Klickitat Watershed Enhancement Project

Annual Report for September 1, 2003 – October 31, 2004

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SUMMARY

The overall goal of the Klickitat Watershed Enhancement Project (KWEP) is to restore watershed health to aid recovery and sustainability of salmonid stocks in the Klickitat subbasin. An emphasis is placed on restoration and protection of stream reaches and watersheds supporting native anadromous fish production, particularly steelhead (*Oncorhynchus mykiss*; ESA- listed as "Threatened" within the Mid-Columbia ESU) and spring Chinook (*O. tshawytscha*).

Habitat restoration activities in the Klickitat subbasin address goals and objectives of the NPPC Fish and Wildlife Program, Klickitat Subbasin Plan, Klickitat Lead Entity Strategic Plan, Yakima Klickitat Fisheries Project (YKFP), and the NMFS Biological Opinion (All-H paper). Work is conducted to enhance instream and contributing upland areas to facilitate increased natural production potential for native salmonid stocks. Efforts in the Klickitat Subbasin fall into two main categories: 1) assessment and information management to assist identification and prioritization of sites for protection and restoration activities, 2) implementation of protection and restoration measures. KWEP personnel also assist monitoring efforts of the YKFP Monitoring & Evaluation Project by providing primary oversight of physical habitat, temperature, and streamflow data.

During the September 1, 2003 –October 31, 2004 reporting period, KWEP personnel continued efforts at information management and development of geographic priorities by:

- Completion of a Large Woody Debris (LWD) inventory along 29 miles of the lower Klickitat River (Task A4.5)
- Assisting development of the Strategic Plan for the Klickitat Lead Entity (Task A3.1)
- Assisting development of the Subbasin Plan and Klickitat steelhead EDT model (Task A3.3)
- Updating and improving the functionality of habitat and temperature databases (Tasks A1.1-1.2)
- Continuing creation and acquisition of GIS data (Task A1.3)
- Ongoing data collection efforts to fill information gaps including streamflow, habitat, and temperature (Objectives C1 and C2)

Significant milestones associated with restoration activities during the reporting period included:

- Completion of large woody debris (LWD) jams at ten different sites totaling 2100 feet along the upper Klickitat River (Task B2.4)
- Completion of restoration and enhancement activities at two different reaches totaling 2900 feet along the Diamond Fork (Task B2.3)
- Completion of a geotechnical analysis of foundation conditions and scour for two sites as part of the Trout Creek Passage project (Task B2.6)
- Completion of a feasibility assessment for in-channel restoration along 1700 feet of Tepee Creek (Task B2.10)
- Completed LWD and summer refugia mapping on 6.4 miles of White Creek (Tasks A4.2 and A4.3)
- Completed field work and hydraulic analysis for a feasibility assessment of enhancing floodplain connectivity along 12.2 miles of the mainstem Klickitat River (Task B2.1)
- Completion of preliminary topographic surveys at four culvert sites in the White Creek watershed

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INTRODUCTION

The overall goal of the Klickitat Watershed Enhancement Project (KWEP) is to restore watershed health to aid recovery of salmonid stocks in the Klickitat subbasin. An emphasis is placed on restoration and protection of stream reaches and watersheds supporting native anadromous fish production, particularly steelhead (*Oncorhynchus mykiss*) and spring Chinook (*O. tshawytscha*). Steelhead in the Klickitat subbasin are ESA-listed as "Threatened" within the Mid-Columbia ESU. Restoration activities are aimed at restoring stream processes by removing or mitigating watershed perturbances and improving habitat conditions and water quality. Protection activities compliment restoration efforts within the subbasin by securing refugia and preventing degradation. In addition to steelhead and spring Chinook, project actions benefit non-target stocks such as fall Chinook and coho (*O. kisutch*) salmon, resident rainbow trout, coastal cutthroat trout (*O. clarki clarki*), bull trout (*Salvelinus confluentus*; ESA-listed as "Threatened" within the Lower Columbia Recovery Unit), and enhance habitat for many terrestrial and amphibian wildlife species. Through these restoration efforts, available habitat has increased for spawning, juvenile rearing, velocity refugia, passage, and adult holding.

KWEP is a Bonneville Power Administration (BPA) funded watershed project implemented by the Yakama Nation Fisheries Program (YNFP) that is the mechanism for addressing Klickitat subbasin habitat issues as part of the YKFP. KWEP is the principal ongoing funding mechanism for salmonid habitat restoration in the subbasin and has been integral to securing in-kind matches from the Washington Salmon Recovery Funding Board (SRFB), Mid-Columbia Regional Fisheries Enhancement Group (MCRFEG), and private sources. These other sources have augmented BPA monies and have been used to more effectively distribute funding for habitat enhancement projects in the Klickitat Subbasin. The project addresses 1994 Columbia Basin Fish & Wildlife Program goals of an ecosystem approach to species recovery through protection and improvement to habitat conditions.

Personnel funded by KWEP include one Watershed Restoration Specialist (1.0 FTE), one Fisheries Biologist (0.5 FTE), one Bookkeeper III (0.5 FTE), one Bookkeeper IV (0.25 FTE), one Water Technician I-B (0.2 FTE), one Water Technician IV-J (0.1 FTE), one Hydrologist (0.1 FTE), one Archeologist (0.1 FTE), and one Cultural Resource Specialist (0.2 FTE). Cooperation with YKFP Data Management personnel has been critical to accomplishments associated with database development and management. YKFP Monitoring and Evaluation personnel are integral to monitoring-related accomplishments. Other cooperators that played key roles for specific tasks are identified accordingly by project below.

Though the FY04 contract was approved by BPA in October 2003 (performance period began on November 1, 2004) project activities were hamstrung for the first six months due to uncertain budget information coming from BPA. About six weeks after initiation of the contract project staff received word that because of a new accounting system, October 2003 KWEP expenditures would be deducted from the FY04 budget (unlike in previous years where budgets were based on the contract-year). This was problematic because it would have effectively cut the FY04 budget in half and because the previous contract had been extended through October at BPA's request and no mention had been made of this potential effect of the extension and new accounting system. Pending NPPC review of a "re-scheduling" request, project staff suspended all tasks involving expenditures beyond personnel and vehicle costs and delayed implementation of tasks involving sub-contracts such as design and assessment work. Eventually the appeal was granted and the full budget was restored. Table 1 provides a chronology of the development and resolution of the "re-scheduling."

Table 1. Chronology of "re-scheduling" associated with FY04 contract.

August 2003	At BPA's request, performance period of FY03 KWEP contract (#5716) is extended from 8/31/03 to 10/31/03
October 2003	In addition to routine expenses, two large arch culverts are purchased associated with FY03 contract
October 2003	BPA approves FY04 budget and work statement
November 1, 2003	Performance period of FY04 contract begins
December 2003	BPA notifies project staff that because of the new accrual-based accounting system, October 2003 KWEP expenditures will be deducted from the FY04 budget (unlike in previous years where budgets were based on the contract-year) effectively cutting the FY04 budget in half.
December 2003	YNFP personnel prepare a "re-scheduling" request to the NPPC and submit to BPA to have the full FY04 budget made available as in the original FY04 award
Winter/Spring 2004	Pending NPPC review of the re-scheduling request, BPA and NPPC staff inform KWEP personnel that approval is unlikely and to proceed as though it will be denied. Consequently, project staff suspended all tasks involving expenditures beyond personnel and vehicle costs.
May 2004	Power Planning Council approved the re-scheduling request
May 2004	With only five months remaining on the FY04 contract, KWEP staff revise the SOW to accommodate the delayed approval. The most notable changes included scaling back three implementation tasks in the White Creek watershed to be planning only and adding implementation to two tasks (Klickitat Meadows Restoration and Klickitat River Meadows Restoration projects).
June 2004	BPA approves revised SOW

While the delays and uncertainty were unsettling and interfered with some project sequencing, its effects were somewhat mitigated by the coincident timing of Subbasin Planning and related demands on staff time. Despite delays, KWEP project personnel managed to complete nearly all tasks as planned.

ACCOMPLISHMENTS

Overall Goal: Restore watershed health to aid recovery of salmonid stocks in the Klickitat subbasin.

Goal A. Continue assessment and prioritization of sites for restoration activities.

Objective A1. Continue assessment of existing habitat conditions.

Since FY01, project staff have been developing and refining an Access database to manage and analyze habitat data collected according to the TFW Ambient Monitoring Protocols. In 2003, a temperature database was also designed and programmed. Benefits of organization into relational databases include centralized storage and editing, faster access to and analysis of data, and easier integration into Geographic Information Systems (GIS).

Task A1.1. Finish QA/QC on existing modules in habitat database.

- An inventory of all historic TFW (pre-database) files was conducted. These legacy files were originally saved by site in Quattro format. Copies were found on seven different computers in three different offices. As many as five different versions of the same file

(based on "modified date" in Windows Explorer) existed for some sites. Though it is unlikely that content had actually been altered, such differences create unnecessary uncertainty. Because the most current data resides in the Access database, it was not the data management nightmare it could have been. However, the presence of numerous legacy files could be problematic if someone unfamiliar with the current status of the data were to perform analysis using the old Quattro files. This inventory underscored the need to have the Access database on a network that multiple users can access to prevent the opportunity for divergent versioning to occur. Plans are being made to convert our Access databases (e.g. TFW and Temperature) to SQL Server to facilitate over-the-network multi-person usage.

- Further work on this task was suspended following approval of SOW modifications to free-up staff time to focus on field-oriented tasks. QA/QC on the TFW database is anticipated for completion during the FY05 contract period.

Task A1.2. Design and develop new database queries and reports.

Development and management of the habitat-related database continued in cooperation with the Klickitat Data Manager (YKFP Management Project). Effort was primarily focused on the TFW and temperature databases.

- Reports were developed and provided to Subbasin Planning personnel developing the Klickitat EDT model for spring Chinook and steelhead. Data from all three habitat modules (Reference Point, Habitat, and Large Woody Debris) was incorporated into the model.
- New queries and reports were developed for the temperature database. Summary reports were developed by month (Table 1) and year. Summary statistics were based on a combination of biologically relevant thresholds from the scientific literature and Washington State water quality standards. A set of pivot charts were also developed that permit plotting of various summary statistics by selected time periods.
- Temperature data were provided to the EDT modeler for incorporation into the Klickitat spring Chinook and steelhead EDT models.

Monthly Temperature Summaries (degrees C)

DIALOWMEDW

2003	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	31	31	31	31	0	0	0	0	0	0	0	–0.1	0.0	0.0
February	28	28	28	28	28	0	0	0	0	0	0	0	1.6	1.7	0.3
March	31	27	31	14	31	0	0	0	0	0	0	0	4.5	3.8	1.3
April	30	13	30	1	30	0	0	0	0	0	0	0	5.8	5.1	3.1
May	31	6	31	0	30	0	0	0	0	0	0	0	8.2	6.7	4.2
June	27	0	15	0	0	0	0	7	0	0	0	0	16.3	9.6	6.7
July	31	0	1	0	0	0	0	31	25	15	14	0	20.9	11.2	9.7
August	31	0	0	0	0	0	0	31	31	8	3	0	19.8	10.5	8.9
September	18	0	5	0	0	0	0	11	5	2	0	0	18.6	10.1	7.2
October	8	3	7	2	6	0	0	0	0	0	0	0	9.0	6.7	3.7
November	30	30	30	30	30	0	0	0	0	0	0	0	0.4	0.5	0.1
December	31	31	31	31	31	0	0	0	0	0	0	0	–0.1	0.0	0.0

Figure 1. Sample of monthly site summary developed for the temperature database.

- The TFW database has been a major improvement in data storage and analysis of existing data over the 60+ individual Quattro files saved by site. However, difficulty with entry of new data has begged the need to redesign the logic of the database so that data relationships are normalized. This will occur in FY05 and will also improve processing time,

troubleshooting ability, quality control, and compatibility with updating to SQL Server-based storage (discussed in Task A1.1).

Task A1.3. Continue development of relevant spatial data.

Spatial data is critical for effective watershed and fisheries analysis and management. Spatial data employed and managed by KWEP falls into two main categories: 1) base layers for map generation and watershed-scale analysis (e.g. contours) and 2) layers for reach-specific analysis or management (e.g. locations of temperature monitoring sites). Spatial data from the first group is typically acquired from other sources such as BIA Forestry, Washington Department of Natural Resources (WDNR), Washington Department of Transportation (WADOT), and U.S. Geological Survey. Data from the second group are typically created by KWEP personnel using ArcINFO and include project sites, watershed delineations, routed stream reaches, and GPS-based habitat inventories. Specific activities during the reporting period include:

- Acquired tabular WDFW fish sampling data from 2000-2002 associated with bull trout surveys. In cooperation with the Klickitat Data Manager, a logical model for a relational database was developed to document historic (and future) fish sampling efforts throughout the Klickitat Basin. Entities and attributes were identified and relationships were developed. The Data Manager built the database structure and KWEP staff error-checked structure and functionality. The database will provide a catalog of sampling by various organizations by documenting sampling locations, type of data was collected, methods used, and species found. Having an index of the sampling efforts done and methodologies used will be very helpful in organizing and utilizing this body of knowledge and documenting fish distribution throughout the Klickitat subbasin. Work was begun on data input (Figure 2), but was suspended upon approval of the SOW modification to free-up staff time to focus on field-oriented tasks. Since fish sampling and distribution is more purely an M&E project function, it is anticipated that the M&E project will assume data entry responsibility in the future. Sites will be tied to points in a GIS layer once complete.
- KWEP staff developed a preliminary geo-database that will document project locations. Entities for actions, funding, logistics, administration, and operational project data will eventually be added.

