Wallowa Falls Hydroelectric Project
FERC Project No. P-308
Study Progress Report
(Draft Technical Report)

Aquatic Resources

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PACIFICORP ENERGY
A DIVISION OF PACIFICORP

For Public Review

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1.0 INTRODUCTION

PacifiCorp Energy filed a Notice of Intent (NOI) and associated Pre-Application Document (PAD) to commence the Federal Energy Regulatory Commission's (FERC) Integrated Relicensing Process (ILP) of the Wallowa Falls Hydroelectric Project on February 22, 2011. As part of the FERC Integrated Relicensing Process, prospective license applicants are required to submit relevant resource study plans (18 CFR 5.11).

During compilation of the PAD, PacifiCorp found limited information concerning aquatic fish and macroinvertebrate species in waters influenced by the project and encompassed within the project boundary. Historical data concerning aquatic species presence or absence; distribution, both spatial and temporal; and abundance was sparse. Prior to Study Plans implemented in 2012, the only empirical fishery data available from within project influenced streams stemmed from three fish salvages of the project tailrace channel due to de-watering during maintenance events and one truncated snorkel survey of the project bypass; no data had ever been collected concerning aquatic macroinvertebrates within the project boundary.

In consideration of available information, PacifiCorp identified three aquatic resource studies to gain information on local aquatic resources and potential impacts of the Wallowa Falls Hydroelectric Project on these resources.

Proposed studies included:

- Relative Abundance, Composition, and Spatial and Temporal Distribution of Fish Species Residing in Waters within the Project Boundary

- Evaluation of Bull Trout use of the Project Tailrace Channel and Bypassed East Fork Wallowa River

- Relative Abundance and Composition of Macroinvertebrate Species Residing in Waters within the Project Boundary

This Study Plan Progress Report is intended to fulfill 18 CFR 5.15(b) of the FERC Integrated License Process and contains the following information:

1. A description of the goals and objectives of each Study Plan;
2. Available background information;
3. Methods employed to implement Study Plans;
4. Results of information gathered during Study Plan implementation;
5. Discussion of results observed;

2.0 STUDY AREA

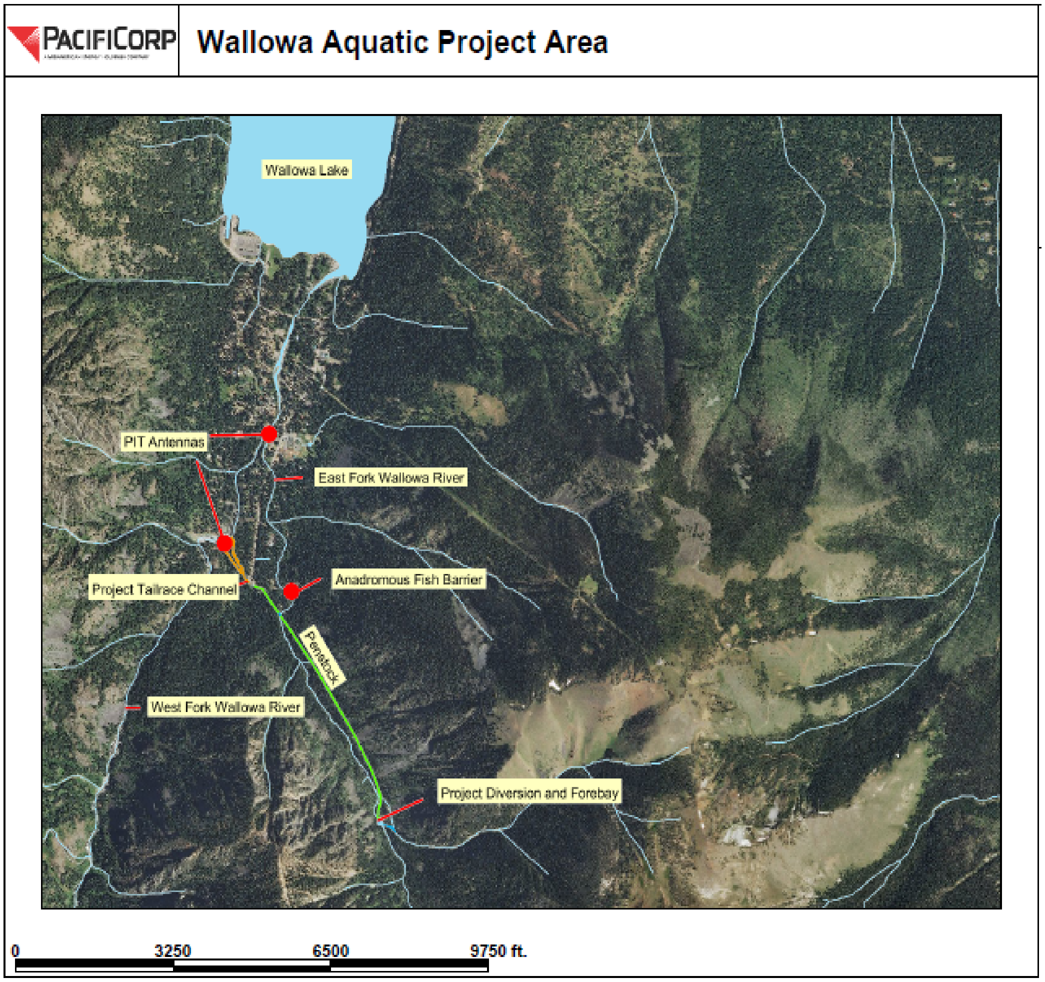
The Wallowa Falls Hydroelectric Project is located on the East Fork Wallowa River approximately 11 miles outside of the City of Joseph in Northeastern Oregon. The Project (Figure 2.0-1) reservoir/forebay lies over 1,600 meters (m) above mean sea level (msl) and is approximately 0.2 surface acres in size. Because the Project operates as run of river, there is no measurable storage. Water diverted from the forebay is conveyed through the flow line and penstock to the generating turbine in the Project powerhouse. Water exits the turbine and flows into an approximately 300 m long tailrace channel that discharges into the West Fork Wallowa River. This channel has an average wetted-width of 3.1 m and an average depth of 0.3 m.

