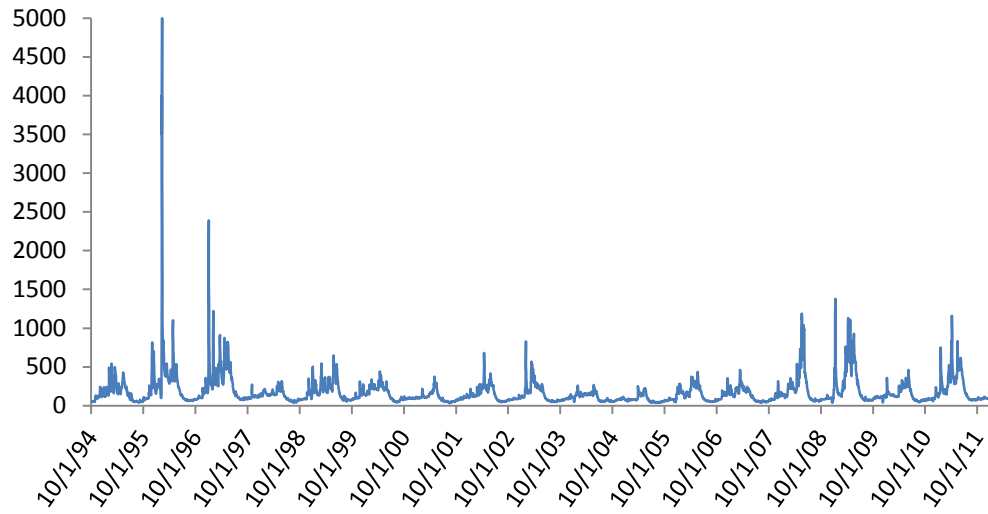
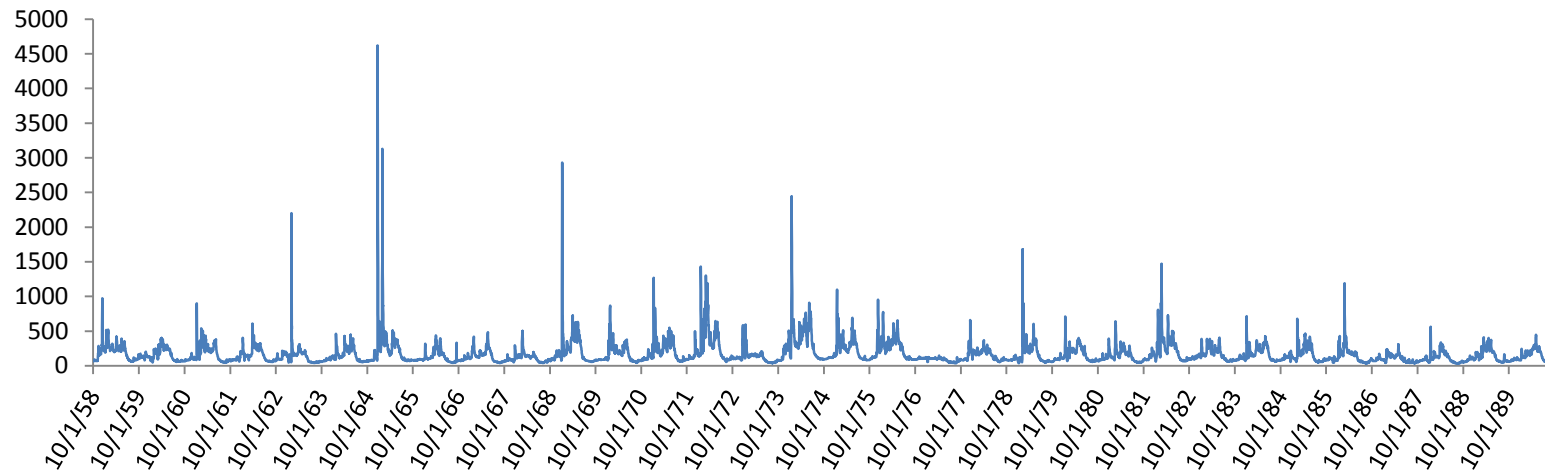


Appendix A: Historic Tucannon River flow 1914-1917, 1928-1931, 1958-1989 & 1994-2011



Stream flow measured at the USGS Starbuck gage in daily mean flow (CFS)

Appendix A (continued)



Stream flow measured at the USGS Starbuck gage in daily mean flow (CFS)

Appendix B: Riparian habitat data produced from the LIDAR data set in Anchor 2011a.