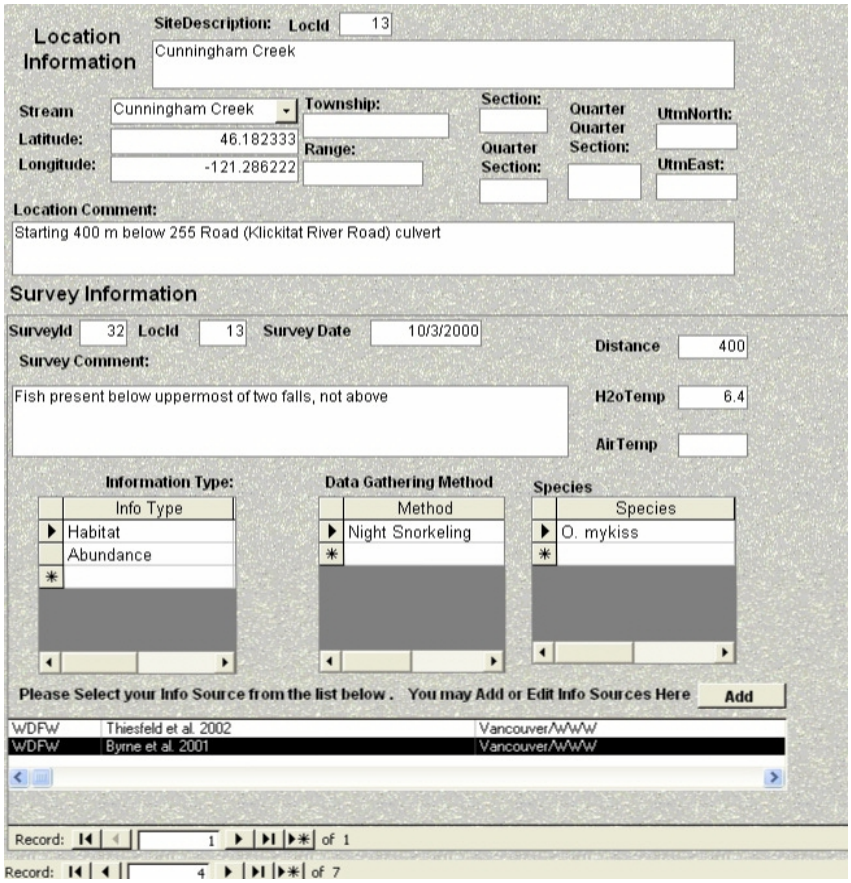

Figure 2. Entry form for fish distribution database.

The point feature class was created in ArcINFO. A logical model will be developed with the Klickitat Data Manager in FY05 prior to further attributing of the point layer.

- Layers were created for the Klickitat Meadows and Klickitat River Meadows restoration projects. Layers that identify work site and element locations were created as well as layers identifying source areas for materials collection (LWD and rock).

Task A1.4. Deleted from work statement in May 2004.

Objective A2. **Identify and review information on historic habitat conditions.**

Task A2.1. Deleted from work statement in May 2004.

Objective A3. **Compile known habitat information into relevant planning documents.**

Task A3.1. Assist development of the Klickitat Strategic Plan.

KWEP specialists participated as members of the Klickitat Technical Advisory Group and working with the Citizens Review Committee to develop a Strategic Plan (under the Washington State 2496 process). Accomplishments include:

- Mapping and documentation of geographic priorities. Habitat needs and actions within priority areas were also identified and prioritized.
- Participating in the technical review of grant applications submitted to the Klickitat Lead Entity and field visits with members from the state-level SRFB Technical Panel.
- The Klickitat Strategic Plan was the only one in Washington State to receive an "Excellent" rating in three out of four criteria areas (SRFB 5th Round (FY2004) Grant Cycle Final Report, 2004). The Klickitat Strategic Plan occurred in the top group for all three evaluation scenarios (ranging between 2nd and 7th out of 26 statewide) used by the SRFB Review Panel. Given that 100% of the technical involvement for the Klickitat Lead Entity is on an in-kind basis (e.g. YNFP (via KWEP), WDFW, and USGS) and that many of the other Lead Entities have full-or part-time technical staff and/or spent large quantities of money on consultants, ranking so highly was quite an accomplishment.

Task A3.2. Deleted from work statement in May 2004.

Task A3.3. Assist other basin-wide assessments and planning efforts.

KWEP personnel are sometimes called upon to apply their technical expertise to various assessments and planning efforts associated with the subbasin. During the reporting period, KWEP personnel assisted development of the Ecosystem Diagnosis and Treatment model, Subbasin Plan, and Master Plan for the Klickitat subbasin. Specific activities included:

- Providing input for physical and biological habitat conditions and steelhead distribution and use for EDT model development for Klickitat steelhead. As well as review of the Klickitat steelhead EDT model and refinement of inputs where results seemed anomalous.
- Project staff also provided guidance on geomorphic conditions for delineation of EDT-reaches.
- Technical review and development of the Klickitat Subbasin Plan including assisting development of "Key Findings" matrix regarding physical and biological habitat needs.
- Writing the habitat chapter and providing comments on the draft Klickitat Master Plan.
- GIS data development and map creation for the Master Plan and Subbasin Plan, particularly updated distribution maps for spring and fall Chinook, steelhead, coho, and bull trout.

- Provided a technical review and comments on the Draft Swale Creek Temperature Report (produced by Watershed Professionals Network for Klickitat County under the Washington State Watershed Planning process). The review included 8 general and 75 specific comments on the document.

Objective A4. **Identify data gaps and initiate measures to fill them.**

Task A4.1. Deleted from work statement in May 2004.

Task A4.2. **Map woody debris distribution along White Creek.**

Much of the mainstem of White Creek has very simplified plane-bed channel form. Physical habitat conditions are correspondingly poor and associated with the absence of LWD in many places. Project personnel walked from the 207 Road crossing (RM 9.6) to the washed-out crossing (RM 3.2) and GPS'd locations of LWD that met "large logs" and "jams" criteria.

- Large Woody Debris (LWD) inventory was based on the Timber, Fish & Wildlife (TFW) Large Woody Debris Survey Manual (Schuett-Hames et al. 1999). Location and tally data was collected for features in Zone 1 (wetted channel) or Zone 2 (bankfull channel outside of wetted channel). To qualify, a piece or jam had to have at least 3.9" of length within Zone 1 or Zone 2 and meet TFW criteria as "Large Logs" (LL, ≥6.6' long with a midpoint diameter ≥19.7") and "Jams" (≥10 pieces, ≥6.6' long with midpoint diameters ≥ 3.9"). Logs and jams were grouped into the lowest Zone within which some portion of their length occurred.

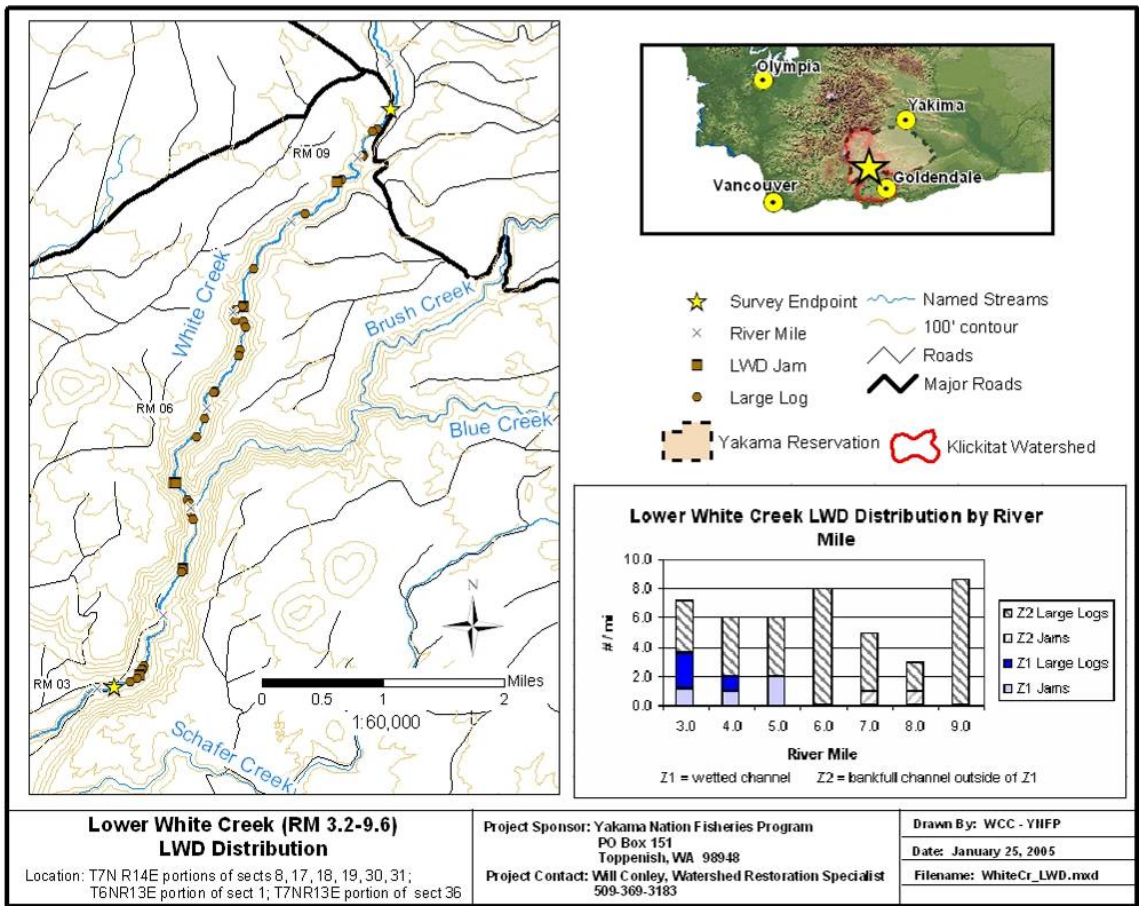

Figure 3. LWD distribution along 6.4 miles of lower White Creek.

- Based on results from Task A4.5, we already knew that GIS hydrography based on pre-1996 flood channel geometry (e.g. SSHIAP) had the potential to be sufficiently inaccurate to skew

reach-based results. Consequently, post-1996 flood channel geometry for the lower 10 miles of the mainstem of White Creek (inclusive of the project area) was digitized from 1:24,000 digital orthophotos (1m pixels). The stream channel layer was then routed and the field-based GPS points were then snapped to the routed hydrography. Thus, each LWD occurrence could be assigned a position along the channel and grouped by river mile for analysis.

- Data were then developed into a distribution map with a chart indicating feature type (log or jam) and channel position (zone 1 or zone 2) (Figure 3).
- LWD frequency is marginal at best, with all subreaches having less than 9 occurrences per mile and the entire reach averaging 6.3 per mile. Canopy cover is marginal to poor for the majority of the reach and the presence of riparian stumps and yarding corridors throughout the reach suggest historic riparian clearcutting as a probable cause of low cover and in-channel LWD frequency. Restoration planning for this reach is discussed under Task B2.11.

Task A4.3. Map refugia along White Creek.

Much of the mainstem of White Creek has very simplified plane-bed channel form. Physical habitat conditions are correspondingly poor and typified by seasonal drying and low pool frequency and quality. Anecdotal evidence indicates that much more of the mainstem of White Creek was historically perennial. Project personnel walked from the 207 Road crossing (RM 9.6) to the washed-out crossing (RM 3.2) and GPS'd locations of wetted channel and pool occurrence. Field survey occurred over two days in September 2004.

- Surface flow is sparse and discontinuous for the majority of the subreach upstream of the Brush Creek confluence (RM 5). In this sub-reach, upstream and downstream endpoints of surface water were marked and a single maximum wetted depth was recorded. For very short sub-reaches, a single point was marked with GPS and length was estimated in the field. The length was then applied to the measure in the route event table to generate a polyline for features based on a single GPS point. Points representing pools in this portion of the surveyed area were located at the centroid of the polyline feature for the wetted subreach. The subreach downstream of the Brush Creek confluence has continuous surface flow and only features satisfying TFW criteria (residual depths ≥0.98' and ≥32.3 ft^2 of surface area) were sampled as "pools" (Pleus et al. 1999). Maximum and tailout depths were measured for all features qualifying as TFW pools and lengths and widths were estimated visually. The presence of salmonids in three different size classes (<4", 4-6", and >6") was also noted.
- Field-based GPS points were then snapped to the routed channel layer developed in Task A4.2. Thus, wetted channel and pool occurrences were assigned a position along the channel and grouped by 5280' long subreaches that corresponded to miles from the confluence with the Klickitat River for analysis.
- Data were then developed into a distribution map with a chart indicating feature type (log or jam) and channel position (zone 1 or zone 2) (Figure 4).
- The field inventory occurred in September to provide an indication of summer wetted channel distribution. The same reach was walked in early August 2001 by the same two specialists and, though not GPS'd in 2001, distribution of wetted conditions was similar. Based on recollection and field notes, there may have been slightly more channel wetted length upstream of the Brush Creek confluence in 2004, most likely due to unseasonably wet weather during August.
- In the upper several miles of the surveyed reach, there are scour marks on riparian tree trunks 5 to 6 feet (vertical) above the channel bottom. Valley bottom deposits in several

different subreaches suggest one or more debris torrents have occurred. The most extensive subreach where this is evident is in the upper 3500' immediately downstream of the 207 Road crossing. Chunks of concrete can be found in the channel diminishing in size from several feet near the 207 crossing to about 3" at the lower end of the subreach. Given the above field indicators and other historic road crossing failures in the vicinity (particularly the one at the downstream end of the survey reach and the Peavine Ridge Road crossing of Trout Creek) it seems likely that one or more crossings upstream of the survey reach have failed in the past.