The Project also consists of a 0.6-meter-high, 2.8-meter-long concrete diversion dam, having a 0.3-meter-wide spillway, at elevation 1,824 meters on Royal Purple Creek which is a tributary to the East Fork Wallowa River; a 75-meter-long, 20-centimenter diameter pvc pipeline discharges flows from Royal Purple Creek into the Wallowa Falls forebay, 62.5 meters upstream of the East Fork Wallowa River dam. No known fish inhabit Royal Purple Creek.

The bypassed portion of the East Fork Wallowa River within and near the Project boundary is approximately 2,800 m long from the Project diversion dam to its confluence with the West Fork Wallowa River. Gradient in this reach is high, with the upper 1,600 m averaging approximately 19 percent and the lower 1,200 m averaging 8.5 percent. Habitat type within most of the upper reach is dominated mainly by steep bedrock, vertical waterfalls, and cascades over boulders; though the upper reaches are steep, the lower 850 m to the confluence with the West Fork is a shallower gradient with habitat consisting of numerous riffles and pools.

Wallowa Lake and portions of the East and West Forks of the Wallowa River are listed under the Bull Trout Critical Habitat Designation Final Ruling (Federal Register, Vol. 75, No. 200 – October 2010 pgs. 63,898 – 64,070). The waterways upstream of the irrigation dam at the terminus of Wallowa Lake are listed as Essential Fish Habitat for spring Chinook and Coho under the Magnuson-Stevens Fishery Conservation and Management Act (NOAA 2008).

Figure 2.0.1 Wallowa Falls Hydroelectric Project.



3.0 RELATIVE ABUNDANCE, COMPOSITION, AND SPATIAL AND TEMPORAL DISTRIBUTION OF FISH SPECIES INHABITING WATERS OF THE PROJECT

3.1 Study Description and Objectives

Based on limited data concerning fish presence in waters within the Project boundary or waters directly influenced by project operations, surveys were proposed to quantify current fish species composition as well as relative abundance of identified species in catch per unit of effort. Surveys were designed to also assess if relative abundance of identified species changes spatially throughout the Study streams and temporally throughout the study time-frame.

Specific information regarding data obtained during the Study were as follows: all captured fish were identified to genus and species, relative abundance of all captured species was quantified in catch per unit of effort, geographic spatial distribution of all captured species was qualified by stream of capture as well as location within the stream.

3.2 Background Information

Fish species known to occur by direct observation in waterways within the Project area prior to 2012 Study Plan implementation included rainbow trout (*Oncorhynchus mykiss*), kokanee (*Oncorhynchus nerka*), brook trout (*Salvelinus fontinalis*), sculpin (*Cottus sp*.), and Endangered Species Act (ESA) listed bull trout (*Salvelinus confluentus*).

Limited information existed concerning current fish presence within the Project area. Fish abundance, distribution, and species composition information prior to Study Plan implementation came mainly from three data sources:

(1) The Oregon Department of Fish and Wildlife (ODFW) annual fish propagation reports;
(2) Fish salvages of the approximately 300 meter long tailrace discharge channel immediately downstream of the Project powerhouse. Salvages were performed prior to or during de-watering events in 2009-2011; and,
(3) Snorkel surveys performed in 2010 within the Project tailrace and bypass reach in the East Fork Wallowa River.

According to the 2012 ODFW Propagation Annual Report, Aneroid Lake, a small highland lake five miles upstream which flows directly into the Project forebay, was most recently stocked with 4,000 Cape Cod strain rainbow trout fingerlings in 2011 (ODFW 2012). Aneroid Lake currently is on a three-year stocking cycle. The same strain of rainbow trout are also annually stocked in Wallowa Lake (ODFW 2012). Cape Cod strain rainbow trout are generally thought to have lower migrating tendencies as compared to other strains of hatchery rainbow trout utilized in Oregon (Kinunen and Moring 1976).