Table D-3a
Riparian Height Calculations by Reach

Reach	River Mile		Length (mi)	Low Floodplain Area (acres) ^a	Height Class (acres)						Height Class (% of Valley)					
	To	From			0-5 ft ^c	5-15 ft	15-25 ft	25-50 ft	50-75 ft	> 75 ft	0-5 ft ^c	5-15 ft	15-25 ft	25-50 ft	50-75 ft	> 75 ft
10	55.0	44.0	11.0	704.3	104.6	31.0	23.8	24.0	17.9	22.4	46.7%	13.9%	10.6%	10.7%	8.0%	10.0%
9	44.0	40.0	4.0	416.6	155.6	13.4	9.2	8.4	7.1	7.0	77.5%	6.7%	4.6%	4.2%	3.5%	3.5%
8	40.0	32.1	7.9	987.1	229.2	25.6	27.2	44.0	33.6	19.2	60.5%	6.8%	7.2%	11.6%	8.9%	5.1%
7	32.1	27.5	4.6	580.2	90.2	7.4	11.0	28.9	16.5	1.9	57.9%	4.7%	7.1%	18.5%	10.6%	1.2%
6	27.5	20.0	7.5	1172.8	354.5	21.5	30.2	92.6	62.0	5.9	62.6%	3.8%	5.3%	16.3%	10.9%	1.0%
5	20.0	13.2	6.8	943.3	244.9	10.3	11.7	36.7	20.1	1.1	75.4%	3.2%	3.6%	11.3%	6.2%	0.3%
4	13.2	8.9	4.3	607.9	144.8	10.3	12.0	35.1	14.4	0.8	66.6%	4.7%	5.5%	16.1%	6.6%	0.4%
3	8.9	4.5	4.4	692.7	53.5	5.0	6.6	18.5	5.6	0.1	59.9%	5.6%	7.4%	20.7%	6.3%	0.1%
2	4.5	0.7	3.8	561.3	163.2	9.7	10.6	33.3	10.4	0.1	71.8%	4.3%	4.7%	14.6%	4.6%	0.0%
1	0.7	0.0	0.7	81.4	57.5	0.2	0.3	0.8	0.0	0.0	97.9%	0.3%	0.5%	1.3%	0.0%	0.0%

Table D-3b
Riparian Density Calculations by Reach

Reach	River Mile		Length (mi)	Low Floodplain Area (acres) ^a	Relative Density of Vegetation by Area (acres) ^b					Relative Density of Vegetation (% of Valley) ^b					Percent Coverage Greater Than 5 feet Height
	To	From			0.0-0.2	0.2-0.4	0.4-0.6	0.6-0.8	0.8-1.0	0.0-0.2	0.2-0.4	0.4-0.6	0.6-0.8	0.8-1.0	
10	55.0	44.0	11.0	704.3	79.4	6.5	0.6	10.8	22.0	35.5%	2.9%	0.3%	4.8%	9.8%	53.3%
9	44.0	40.0	4.0	416.6	40.6	4.3	0.3	0.0	0.0	20.2%	2.1%	0.2%	0.0%	0.0%	22.5%
8	40.0	32.1	7.9	987.1	123.3	25.4	0.8	0.2	0.1	32.5%	6.7%	0.2%	0.0%	0.0%	39.5%
7	32.1	27.5	4.6	580.2	57.6	7.9	0.2	0.0	0.0	37.0%	5.0%	0.1%	0.0%	0.0%	42.1%
6	27.5	20.0	7.5	1172.8	202.5	9.4	0.3	0.0	0.0	35.7%	1.7%	0.0%	0.0%	0.0%	37.4%
5	20.0	13.2	6.8	943.3	76.9	2.8	0.2	0.0	0.1	23.7%	0.9%	0.0%	0.0%	0.0%	24.6%
4	13.2	8.9	4.3	607.9	70.1	2.2	0.2	0.0	0.1	32.3%	1.0%	0.1%	0.0%	0.0%	33.4%
3	8.9	4.5	4.4	692.7	34.7	1.0	0.0	0.0	0.0	38.9%	1.2%	0.0%	0.0%	0.0%	40.1%
2	4.5	0.7	3.8	561.3	62.3	1.6	0.2	0.1	0.0	27.4%	0.7%	0.1%	0.0%	0.0%	28.2%
1	0.7	0.0	0.7	81.4	1.2	0.1	0.0	0.0	0.0	2.0%	0.1%	0.0%	0.0%	0.0%	2.1%

Notes:

- a. The area of the reach that is less than or equal to 40 feet in elevation relative to the channel, based on relative elevation maps created from 2010 LIDAR.
- b. Areas of vegetation less than 5 feet tall were excluded from the density data set; does not account for areas with highest hit values equal or close to bare earth.
- c. Cells without a highest hit return were assumed to be close to zero and have been added to the 0 to 5-foot category.