- Water temperature measurements were also made for 27% of the pools. Water temperatures were favorable for salmonid survival and growth and varied between 8° and 16°C.
- The greatest amount of pool habitat occurs downstream of the Brush Creek confluence with an average of 26 pools per mile accounting for 14% of the subreach length. Upstream of Brush Creek, pools account for less than 1% of subreach length on average. It should be noted that pool frequency and quantity by length for river-mile 5 are probably underrepresented because there is roughly 4800' of wetted channel in this Subreach and only one pool depth was recorded. While there was certainly more than a single pool in the reach field notes indicate that there are still probably only 4 TFW pools present.

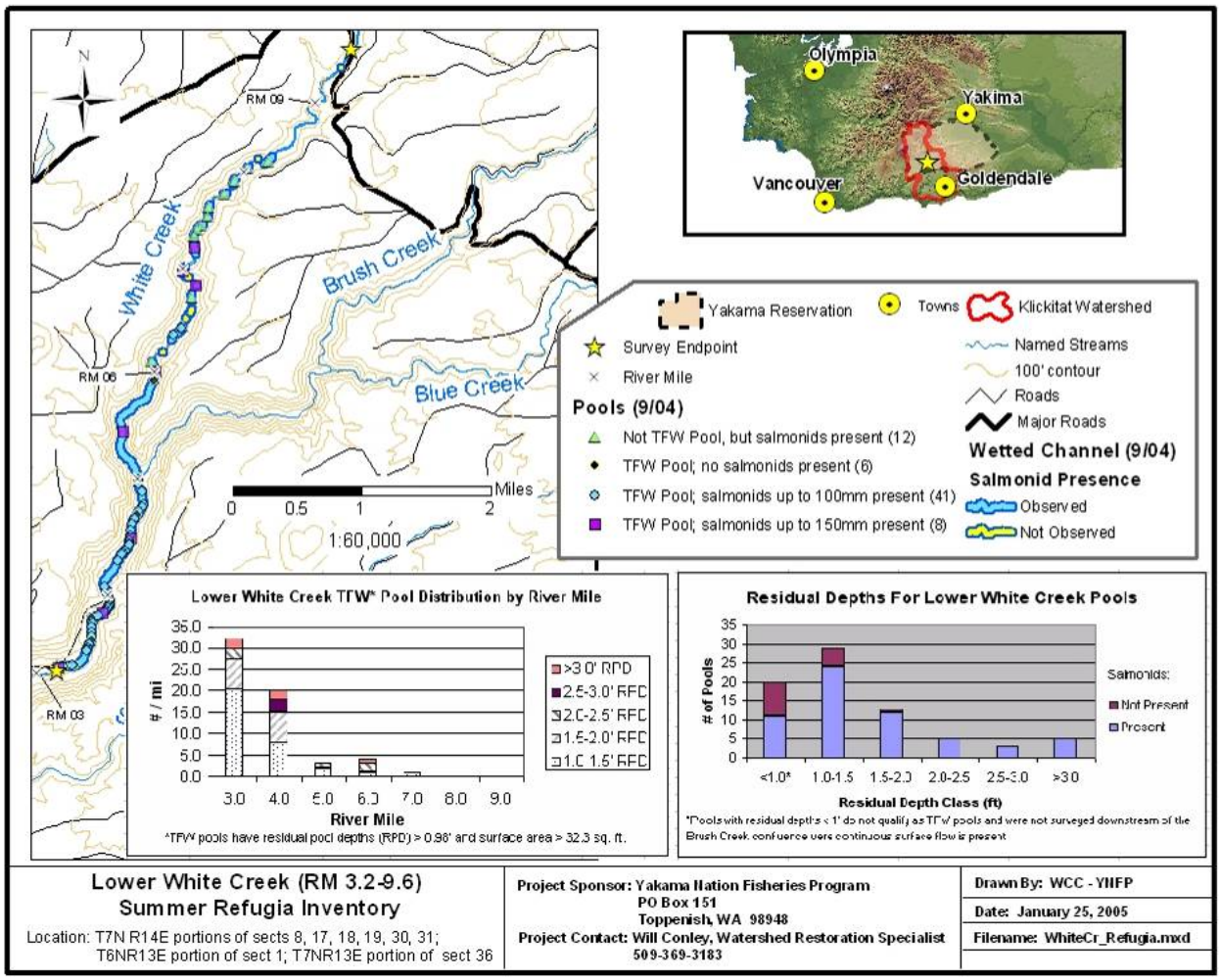

Figure 4. Summer refugia and salmonid presence along 6.4 miles of lower White Creek.

- Salmonids were present throughout the survey reach, but observed abundance was sharply correlated with pools. The vast majority were young of the year (0+, <100mm), though a

few 1+ individuals (100-150mm) were observed. No individuals over 150 mm were observed in the survey reach.

- Not surprisingly, proportionality of pools of a given depth hosting salmonids increased with residual depth (Figure 4), though quality pool habitat (>2.5' RPD) was very limited. Restoration planning for this reach is discussed under Task B2.11.

Task A4.4. Assess historic meadow habitats in the White Cr. watershed.

Most meadow stream reaches in the White Creek watershed are incised and channelized. They support higher steelhead spawner densities during the spring but dry up for some portion of the summer. Anecdotal evidence suggests that many were historically perennial. Gathering and review of historic anecdotal, survey note, and photographic information is ongoing to provide a foundation for subsequent restoration actions. Aerial photography from 1949 was acquired for the primary meadows of interest: 2 on White Creek and 2 on Tepee Creek. The 1949 flight does not provide coverage for a third meadow because of a gap between flight lines. As relic field indicators suggest, historic channel geometry was more sinuous. Interestingly, belt-width is uncharacteristically narrow for low-gradient, unconfined streams but this is consistent with field indicators. Conifer encroachment has been considerable, particularly for one meadow on Tepee Creek which is currently dominated by ponderosa pine. During the FY05 contract period, KWEP specialists will identify availability and, if possible, acquire old (late-1800s preferably) survey records as well as additional imagery from the Yakama Agency

Task A4.5. Map large woody debris distribution in the lower Klickitat River.

Qualitatively, project specialists have thought that LWD abundance in the lower 20 miles of the mainstem Klickitat River is much lower than expected, particularly in light of generally good LWD frequency upstream. To determine if a quantitative difference existed, KWEP specialists surveyed large woody debris abundance and distribution along 29 miles of the mainstem Klickitat River from just above Lyle Falls (RM 2.9) to Leidl Bridge (RM 32) over 7 days in March and April 2004. The lower three miles were excluded because of limited access associated with a bedrock gorge and a Class VI rapid.

- Large Woody Debris (LWD) inventory was based on the Timber, Fish & Wildlife (TFW) Large Woody Debris Survey Manual (Schuett-Hames et al. 1999). Features meeting TFW criteria as "Large Logs" (LL) and "Jams" were mapped. Though the initial intent was to inventory all jams, this was recognized as being unrealistic the initial morning of inventory. Stopping to examine every potential jam in 29 miles of river would be far too time consuming given available resources. Additionally, the size criteria for member pieces is fairly minimal (at least 10 pieces ≥ 6.6' long with midpoint diameters ≥ 3.9", at least one piece of which has to have 3.9" within the bankfull channel) and of limited significance to a river the size of the mainstem Klickitat which has a Q_2 = 7745 cfs. Thus, a more restrictive criteria was used that required that at least 5 members meet the TFW criteria for "Medium Logs" (ML) or larger (≥ 6.6' long with a midpoint diameter ≥ 7.9"). GPS coordinates were collected for all LL, jams, and bedrock contacts encountered.
- Hourly streamflow from the USGS gage at Pitt (Figure 6) was downloaded to track the potential for runoff events that could potentially redistribute LWD during the survey period as well as provide an indication of the validity of Zone 1 to Zone 2 comparisons between survey dates. No significant runoff events occurred and LWD was not observed being mobilized on any date during the sampling period (both KWEP specialists drive the lower 18 miles of the Klickitat River daily as part of their commute).

- Existing GIS coverages represented pre-1996 flood channel alignments. Initially, points were grouped by river miles indicated on USGS 7.5' topographic maps using channel geometry from a preexisting layer (SSHIAP hydrography for WRIA 30), however there was too much inconsistency in actual length due largely to both references being based on pre-1996 flood alignments. To more accurately represent the alignments that were actually surveyed, mainstem channel geometry was digitized using post-1996-flood aerial photography. Digital ortho-imagery derived from 1996 aerial photography was the most current available. After digitizing, the post-1996 flood alignment was converted to a "routed" layer. This allowed grouping of data points by regular increments (5280') of mainstem channel length. Across the study area, post-1996 geometry the USGS river miles were generally comparable to the routed approach (average river mile length = 5266' of mainstem channel). However, there was a standard deviation of 382' and individual mile segments were as little as 4129' or as much as 6287'. To eliminate the effect of these reach-specific departures the unit of comparison was standardized to 5280 feet of mainstem channel length. Thus, all data points were referenced to the routed post-1996 geometry because it provided the most accurate representation of the channel geometry that was actually surveyed. as well as the most consistent increments from one mile to the next.

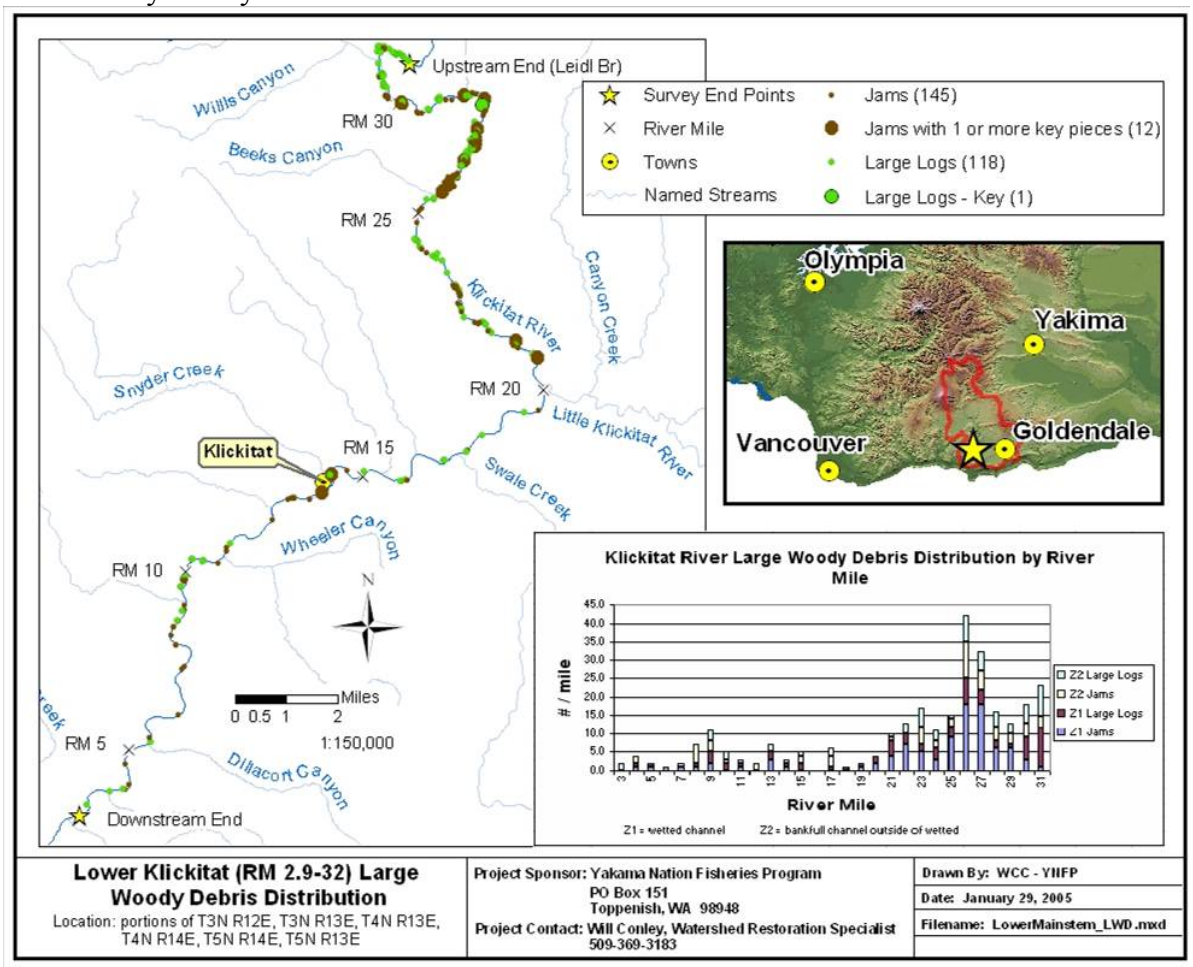

Figure 5. Results of large woody debris inventory along 29 miles of the lower Klickitat River.