Historically, Wallowa Lake supported a native stock of kokanee. The native population experienced a precipitous collapse in the early 1960's which lead to artificial supplementation of kokanee from sources located out of basin. The lake was last stocked with kokanee in 1982.

The current population is self-sustaining though genetically not comprised of the native stock (Cramer and Witty 1998). In the past, kokanee have been known to spawn in the lower gradient reaches of both the Project tailrace channel and the bypass section of the East Fork Wallowa River. This was verified during a survey on September 15, 2010 when PacifiCorp observed numerous adults actively constructing redds and spawning in the lower 40 m of the Project tailrace channel and lower 200 m of the bypass section.

Non-native introduced brook trout are also found within the project area. Brook trout were stocked in Aneroid Lake starting in the early 1900's with the last hatchery plant occurring in the 1950's (Pers. Comm. Bill Knox, ODFW, September 2010). These fish have naturally persisted and are dispersed throughout the Project area.

It is unknown what strain or local population the bull trout inhabiting the Project area are comprised of. Most native stock bull trout were thought to be extirpated by the late 1950's during an eradication effort to reduce predation and competition on rainbow trout within Wallowa Lake. This local extirpation led to a hatchery reintroduction program in 1968, when bull trout and Dolly Varden (*Salvelinus malma*) from an Alaskan hatchery were released into Wallowa Lake. This reintroduction program was believed to have failed and was discontinued in 1978 (Buchanan et al. 1997). In 1997 the ODFW released 600 bull trout ranging in size from 70 – 380 millimeters (mm) into Wallowa Lake. These fish were salvaged from a decommissioned hydroelectric plant's power canal located on Big Sheep Creek in the Imnaha River drainage. No monitoring was conducted of these released bull trout, but catches of bull trout showed up periodically in lake creel surveys after the 1997 release until 2004 (Pers. Comm. Bill Knox, ODFW, September 2010). Based on the lack of bull trout observed from 2004 on, bull trout in Wallowa Lake were once again identified as extirpated in 2005 (Goodson et al. 2005). More recently, bull trout were once again observed by PacifiCorp in Wallowa Lake in 2010.

Figure 3.2.1 illustrates the number of fish captured, by species, during salvages of the Project tailrace channel from 2009-2011. The channel was dewatered and salvaged for fish four times during this three-year span, once on July 20, 2009; twice in 2010, on July 12, 2010, and August 2, 2010; and once in 2011 on July 18. The majority of fish captured were rainbow trout (90 percent) followed by brook and bull trout and sculpin at 3.3 percent each.

Figure 3.2.2 illustrates the size distribution of fish captured in the Project tailrace discharge channel during fish salvages from 2009-2011. Of the total fish captured, 66 percent were between 101 and 200 millimeters (mm). Of the 57 rainbow trout caught during this time-frame, all but five were <200 mm. Brook trout encountered during fish salvages (2) were between 200 and 300 mm, captured bull trout (2) were >300 mm, and captured sculpins (2) were <110 mm.

Figure 3.2.1. Number of fish captured by species in the Project tailrace discharge channel during 2009-2011 fish salvages. Salvages were performed during planned Project de-watering events.

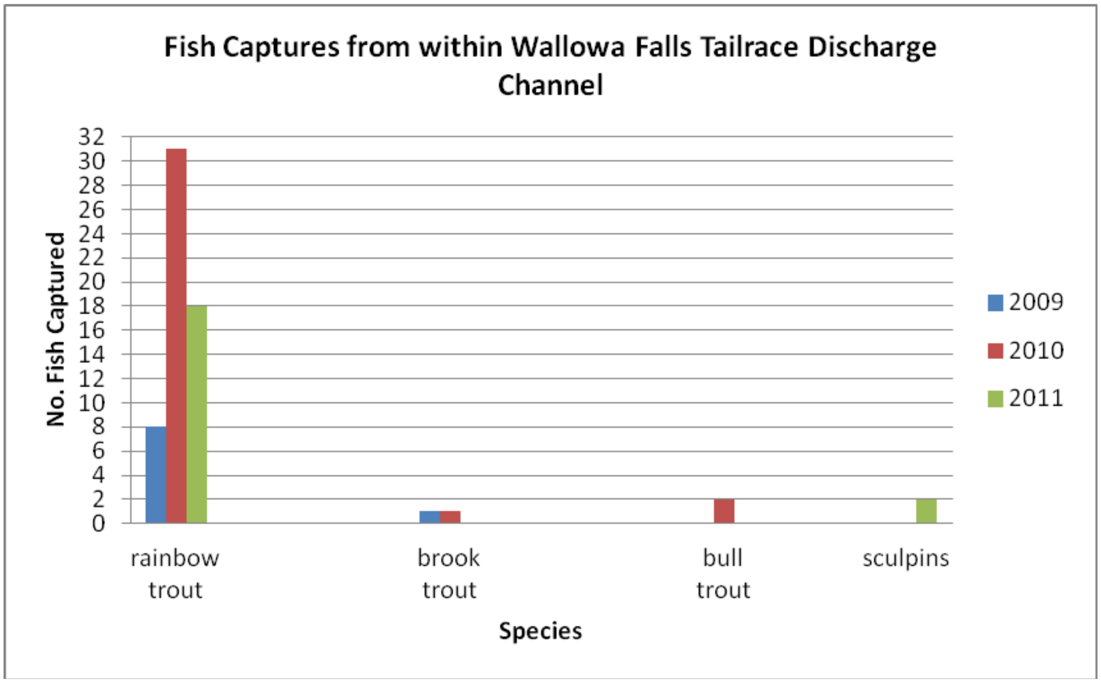
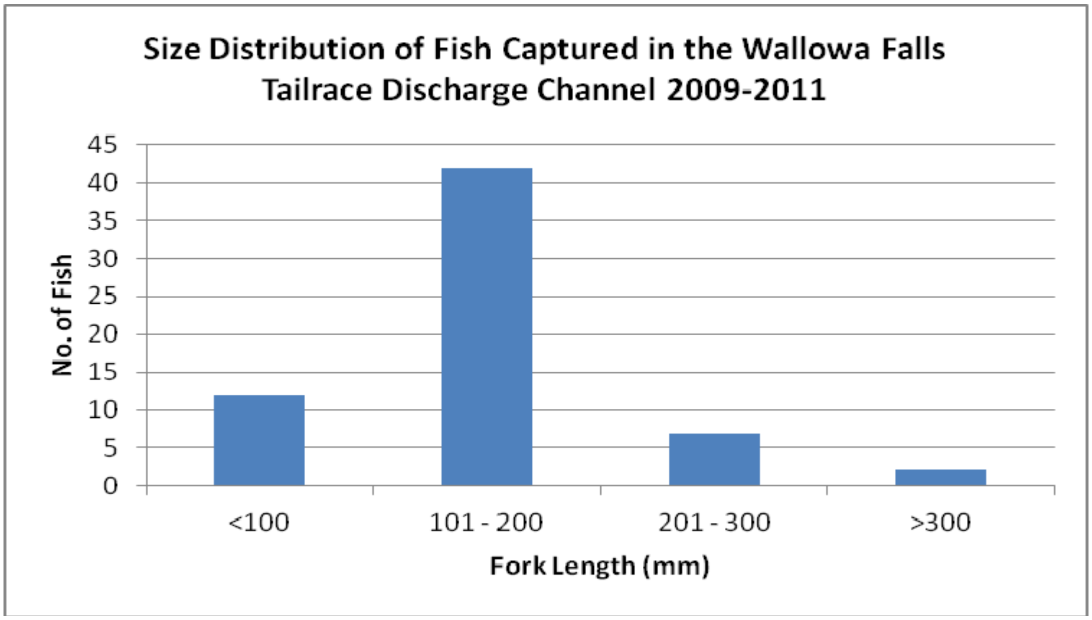


Figure 3.2.2. Size distribution of fish captured in the Project tailrace discharge channel from fish salvages during de-watering events in 2009 -2011.



3.3 Methods

Electrofishing surveys were performed of the entire natural channel of the East Fork Wallowa River below the anadromous fish barrier (Figure 3.3.1 and 3.3.2), a portion of the East Fork Wallowa River above the anadromous fish barrier, and the entire Project tailrace channel.

Figure 3.3.1 Site map of Study Area.