- Results (Figure 5) indicate a fairly dramatic contrast between segments upstream and downstream of river mile 20. Upstream, average LWD/mile is 17.8 while downstream

averages 3.7 per mile ($p < 0.01$). This threshold corresponds with two major changes: 1) a large increase in artificial banks and 2) a large increase in contributing drainage area.

- The Little Klickitat River confluence (RM 20.1) marks the upstream-most position of State Highway 142 along the Klickitat River (upstream-most active channel contact at RM 19.7). The old SP&S railbed comes down Swale Creek Canyon and meets the Klickitat River near the mouth of Swale Creek (upstream-most active channel contact at RM 17.1). Artificial banks were digitized from field notes and digital orthophotos with 1m pixels at 1:5,000. Some post-digitized ground-truthing was conducted by boat as well as by vehicle along highway 142. Artificial banks were characterized as foreign materials introduced to the bankfull channel as well as native materials that had been anthropogenically graded and typically consisted of railroad and highway fill materials. Based on GIS analysis artificial banks increase by roughly 50% (average artificial confinement is 0.66 miles/mile downstream and 0.41 miles/mile upstream; $p < 0.05$) downstream of the Little Klickitat confluence.
- The Little Klickitat River increases contributing drainage area by 34% (281 mi^2). Additionally, Swale Creek enters at RM 17.5 and increases contributing drainage area by 131 mi^2 (12%). Since drainage area is one of the most consistent predictors of discharge, it would be expected that flood discharges would be correspondingly greater. Assuming similar hydraulic boundary conditions upstream and downstream, the discharge increase could be expected to increase stream power. In other words, the river could have a greater capacity to entrain and transport LWD from RM 20 downstream. It should be noted that boundary conditions were not evaluated as part of this study.
- Gradient is less than 1% in both subreaches, it is not expected as a predictive factor. In fact, GIS analysis suggests that the upper subreach (with more LWD) is actually steeper (0.007 ft/ft) than the downstream reach (0.004 ft/ft). This is contrary to what would be expected if gradient were a major influence. The difference is negligible and likely is not significant given the means by which it was determined.
- Local increases in LWD tend to occur with decreases in artificial bank length and vice versa (Figure 6). Note in particular river miles 6, 9, 13, 15, and 17. If the change in stream power were the governing condition on the change in distribution it seems unlikely that such a relationship would persist downstream of RM 20. Thus, spatial correlation between LWD and artificial banks suggests that confinement and channel conditions are more probably affecting distribution. It should be noted that the relationship between LWD and artificial banks is stronger for spatial association (e.g. presence/absence) than it is for the magnitude of their values (e.g. r^2 values). The r^2 value increased from 0.28 at 1-mile increments to 0.53 with a 3 mile moving average, to 0.67 with a 5 mile moving average. Thus, the strength of the predictive relationship between LWD magnitude and artificial banks increased with longer increments.

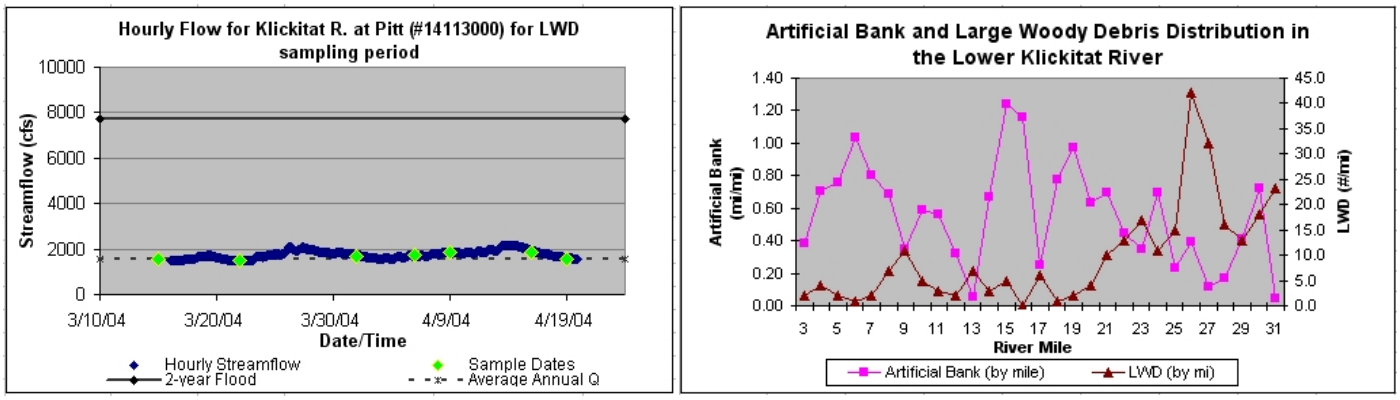

Figure 6. Streamflow at Pitt during sampling period relative to average annual discharge and 2-year return interval event (left) and LWD and artificial bank length per mainstem river mile (right).

- The effects of artificial banks are threefold: 1) increased hydraulic confinement above and beyond natural levels, 2) simplification of channel planform, and 3) reduced LWD recruitment potential. Increased confinement effects would effectively increase stream power which would both increase the likelihood of mobilizing LWD from within the reach as well as decreasing the likelihood of LWD deposition within the reach. The simplification of channel planform decreases the conditions where accumulation of LWD can occur. Hardening and or reshaping of banks has traditionally (outside of the restoration context) resulted in substrate less suitable for plant establishment (e.g. asphalt on Highway 142 or maintenance of railbed corridor). These effects would be expected to compound whatever effect the drainage area increase may have.
- If a change in transport potential were the major effect, then we should observe a large accumulation of LWD at the confluence with the Columbia River where it is backwatered by Bonneville Dam. Given that large accumulations of LWD do not exist at the mouth and there is variability within the reach, other processes may be more likely to limit LWD downstream of RM20, though stream power like still has some effect. Additionally, it would seem that the spatial variability observed in LWD distribution along the study reach (figure 6) would be less likely to exist. Pending funding and personnel availability, future analysis will assess.
- Natural valley confinement is expected to be a contributor. Qualitatively, lower portions of the river, appear to be more entrenched and have confinement, most likely as a consequence of historic deposition that occurred during backwater periods generated by paleofloods on the Columbia River and landslides occurring following draw-down of such backwaters. Recruitment potential is also a possibility, though it wouldn't explain why LWD from upstream isn't being retained.
- Based on current results, it seems that while confinement (combination of natural and artificial) is probably limiting LWD distribution in the lower portion of the river, abundance is probably being limited by recruitment potential (either from local bank inputs and/or low transport into the reach). Until the degree of natural confinement is determined, current results cannot fully determine the relative role of artificial confinement, but it is likely greatest between RM 10 and RM 20. Assessment of causative/influential factors will be assessed more thoroughly in the future.
- Preliminary results were useful in preparation of two Salmon Recovery Funding Board (SRFB) grants in May, both of which were approved for funding.

Goal B. Protect, restore, and enhance priority watersheds and reaches

Increase riparian, wetland, and stream habitat quality by restoring stream habitat conditions via in-situ and watershed-scale activities that mitigate or resolve conflicting historic, present, and/or future land-uses.

Objective B1. Protect areas of existing high-quality habitat condition

Task B1.1. Pursue easements and land acquisitions.

Many landowners are unwilling to conduct or permit conservation activities on their properties without compensation for perceived foregone economic opportunities. Residual high quality habitats will receive priority as well as degraded habitats identified as important for restoration. Since this project does not presently have a component to fund these efforts, it is accomplished by outside funding sources and partnerships with Columbia Land Trust. Easements and/or acquisitions occur only on a willing buyer – willing seller basis.

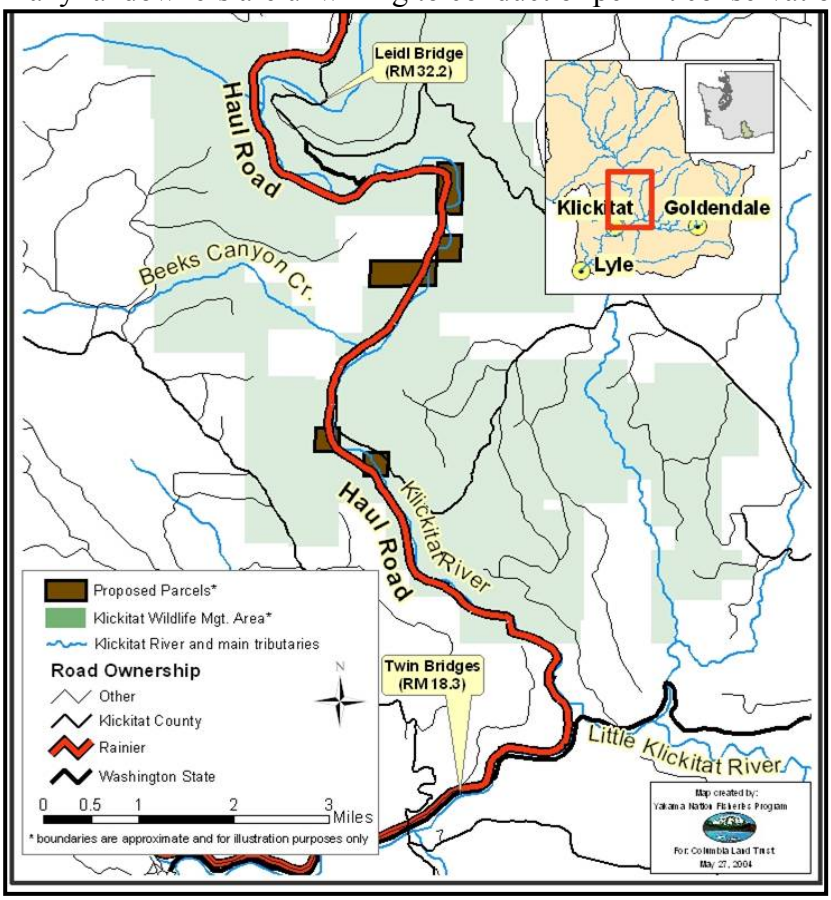

Figure 7. Overview of Klickitat River Floodplain Conservation and Restoration Project.

• KWEP specialists provided technical content for a SRFB project application with Columbia Land Trust as sponsor that will conserve and restore riparian and floodplain habitat along the mainstem Klickitat River between river miles 18.3 and 30.5. KWEP staff developed conceptual design and cost estimates for the restoration component of the project, created maps, provided technical content for the application. Phase I of the project will protect 320 acres of floodplain, riparian and associated upland, acquire a 14 mile-long road segment that encroaches on the floodplain, revegetate 7.5 acres of riparian and floodplain habitat.

- The feasibility assessment conducted in Task 2.1 is a component of this project and will assist scope determination of Phase 2 restoration actions associated with confinement caused by the haul road.

Task B1.2. Comment on proposed land-use actions

This task affords an opportunity to provide input to prevent or minimize the likelihood that today's land-use actions will become tomorrow's watershed problem. Actions and documents potentially affecting stream habitats in the Klickitat basin are reviewed as they are issued.

During the reporting period, KWEP staff provided some input on planning, reviewing, and monitoring forest management activities on the Yakama Reservation. Personnel time for these inputs were cost-shared with other YNFP funds, specifically YN Forest Management Deductions (from timber sale receipts) and Klickitat M&E Project. KWEP activities conducted during this contract period included:

- Attending an Interdisciplinary Team meeting to review forest management activity
- Reviewing and commenting on the 2004-2013 YN/Bureau of Indian Affairs Forest Management Plan
- Reviewing and providing fisheries-related information for Environmental Assessments for four timber sales
- Providing fisheries-related information for two forest road improvement/repair projects
- Reviewing and commenting on a proposal for development of a 4-season resort in the on-reservation Mt. Adams Recreation Area

Objective B2. Restore degraded stream channel and watershed conditions.

This objective involves development and implementation of restoration projects. Generally, KWEP specialists are the primary developers and project managers, but in some cases KWEP specialists provide technical input for projects sponsored by other entities.

Task B2.1. Restore mainstem Klickitat River floodplain connectivity

Though no longer in use, a privately-owned haul road continues to dissect floodplain habitat and encroach on the active channel of the Klickitat River between river miles 18 and 31. This task involved contacting the landowner and conducting a feasibility study.

- KWEP specialists arranged and participated in a field meeting between the owner's management company (Campbell Group) and Columbia Land Trust during fall 2000
- Developed a SRFB project proposal with Columbia Land Trust as sponsor to conserve and restore riparian and floodplain habitat along the mainstem Klickitat River between river miles 18.3 and 30.5 (described in Task B1.1).
- KWEP staff developed conceptual design and cost estimates for the restoration component of the project, created maps, provided technical content for the application.
- Advertised Request For Qualifications (RFQ) in the Seattle Daily Journal of Commerce for design and assessment assistance. Received responses from 15 interested firms. Awarded subcontract to InterFluve, Inc.

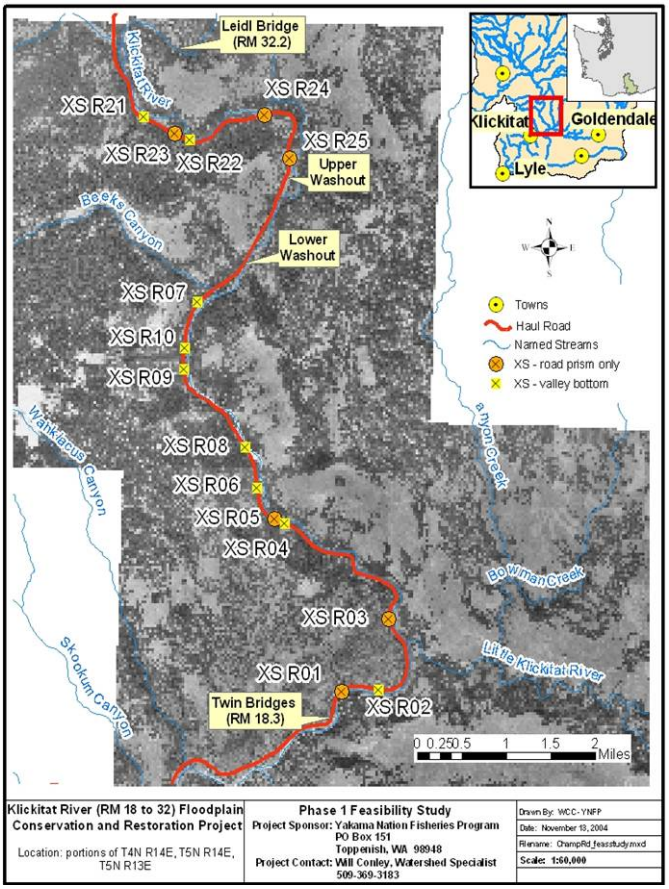

Figure 8. Sampling locations for feasibility assessment.

- Contracted with InterFluve, Inc to conduct a feasibility assessment to identify project sites for Phase 2 implementation and quantify potential benefits and costs.
- Developed contract exhibits and conducted site visits to the Klickitat River mainstem between Twin Bridges (RM 18.3 and Leidl Bridge (RM 32.2) and identified priority areas for cross-sections.
- Assisted InterFluve personnel survey cross-sections 9 valley-bottom and six road prism cross-sections (Figure 8). Also provided InterFluve with hydrology data.
- InterFluve reduced survey data, performed flood frequency analysis, and developed a hydraulic model using WinXS Pro. Conceptual alternatives were discussed.
- Draft and final reports will present model results, design alternatives, and cost estimates and be prepared as part of the FY05 KWEP contract.

Task B2.2. Initiate resolution of fish barriers in the White Cr. watershed.

Previous surveys by Klickitat M&E Project personnel and analysis by KWEP specialists identified several culverts within the White Creek watershed that are barriers to fish migration.

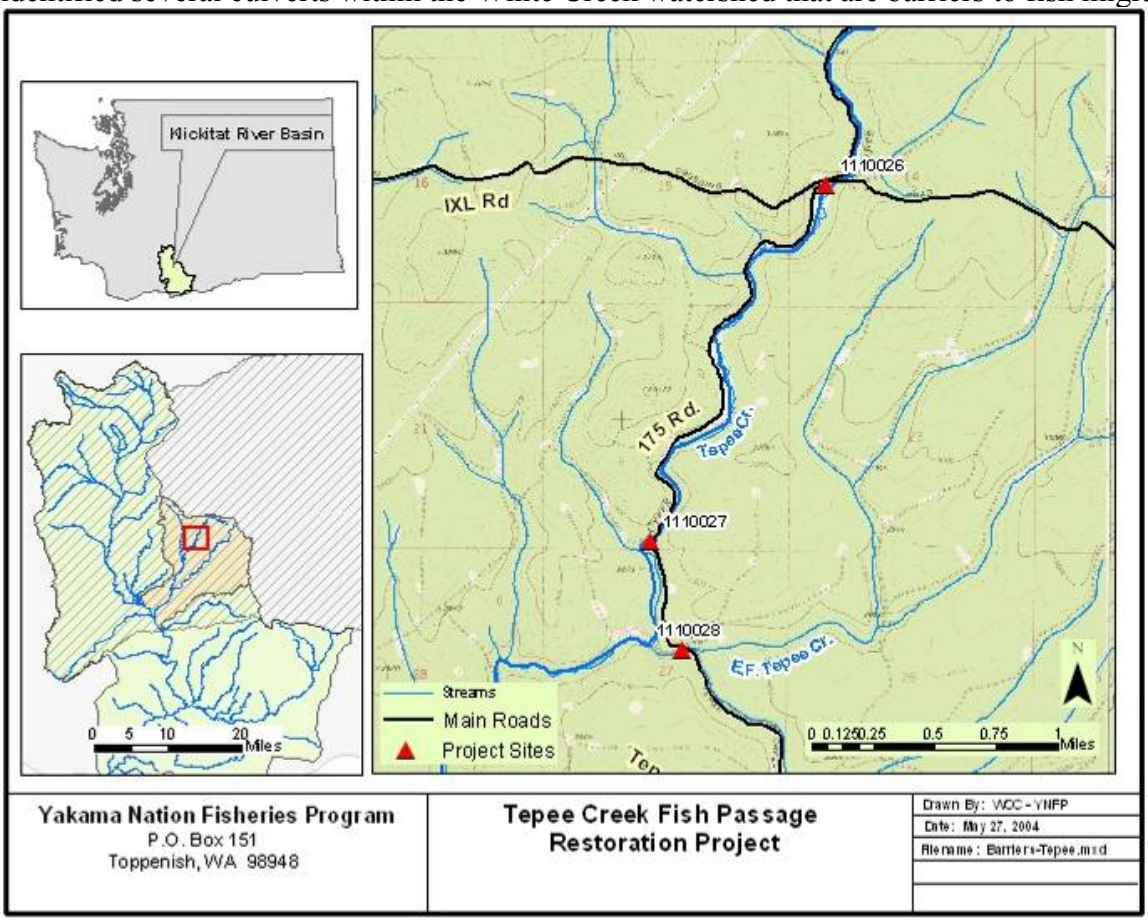

Figure 9. Work sites for Tepee Creek Fish Passage Restoration Project.

- Preliminary topographic surveys were completed at four sites: White Creek at IXL Rd, Tepee Cr at IXL Rd, Tepee Cr at 175 Rd, and EF Tepee Cr at 175 Rd (Figure 9). Control points were established and longitudinal profiles of streambed and water surface were surveyed at least 200 feet upstream and downstream of each crossing.
- Developed site hydrology, sized pipes and developed conceptual design and cost-estimates.
- Developed a SRFB project proposal for the three crossings occurring in the Tepee Creek sub-watershed that will replace 3 partial barriers to restore juvenile access to 8.7 miles of

upstream habitat. The SRFB proposal was approved for funding in December 2004. The FY05 KWEP contract will provide in-kind design, permitting, and materials support.

Task B2.3. Klickitat Meadows (Diamond Fork) Restoration Project.

Work occurred at two different work sites in Klickitat Meadows along Diamond Fork Creek (Figure 10). KWEP funded planning, design, permitting, materials, construction oversight and a small portion of construction. Construction costs were funded primarily by a SRFB grant received by the YNFP.

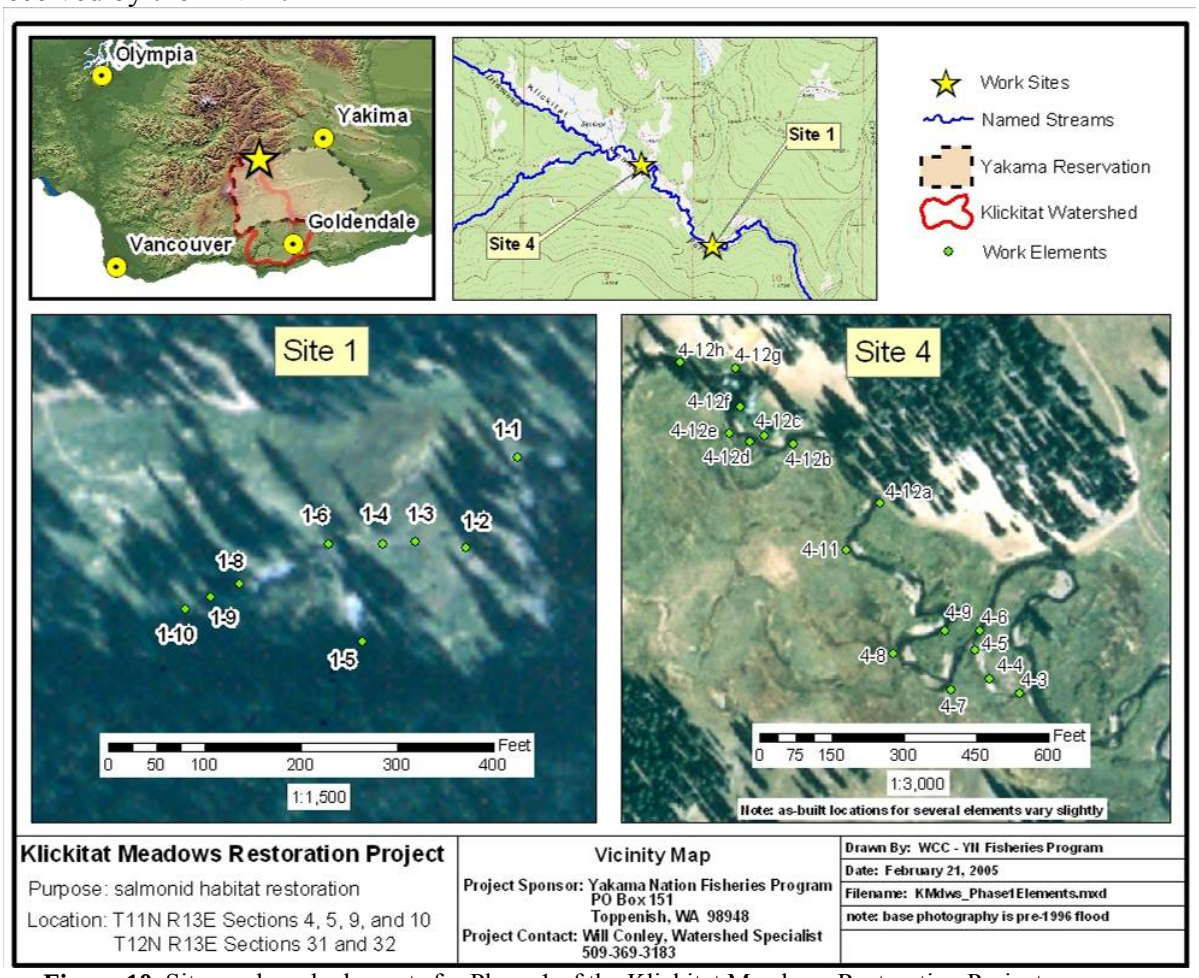

Figure 10. Sites and work elements for Phase 1 of the Klickitat Meadows Restoration Project.

The primary goal at Site 1 was to reduce potential of stream capture by an off-channel head-cut initiated by an illegal jeep trail. Minimizing the draining effects of the head-cut on the meadow and in stream habitat enhancement were secondary goals. Work involved 9 elements along roughly 700' of stream. The primary goal at Site 4 was to localize vertical instability associated with an avulsion channel and enhance habitat conditions. Implementation involved 16 elements along roughly 2200' of stream. General habitat conditions have diminished associated with increased width-depth ratios and reduced riparian cover and floodplain connectivity most like associated with historic overgrazing. Both project sites occur on Washington State trust parcels (administered by WDNR) within Tract C of the Yakama Reservation.

- Coordinated the annual meeting with regional and district-level Washington State Department of Natural Resources (WDNR) staff to review activities associated with the Klickitat Meadows Restoration Project MOU. Developed a PowerPoint presentation that reviewed and forecasted restoration activities. Received necessary permits (WDNR Land-

Use License, ACOE Nationwide 27, and WDFW Hydraulics) and exemptions (Yakima County Shorelines and WDOE Water Quality Certification) in fall 2003. Prepared NEPA checklist for KWEP-funded implementation.

- Delay in receipt Nationwide 27 and HPA permits pushed initial construction into late-October 2003. Early winter weather resulted in only partial completion during 2003. LWD collection was completed at Site 1 and partially completed at Site 4. Rock collection and stockpiling was completed. Installation was completed for two elements at Site 1. Primary design was conducted by The Watershed Company.

Figure 11. Site 1 as-built photos: LWD jam (element 5, left) and LWD and riffle coarsening at (elements 9 and 10, right).

- Applied for and received an extension of SRFB funding to complete construction during summer 2004. Realigned KWEP funds (as part of May 2004 rescheduling budget modification) to allow implementation of project elements for which there was insufficient SRFB funding.

Figure 12. Before (left) and after (right) pictures of downstream control for avulsion channel (Site 4, Element 3).

- Completed LWD collection and in-channel installations at both work sites as well as rehabilitation activities. Installation of earth anchors did not occur initially due to equipment availability.
- Our design approach minimized excavation because of concerns of the YN Cultural Resources program. Thus, excavating new channel was ruled-out early on. Our preferred design approach for controlling bed elevation was to coarsen riffles upstream of the respective avulsion paths, however, the initial HPA did not permit this activity. Upon appeal, it was allowed at Site 1 but not at Site 4 despite the presence of analogue conditions nearby.

KWEP specialists did not think that log-weir structures suggested by WDFW were appropriate for the geomorphic setting and stream type. Thus, further upstream migration of several small headcuts already within the primary channel was not directly addressed. It was indirectly addressed by modifying the location of elements 8 and 11 to allow or encourage increase in channel length which will hopefully make up some of the grade differential in the long run.

Figure 13. Upstream control for avulsion channel (Site 4, Element 5) before (7/8/03, left) and after construction (7/7/04, right).

Figure 14. Fine sediment trapped in former avulsion channel (Site 4, Element 5, 8/29/04, left) a week after thunderstorms generated near-bankfull flows and seven weeks after construction. Element 7 (right) as-built following modifications on 10/29/04.