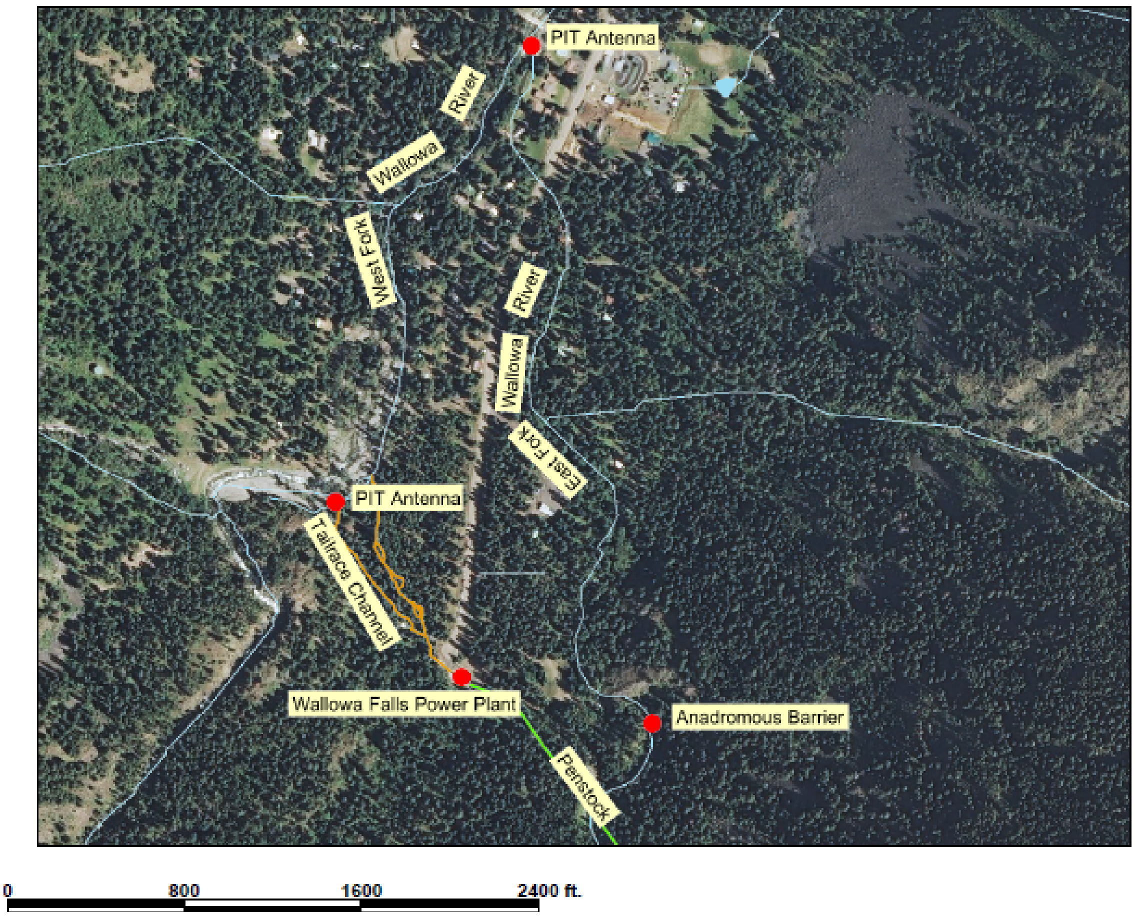
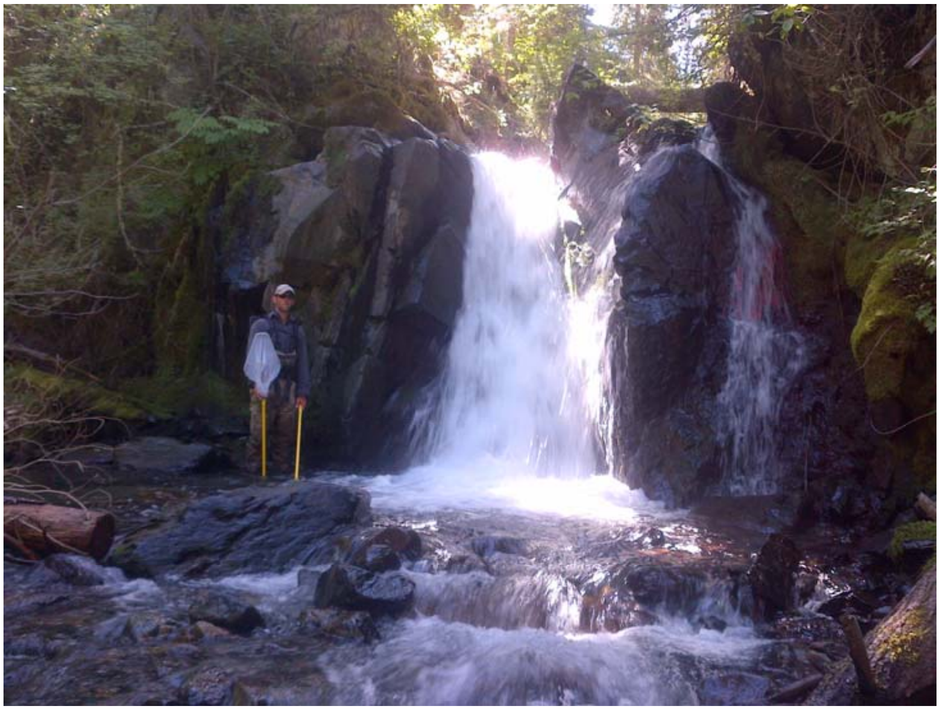


Figure 3.3.2 East Fork Wallowa River natural channel anadromous fish barrier.



Triple-pass depletion electrofishing methods with the use of block-nets were employed in the lower gradient, first 500 meters (m) of the East Fork Wallowa River natural channel and of the entire Project tailrace channel. Due to high gradient, and high water velocity, the upper approximately 350 m of available habitat below the anadromous fish barrier in the East Fork Wallowa River natural channel was single-pass electrofished only, without the use of block-nets. The approximately 100 m section surveyed above the anadromous fish barrier in the East Fork Wallowa River natural channel was also single-pass electrofished only with no block-nets.