- Thunderstorms in mid-August 2004 created near-bankfull conditions and high turbidity. Site inspection confirmed that turbidity was a result of systemic fine sediment inputs and not a results of mass wasting or failure of project elements.
- Equipment was mobilized to install earth anchors for Site 4 elements in October 2004. Earth-anchor installation was much more difficult than anticipated and, as a result, occurred in roughly six locations. Consequently, modifications were made to size and arrangement of previous LWD placements. Ten placements were consolidated into six to provide increased structural complexity and mass for stability. Additionally, roughly 550 willow cuttings were collected, prepared and planted in two locations.

- Completed IAC reporting (documentation of in-kind contributions, etc.) and the KWEP-funded portion of the project was completed under-budget and the balance was re-aligned to allow full implementation of the Klickitat River Meadows Project design.

Figure 15. Bank before (7/28/03, left) and after (10/29/04, right) LWD jam construction at Site 4, Element 12a.

Task B2.4. Klickitat River Meadows Restoration Project.

Work occurred within two meadows (Kessler's Ranch and Caldwell Prairie) between river miles 78.2 and 81.2 of the Klickitat River (Figure 16). KWEP funded planning, design, permitting, materials, construction oversight and a portion of construction. Construction costs were funded primarily by a SRFB grant sponsored by the YNFP. All work was conducted on tribal trust land of the Yakama Reservation.

- Implementation of the Klickitat River Meadows project was initiated in November 2003 and involved collection of materials (rock and wood) prior to suspension of activity due to onset of winter weather conditions. Accomplishments for the period included: collection, transport, and stockpiling 100% of ballast required (135 boulders) at 8 different work sites; regrading, seeding, and mulching of the boulder collection site; and harvest and stockpiling of 55% of LWD (158 trees, 96 of which had rootwads). Implementation was funded by a Salmon Recovery Funding Board (SRFB) grant. Oversight and administration was conducted by Klickitat Watershed Enhancement Project (KWEP) project staff.
- Applied for and received an extension of SRFB funding to complete construction during summer 2004. Realigned KWEP funds (as part of May 2004 rescheduling budget modification) to allow implementation of sites for which there was insufficient SRFB funding. Initial combined BPA and SRFB budgets were sufficient to fund roughly 75% of the total design. Completion of the Klickitat Meadows (Diamond Fork) project under-budget allowed re-alignment to facilitate full implementation of the Klickitat River Meadows design.
- Project staff wrote and submitted Biological Assessment to BPA Environmental Program and ESA consultations were completed. Prepared NEPA checklist and submitted to BPA Environmental Program.

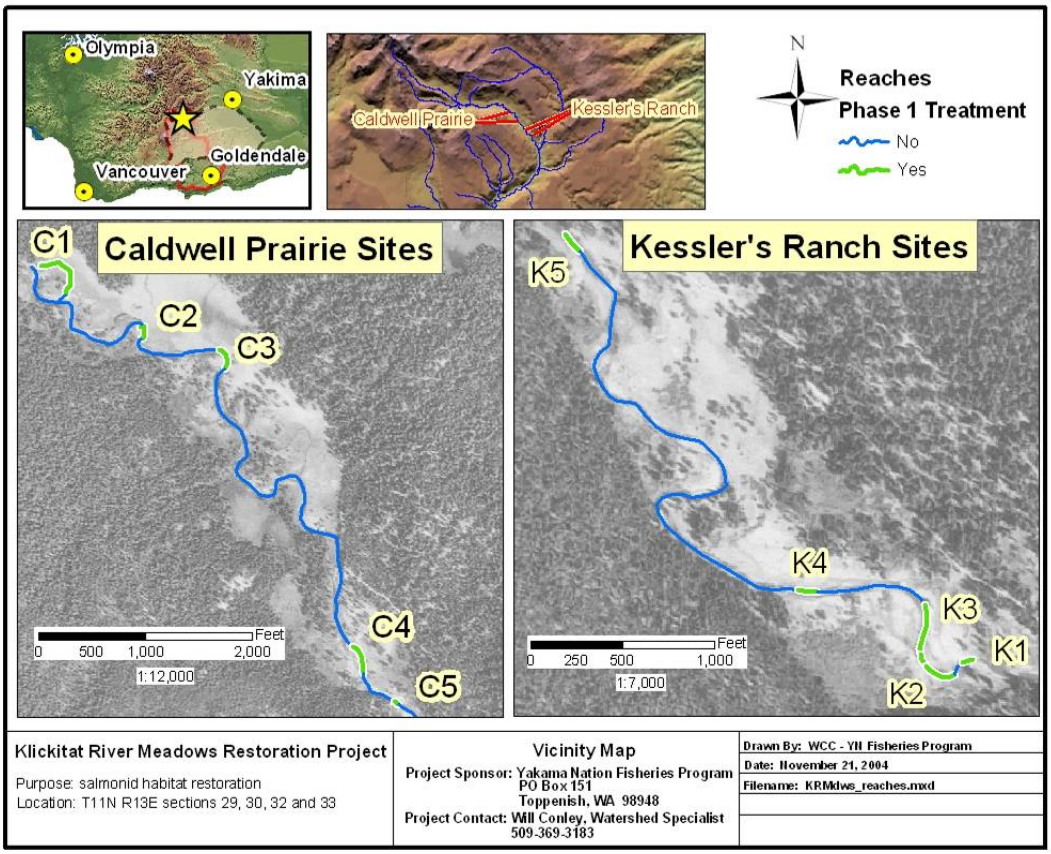

Figure 16. Map of Phase 1 work sites for Klickitat River Meadows Project.

- The design approach minimized excavation because of concerns of the YN Cultural Resources program.

Figure 17. Before (left) and after (right) pictures of the upper portion of site C2.

- Completed LWD collection and in-channel installation during June, July, and August 2004. Fit-in-the-field design and installation oversight was conducted primarily by InterFluve, Inc. Rehabilitation activities were completed in early September. Though the project was conceived with a 300-series excavator in mind for installation, the construction subcontractor could not obtain one to complete the project with budget and fish window timelines. Given

the high level of skill and experience of the operator, KWEP specialists decided to proceed using a 200-series excavator. The LWD jams were still constructed as conceived, though some additional access issues had to be resolved (due primarily to shorter reach length and lighter counterweight). Because payment for the subcontract was on a lump-sum as completed basis, the additional time required to complete structures because of using smaller equipment was absorbed by the contractor.

Figure 18. Before (left) and after (right) pictures of site C3.

- Treatments consisted of LWD placement and minor excavation of banks. Roughly 825' of active channel and 150' of floodplain were treated in Kessler's Ranch while 725' of active channel and 550' of floodplain were treated in Caldwell Prairie. All active channel placements were cabled and most (except for K1 and K5) were ballasted with boulders using a cable-epoxy technique.
- Several site visits were conducted to monitor rehabilitation of access routes and collection sites.

Figure 19. Site C5 (left) and the upper portion of site K3.

- Thunderstorms in mid-August 2004 created high turbidity. Site inspection confirmed that turbidity was a result of upstream sources and not a result of erosion from project sites.
- Completed IAC reporting (documentation of in-kind contributions, etc.) and the KWEP-funded portion of the project was completed within-budget.

Figure 20. Roughness elements placed at Site C1 along avulsion path (left). In-channel LWD jam constructed at site K5.

- Salmonids were observed using many of the structures within days of their completion. Adult Chinook salmon generally moved into the Kessler jams within a day of completion. In one case three adult Chinook held within a completed portion of a structure where we working on an adjacent installation less than 100' upstream. In Caldwell Prairie, juvenile and resident *O. mykiss* as well as Pacific tree frogs (*Hyla regilla*) colonized sites C2 and C3 within days of completion.

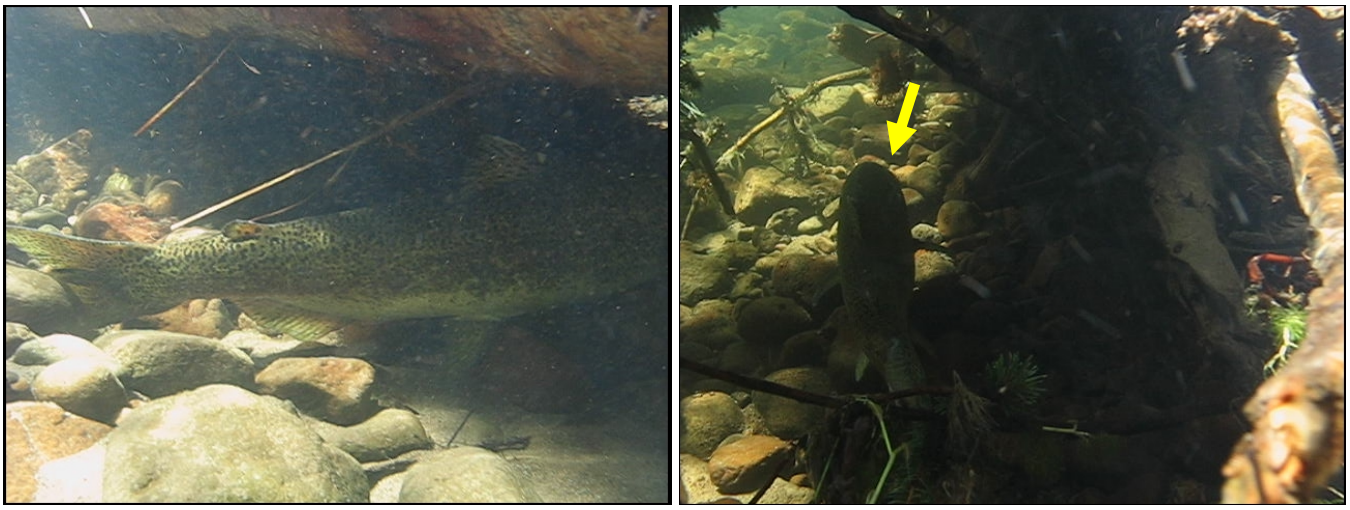

Figure 21. Adult Chinook salmon holding in LWD placed 3 days earlier at site K1.

Task B2.5. Deleted from work statement in May 2004.

Task B2.6. Replace fish passage barriers in Trout Creek watershed.
This project involves replacing two stream crossings of the Peavine Ridge Road: one on Trout Creek and one on Bear Creek. These crossings were identified as barriers to fish migration by the Klickitat M&E Project using WDFW methodology (WDFW 1998). Installation costs are being funded by a YNFP-sponsored SRFB grant and Yakama Forest Products. KWEP is providing in-kind support by purchasing materials and providing planning, design, and implementation oversight. Construction was originally scheduled for August of 2004 but was

postponed because delays in approval of the rescheduling request delayed the ability to award a subcontract for geotechnical assessment.

- Conducted planning and design for the Trout Creek Passage Restoration project.
- Advertised Request For Qualifications (RFQ) in the Seattle Daily Journal of Commerce for engineering assistance. Received responses from 6 interested firms. Awarded subcontract to GeoEngineers.

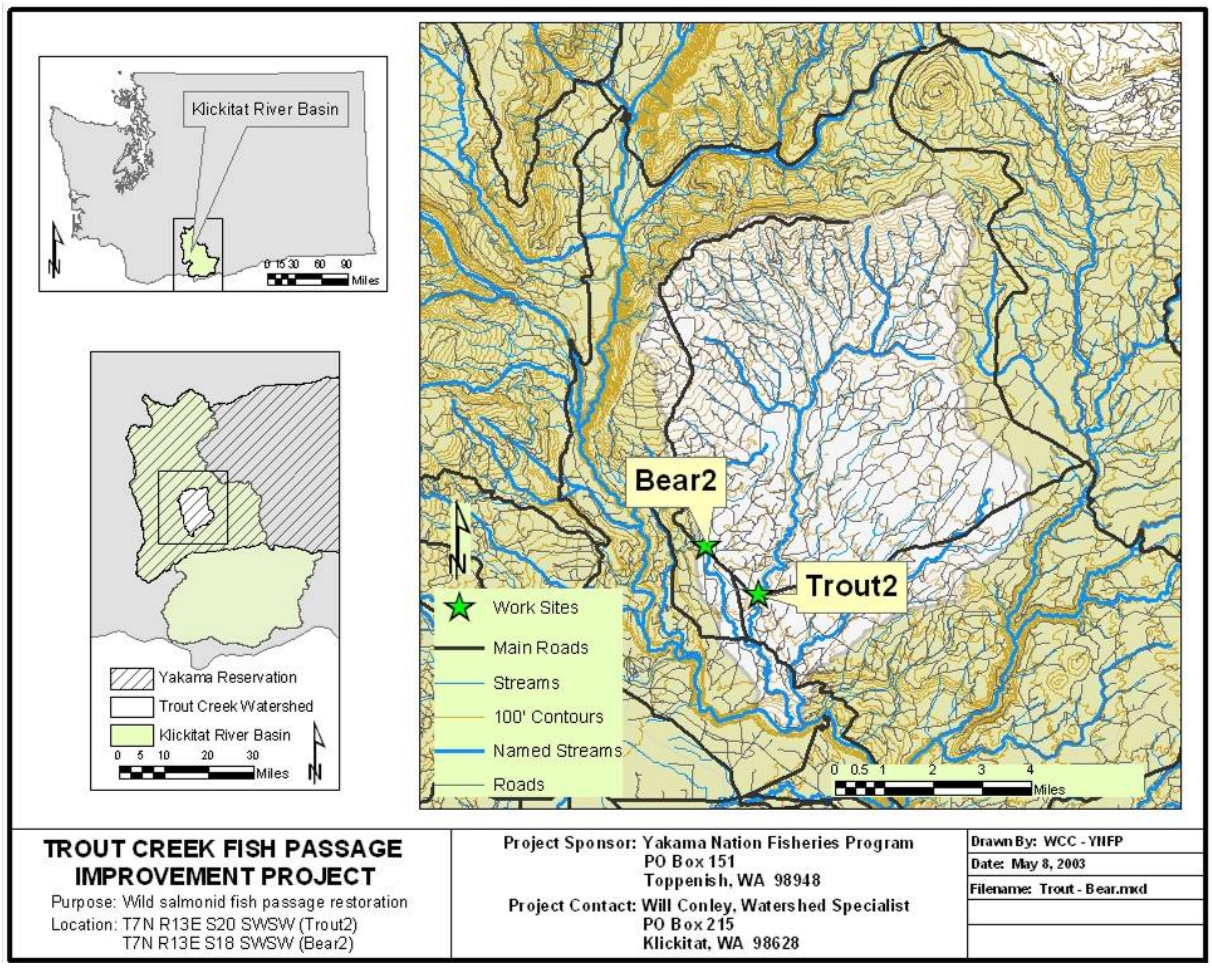

Figure 22. Location of work sites associated with Trout Creek Fish Passage Improvement Project.