The lower 500 m of the East Fork Wallowa River natural channel and the entire tailrace channel were broken into 100 meter sections. Using block-nets, each section was depletion electrofished using a three-pass method with a Smith-Root® model LR-24 backpack electrofisher. During each electrofishing pass, all captured fish were quantified to species, measured to the caudal fork and then released back to the stream, below the downstream block-net so as to avoid recapture during the next electrofishing pass. Surveys started at the downstream end and progressed upstream (Nielsen and Johnson 1983).

In addition to recording standard biological data for captured species during electro-fishing surveys, the Forest Service and Oregon Department of Fish and Wildlife requested that condition factors also be recorded from fish captured in the East Fork Wallowa River natural channel. To that end, it was decided that a sub-sample of captured fish by species from the natural channel would also be weighed to the nearest gram. Weights were recorded of the first 25 specimens collected per species in the natural channel only. After the first 25 specimens per species were collected, weights were then recorded from a 10 percent sub-sample per species. Lengths and weights of East Fork Wallowa River natural channel captured fishes were then converted to represent a condition factor.

Condition factor (K-factor) is a simple weight-length relation that is generally thought to be one of several indices of healthy fish (Nielson and Johnson 1983). Fulton (1902) established the weight-length relation equation that was used to estimate K-factors in this study.

The Fulton-type equation used is as follows;

$K= (W/L^3)*X$

Where;

K = metric condition factor

W = weight in grams

L = length in millimeters

X = Arbitrary scaling constant (for our purposes 10^5 was used)

All fish were weighed individually while in water. Fish were weighed to the nearest gram using a portable scale. To weigh fish, a container holding water was placed on the scale and allowed to tare to 0, the captured fish were then placed in the container and the weight recorded.

If bull trout were encountered during any electrofishing survey, a small 1 square centimeter (cm) tissue sample (as recommended by the USFWS Abernathy Conservation Genetics Lab standard protocol) was taken from each fish for future genetic analysis. If the captured bull trout was >120 millimeters (mm) in fork length (FL), a uniquely coded 13 mm half-duplex (HDX) Passive Integrated Transponder (PIT) tag was inserted into the dorsal sinus for identification in case of future recapture. The PIT tag was inserted using a tagging syringe with the needle positioned just anterior to the dorsal sinus and the tag gently pushed toward the caudal peduncle, through the incision, into the sinus. This same tagging procedure has been occurring for all maiden captured bull trout on the Lewis River in Southwest Washington since 2002 with no known tag mortalities and little to no tag loss (PacifiCorp Energy 2011).

All electrofishing activities followed protocols as set forth in the National Marine Fisheries Service Backpack Electrofishing Guidelines (NMFS 2000). Generally, the electrofisher was set to un-pulsed direct current (DC) at the lowest possible setting to still allow capture of fish. Care was taken during electrofishing surveys to stay away from actively spawning fish and newly constructed redds.

Along with the electrofishing surveys in the East Fork Wallowa River natural channel and Project tailrace channel, seining surveys of the project reservoir/forebay also occurred during a seasonal time-frame.

The project impoundment was sampled with a 2 m deep, 30 m long stick seine with 6 mm mesh. Given the small size of the impoundment (0.2 surface acres), the entire area was sampled.

3.4 Results

East Fork Wallowa River Natural Channel

The East Fork Wallowa River natural channel was electrofished on August 23-24, 2012 from the confluence of the West Fork Wallowa River to its anadromous fish barrier (Figure 3.3.1). During this time-period, 479 total fish were captured (Figure 3.4.1), biologically assessed, and then released back to point of capture. No fish mortalities were observed. Captured fish were quantified by species as well as capture location within the stream (Figure 3.4.2).

Figure 3.4.1 Species Composition Survey East Fork Wallowa River natural channel.

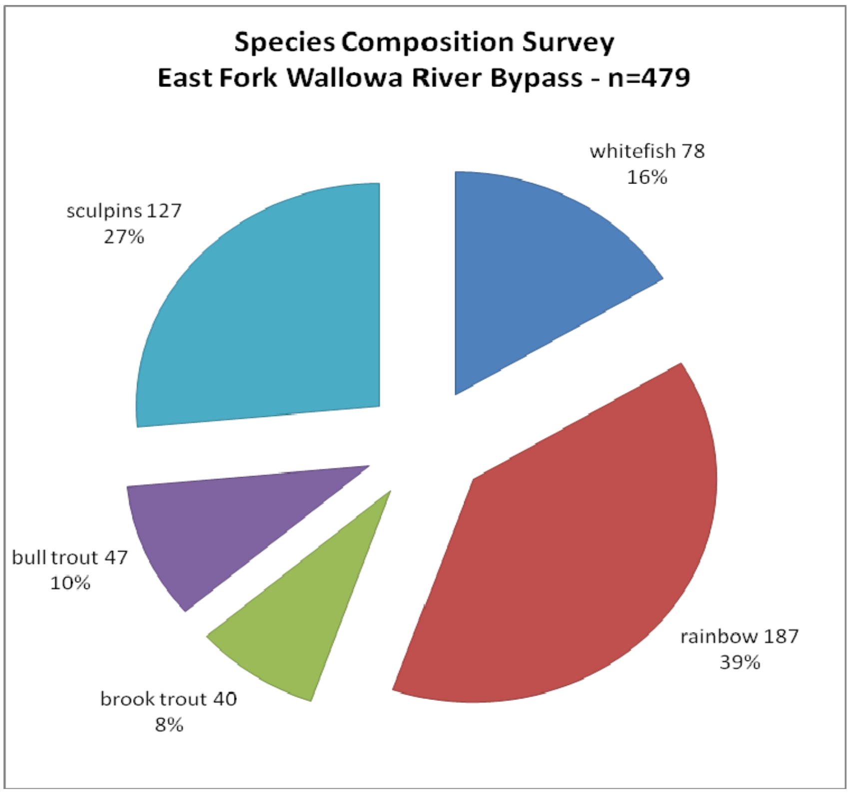
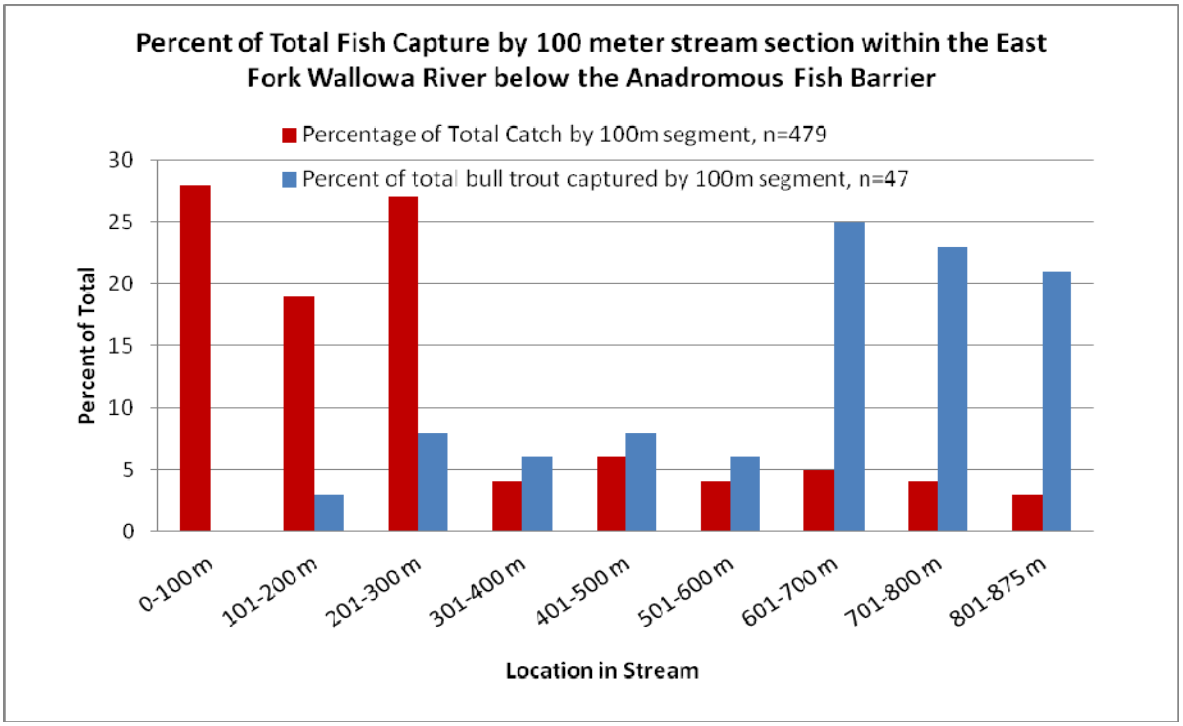


Figure 3.4.2 Percent of Total Fish Capture by 100 Meter Stream Section within the East Fork Wallowa River below the Anadromous Fish Barrier.