- KWEP specialists provided GeoEngineers with substrate, hydrology, design, and topographic data for both crossings.
- GeoEngineers conducted site visit to evaluate bearing conditions, developed a hydraulic model to evaluate bed scour for both crossings, and presented conclusions in letter report. The geotechnical evaluation determined that footings could be designed based on an allowable bearing strength of 6,000 psf. Hydraulic modeling of the designs for both crossings indicated that scour depths associated with 100-year flows will not undercut footings.

Task B2.7. Conduct revegetation planning along the lower Klickitat River.

Flooding in 1996 left extensive gravel deposits along the mainstem Klickitat River that are not showing signs of natural revegetation. Many of these surfaces are elevated well above the surface of the two-year recurrence interval (a.k.a. bankfull) which typically correlates to the presence of perennial vegetation. Where native woody riparian species have recolonized these deposits, it is generally only a narrow strip around the margins.

- Developed a SRFB project application with Mid-Columbia Regional Fisheries Enhancement Group as sponsor for riparian and floodplain revegetation along the mainstem Klickitat River between river miles 2.6 and 18.3. Phase I activities will occur on seven sites and total 6.9 acres with 1.45 miles of stream bank (Figure 23).

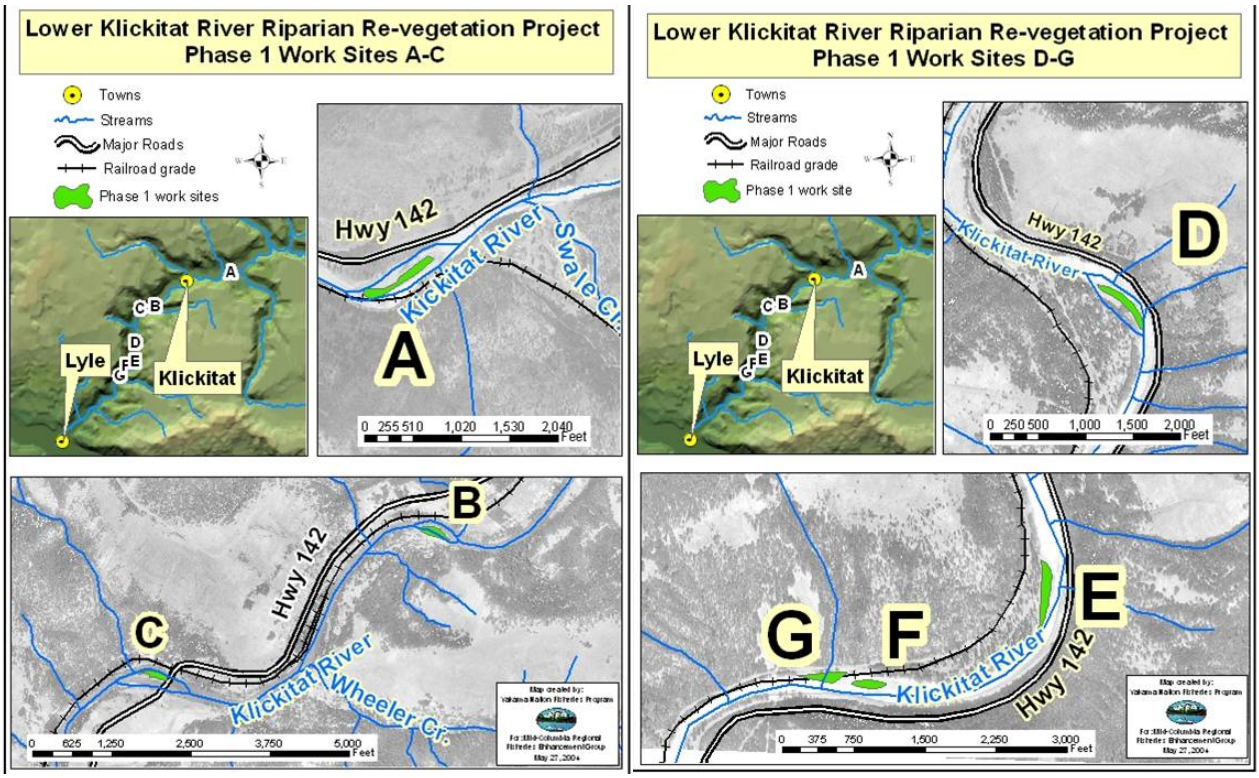

Figure 23. Phase 1 worksites for Lower Klickitat Riparian Re-vegetation Project.

- Developed a second SRFB project application with Columbia Land Trust as sponsor (related to Task B1.1) for riparian and floodplain revegetation along the mainstem Klickitat River between river miles 18.3 and 32.2. Phase I activities will occur on seven sites and total 7.5 acres with 0.6 miles of stream bank (Figure 23).
- KWEP specialists developed conceptual design and cost estimates, created maps, provided technical content for the application. Both projects will address limiting features and functions (poor riparian and floodplain vegetation) identified by the Klickitat TAG for the project reach. KWEP will provide design, permitting assistance, implementation oversight, and assist with materials.
- Phase 1 implementation for both projects is anticipated for late 2005 or early 2006. Planting for both projects will occur as part of the same effort, so that mobilization costs are kept to a minimum.

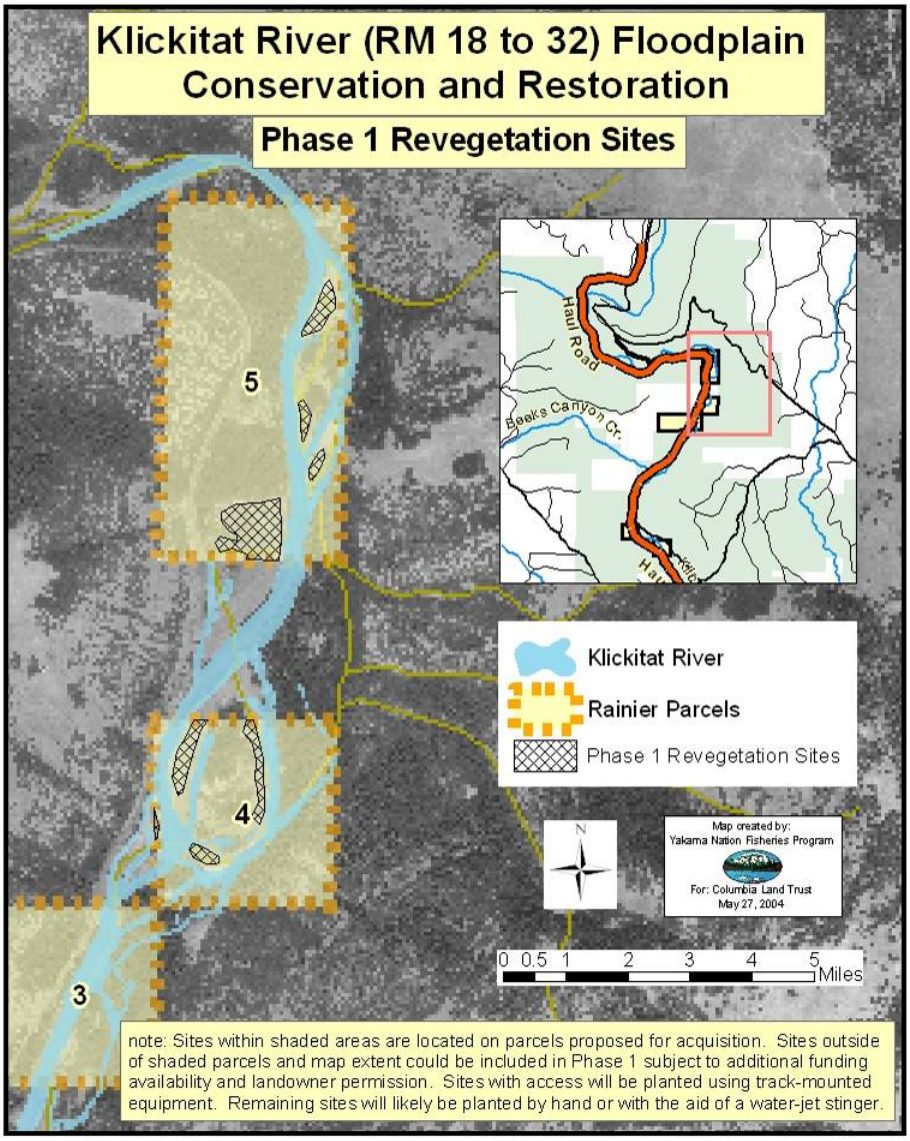

Figure 24. Phase 1 worksites for Klickitat River Floodplain Conservation and Restoration Project.

Task B2.8. Continue restoration planning associated with SP&S railbed.

A study funded by the SRFB, MCRFEG, and KWEP's precursor (the Lower Klickitat Riparian and In-Channel Habitat Enhancement Project) in 2001-2002 identified eight major locations for restoration projects in Swale Canyon. KWEP specialists have also identified work sites along the mainstem Klickitat River. Planning and design have been on hold until the potential managing agencies (Washington State Parks and Recreation Commission and U.S. Forest Service) sort out their responsibilities and interests.

- The USFS issued a Decision Notice that their involvement in management of the proposed trail would be limited to roughly the lower 15 miles. The WSPRC (responsible party for the railway) decided to retain their interest in the portion of the railbed not managed by the USFS. KWEP specialists have made both agencies aware of habitat concerns associated with the railbed and it is hoped that more detailed discussion on restoration and enhancement will proceed during the FY05 reporting period.
- Assisted a Swale Creek landowner prepare a Washington State Landowner Incentive Program grant application that was successfully funded. KWEP specialists provided

conceptual design alternatives, created maps, and provided technical content for the proposal and will provide technical assistance with project implementation (anticipated in 2006).

Task B2.9. Deleted from work statement in May 2004.

Task B2.10. Restore stream and meadow habitat along Tepee Creek.
Tepee Creek is a tributary of White Creek that provides spawning habitat for mid-Columbia steelhead (ESA-threatened). Extensive reaches of Tepee Creek have become incised and are now intermittent in many places that anecdotal evidence suggests were once perennial. The overall project goal is to restore floodplain connectivity and channel planform for a 1700' reach immediately downstream of the IXL road crossing (site 1110026, Figure 9). This would have the effect of increasing floodplain storage, reducing severity of active channel hydraulic conditions during high flows, and potentially restore low flows to this and downstream reaches. The preferred conceptual approach is to restore channel grade and elevation using planform adjustments and natural bedforms. Despite its degraded conditions Tepee Creek has accounted for up to 21% of the observed spawning in the Klickitat subbasin in recent years. Even though steelhead spawning in Tepee Creek probably accounts for more like 5 and 10% of basinwide spawning in most years, it is still a significant contributor.

- Advertised Request For Qualifications (RFQ) in the Seattle Daily Journal of Commerce for engineering assistance. Received responses from 14 interested firms. Awarded subcontract to InterFluve, Inc to evaluate conceptual design alternatives, collect topographic data, develop a one-dimensional model, and provide materials and cost estimates for design alternatives.
- KWEP specialists conducted sediment sampling (bulk and pebble count) and assisted InterFluve with topographic survey.
- KWEP specialists provided InterFluve with precipitation data and a copy of the HEC-HMS derived hydrology data (nhc, 2003).
- InterFluve reduced survey data, reviewed hydrology information, and developed a hydraulic model using HEC-RAS.
- Conceptual alternatives were discussed and a InterFluve prepared a report presenting model results, design alternatives, and cost estimates.

Task B2.11. Planning for mainstem White Creek in-channel restoration.
White Creek is an important spawning and rearing tributary for mid-Columbia steelhead (ESA-threatened). Much of the mainstem of White Creek has a very simplified, plane-bed channel form and physical habitat conditions are correspondingly poor. This task focuses on the reach between the 207 Road crossing (RM 9.6) to the washed-out crossing at RM 3.2. This reach was selected because it has clearly experienced simplification and it straddles the transitional zone of perennial water presence. Fish stranding in the summer is common upstream of Brush Creek and pool quality is poor to marginal downstream. Given the coarse nature of valley bottom sediments throughout the reach (i.e. low potential for long-term floodplain storage) and generally close proximity of bedrock, it seems most likely that baseflow hydrology is currently governed by groundwater inputs from flood basalts. Under the best conditions in this reach, pools only account for 14% (by length) of the channel and quality (based on residual depth) is poor to marginal. LWD frequency is also poor and averages 6.3 large logs and jams per mile. The presence of riparian stumps and yarding corridors throughout the reach suggest historic riparian clearcutting as a probable cause of low cover and in-channel LWD frequency. Increased peak flows associated with road development in the headwaters (nhc 2003) have likely had negative

consequences on stream channel morphology and habitat. Additionally, scour marks on trees and deposits in the upper mile of the reach suggest one or more debris torrents have occurred. Torrents may have been associated with historic road crossing failures for which there is also evidence. Despite its degraded condition, the White Creek watershed as a whole is likely the most important steelhead spawning tributary watershed within the Klickitat subbasin. In recent years, the White Creek watershed has accounted for up to 40% of the observed steelhead spawning in the entire Klickitat subbasin.

- Advertised Request For Qualifications (RFQ) in the Seattle Daily Journal of Commerce for engineering assistance. Received responses from 14 interested firms. Awarded subcontract to InterFluve, Inc to conduct a site visit to assist KWEP specialists identify and prioritize potential restoration and enhancement work sites.
- Two representatives from InterFluve walked the reach with KWEP specialists to provide input on selection of project sites and constructability given the degree of apparent change in channel conditions and lack of access. It was agreed that restoration activities should focus on enhancing areas with current late-summer water.
- Twenty-six sites were identified, 18 of which are downstream of the Brush Creek confluence (Figure 25). Treatments will all involve LWD placement and may involve some excavation of existing pools to improve pool quality. KWEP personnel will revisit the reach during the FY05 reporting period to develop site-specific prescriptions and prioritize sites. Access routes and helicopter logistics will also be assessed.

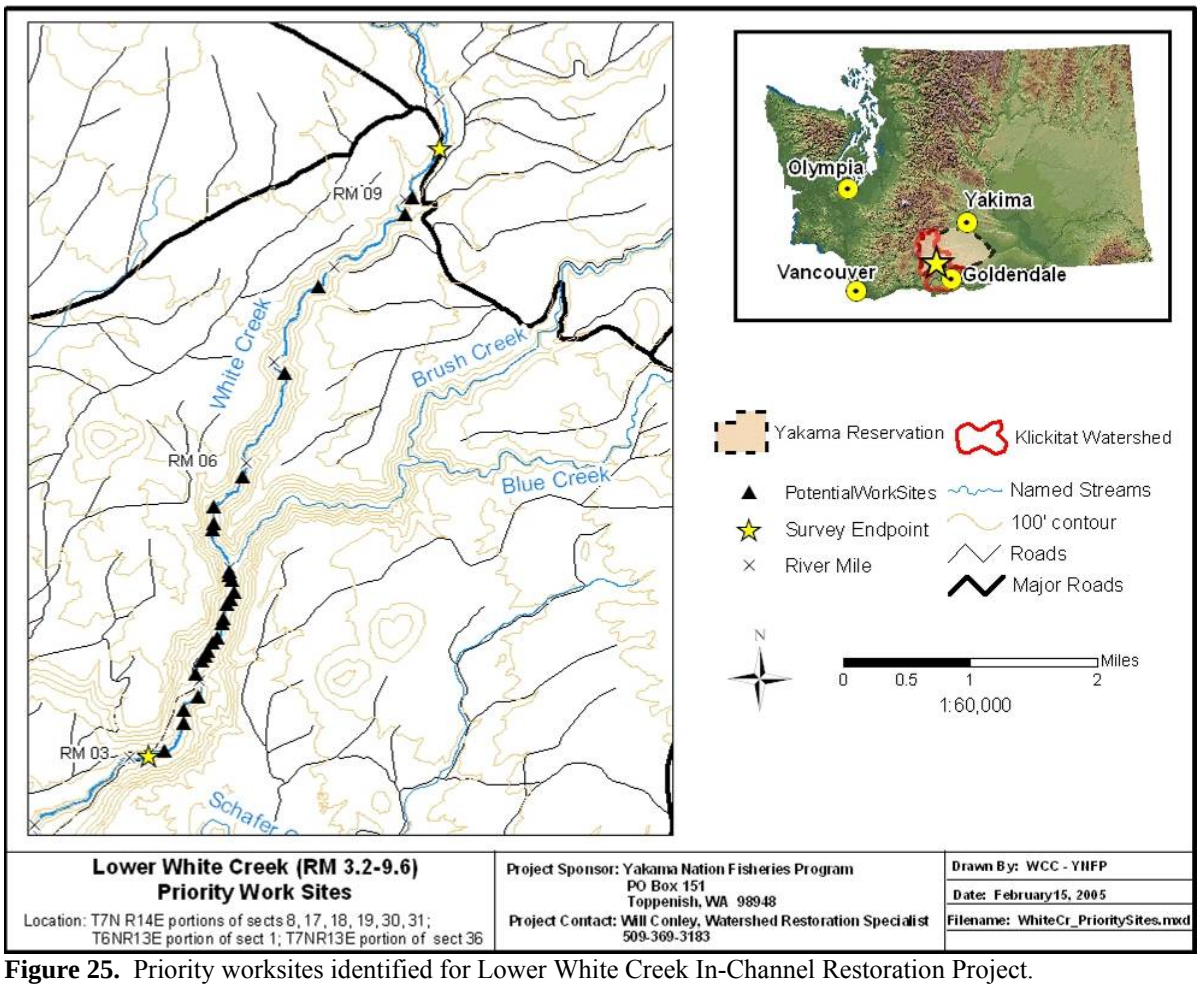

Figure 25. Priority worksites identified for Lower White Creek In-Channel Restoration Project.

Task B2.12. Assist ongoing restoration efforts at the former Klickitat Mill.
Project staff will provide technical input and on revegetation efforts at the Klickitat Mill. Revegetation will focus in the vicinity of the old mill pond and two road crossings upstream of the old pond. If necessary, we may also assist with providing plant materials.

- A longitudinal profile and several cross-sections were surveyed in the portion of the Klickitat Mill Project immediately upstream of the flume in the vicinity of the old pond. Data will be used as a baseline for monitoring purposes.
- Assistance was provided to a volunteer planting effort at the Klickitat Mill sponsored by the Mid-Columbia Regional Fisheries Enhancement Group (MCRFEG). Planting occurred in the vicinity of the old pond and consisted of dormant cuttings and rooted stock. KWEP personnel provided technical instruction on identification, collection, preparation, and installation of willow, cottonwood, and dogwood cuttings. Approximately 600 cuttings were planted along roughly 200' of the newly constructed right-bank in the vicinity of the old pond as well as in the adjacent floodplain. Selection and installation of rooted-stock was conducted by MCRFEG.
- KWEP specialists made two visits to the project site to observe channel changes, weir performance, plant survival, and fish distribution and spawning. Steelhead were observed spawning as far up as the vicinity of the second group of log weirs (~STA 1200).

Goal C. Monitor site-specific and basin-wide conditions
The Klickitat M&E Project is the principal effort charged with monitoring physical habitat data in the Klickitat subbasin. However, in the last four years KWEP staff have assisted the M&E project by taking-on oversight of habitat, temperature, and sediment data collection and management as well as data analysis. KWEP also monitors streamflow at 10 sites within the subbasin.

Objective C1. Monitor site-specific habitat conditions.
KWEP staff provided quality control and quality assurance, data management, and analysis for habitat-related data collected by the M&E project.

Task C1.1. Assist collection and quality control of habitat data.
KWEP staff assisted collection of habitat data (using TFW protocols) by Klickitat M&E project personnel and provided quality control.

- KWEP specialists conducted a 3-day pre-sampling field review of TFW habitat survey protocols with M&E technicians.
- Reference Point (channel cross-sections), habitat, and large woody debris data were collected at six locations (2 on Klickitat River, 2 on Diamond Fork, and 1 each on Bear Creek and Swale Creek). All six sites had been previously inventoried. Once TFW database modifications are completed during FY05 reporting period, these data will be compared over time.

Objective C2. Monitor indicators of basinwide habitat conditions.

Task C2.1. Continue collection streamflow data.
The Yakama Nation has 22 staff gages deployed throughout the subbasin. Measurements to maintain ratings on these sites is conducted primarily by YN Water Program personnel funded through KWEP. Ten of these currently have crest gages and three have data loggers. KWEP personnel plan to install eight more data loggers by the end of 2006. This data is presently

maintained by KWEP personnel but will likely be incorporated into the temperature database at some point because the data structure is so comparable.

- Maintenance of streamflow stations including data management, physical site maintenance, and flow measurements for rating curves continued.
- Crest gages were fabricated and installed at 9 sites.
- Purchased ten pressure transducers with dataloggers to provide continuous flow data. Sensors will be installed during the FY05 reporting period.
- 58 instantaneous streamflow measurements were taken at 19 gage sites on 12 streams.
- Instantaneous streamflow measurements were taken at five sites at the mouth of Swale Creek to quantify surface flow loss to alluvial fan sediments.

Task C2.2. Assist collection and quality control of temperature data.

In early 2003, oversight of temperature monitoring was transferred to KWEP oversight. KWEP specialists have worked with the Klickitat Data Manager to develop and maintain a relational database. All water and air temperature data collected since monitoring was initiated in 1995 has been imported into the database. Temperature sensors are currently deployed at 31 sites throughout the basin.

- In fall 2003 KWEP staff began phasing-out all HoboTemp devices for replacement with Optic StowAway devices at water temperature sites and HOBO-H8 devices at air temperature sites. Stowaway and HOBO-H8 sensor/loggers have greater memory and can store a full years worth of data at 30-minute intervals. This conversion has resulted in more accurate data with fewer gaps and required less personnel time for retrieval.
- Beginning in 2004 all sensors are being calibrated (single-point) in an ambient water bath to an NIST-certified thermometer at least once a year. The 30-minute sampling increment, NIST calibration, and greater device accuracy have significantly increased our data quality. Air temperature stations are utilizing the HOBO-H8 devices as they provide a greater sensing range (-20°C to +70°C) than the StowAways (-4°C to +37°C). We anticipate adding air temperature sensors at more sites in FY05. A total of 113 sensors (Stowaways and HOBOs) were calibrated during the reporting period.
- 40 protective housings were fabricated out of PVC by project staff for containing "Stowaway" type sensors.
- Thermographs were swapped-out at all temperature monitoring locations. Data was downloaded, error-checked, and imported into the Temperature Database.
- Raw data was plotted and checked for spiking, drift, and other data irregularities prior to importation to the database.

Task C2.3. Assist collection and quality control of substrate data.

Bulk spawning gravel samples are collected annually by Klickitat M&E Project technicians at several sites throughout the basin but primarily along the mainstem Klickitat River. Monitoring began in 1998 at three sites and has averaged 10 sites/year since with a total of 18 sites being sampled since 1998. Sample are typically collected in October and November sieved in January and February. Data are entered and analyzed in March and April. This data was managed by Klickitat M&E personnel until 2003 when it was transferred to KWEP personnel.

- Entered and analyzed sediment data from 12 locations along the Klickitat River mainstem and Diamond Fork collected in fall 2003.
- Developed into cumulative frequency and percent fine sediment by year charts for inclusion in the Klickitat Monitoring and Evaluation (M&E) project's annual report.
- Provided instruction on collection of 2004 samples.

Other Accomplishments

- Gave a presentation to the Anadromous Fish Committee of the Columbia Basin Fish and Wildlife Authority. Developed and presented a PowerPoint slideshow for the Project Implementation Review conducted by the Anadromous Fish Committee of the Columbia Basin Fish and Wildlife Authority. The presentation provided a review of project accomplishments since the September 2000 Provincial Review.
- A deliverables forecast was prepared and delivered, per the request of the BPA-COTR.
- Project inspections were conducted by a representative of the Interagency Council for Outdoor Recreation (IAC) contract representative for completed and active projects funded all or in-part by SRFB grants (Surveyors Cr. and Klickitat River Meadows projects).
- The longitudinal profile was re-surveyed at the Surveyors Creek project site to monitor post implementation changes one year following implementation (and subsequent four-year flood).
- Conducted 3 site visits to Surveyors Creek project to monitor performance and planting survival.
- Attended River Restoration Northwest conference in Stevenson. Valuable contacts were made with several project presenters that will benefit implementation of future Klickitat projects. Because of its close proximity to staff duty station, staff commuted daily to save lodging and per-diem costs.
- Attended aquatic passage design course sponsored by the United States Fish & Wildlife Service (USFWS). The course focused on natural channel design of road crossings and instructors were some of the most experienced designers and practitioners from around the Northwest. The course affirmed design practices currently employed by KWEP staff and provided additional insights and tools for design that will increase effectiveness of future KWEP passage projects. Tuition was free.
- Completed NEPA documentation (categorical exclusion) with the assistance of BPA Environmental Program staff for monitoring and assessment activities associated with KWEP.
- Attended BPA Process Improvement meeting in Toppenish and worked on draft of FY05 KWEP Work Statement and Budget.
- Assisted YKFP EDT modeler install scour chains and survey cross sections at two locations on Tepee Creek.
- Project staff prepared several drafts of the FY05 Statement of Work, Budget, and Spending Plan for KWEP. The documents were revised to accommodate the new format formatted required by BPA's "Process Improvement" and incorporated comments from BPA staff.

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