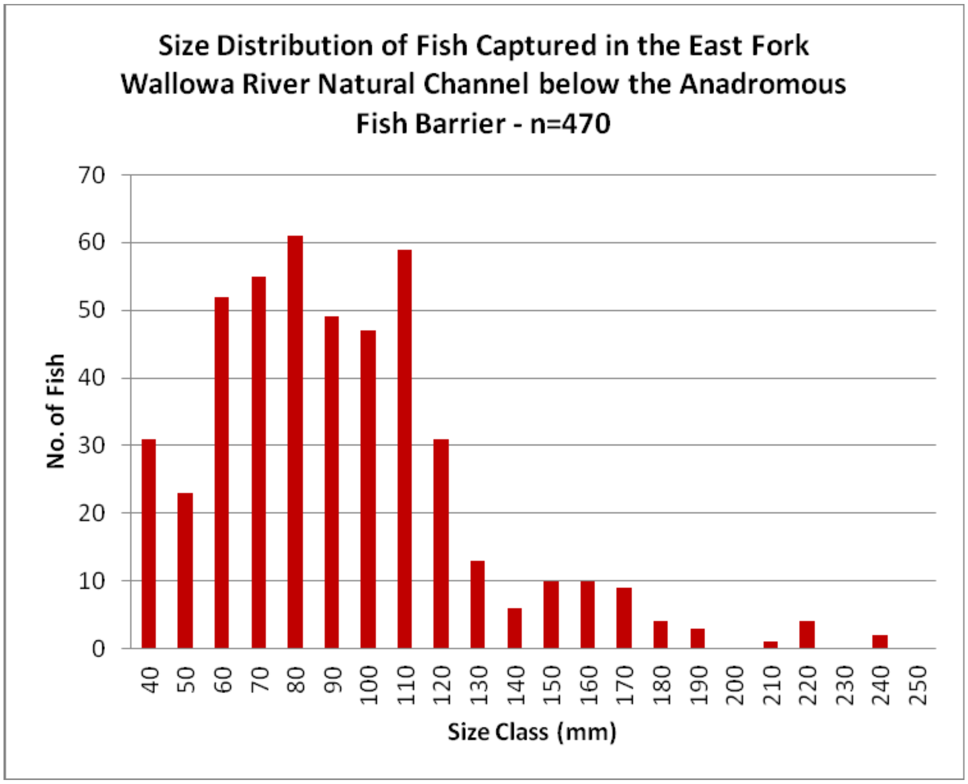
Seventy-four percent of the total fish captures were collected in the lower 300 m of the survey area. Conversely, 69 percent of the total captured bull trout were encountered in the upper 300 m of the survey area below the anadromous fish barrier (Figure 3.4.2). Mountain whitefish and sculpin were not observed above the 300 m section in the East Fork Wallowa River natural channel. At this location in the stream there is a small step pool that may be an upstream migration hindrance during certain times of the year and under certain flow conditions. All captured fish were measured to the caudal fork (Table 3.4-1).

Table 3.4-1 Biological information of East Fork Wallowa captured fishes.

SPECIES	Sample Size	MEAN LENGTH (mm)	STANDARD DEVIATION	MAXIMUM LENGTH
rainbow trout	187	97	34.09	240
mountain whitefish	78	107	22.13	164
brook trout	40	129	49.73	228
bull trout	47	113	44.46	245
sculpin	127	68	21.07	111

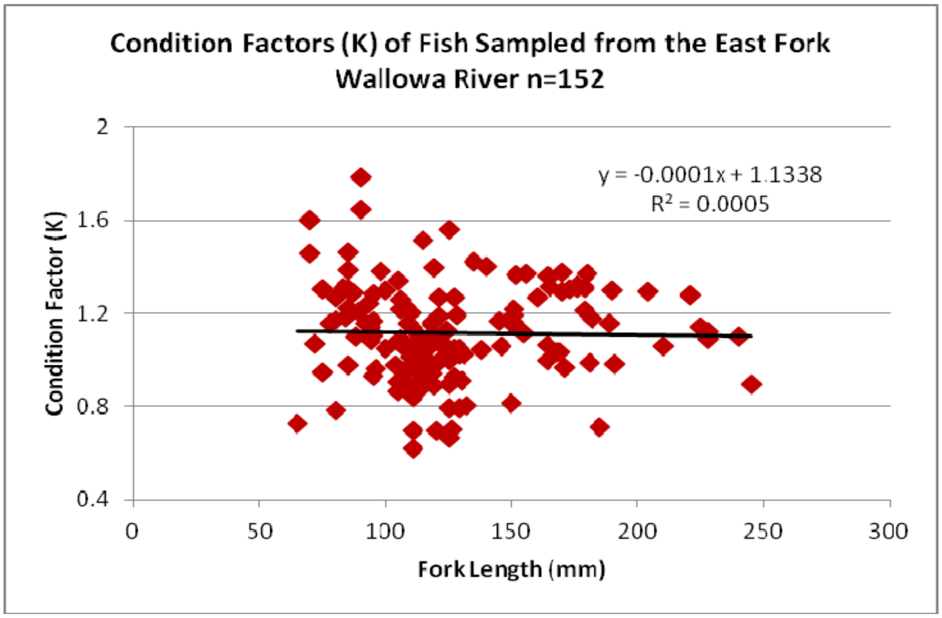
Nearly 99percent of captured fishes were <200 mm fork length as Figure 3.4.3 illustrates.

Figure 3.4.3 Size Distribution of Fish Captured in the East Fork Wallowa River Natural Channel below the Anadromous Fish Barrier.



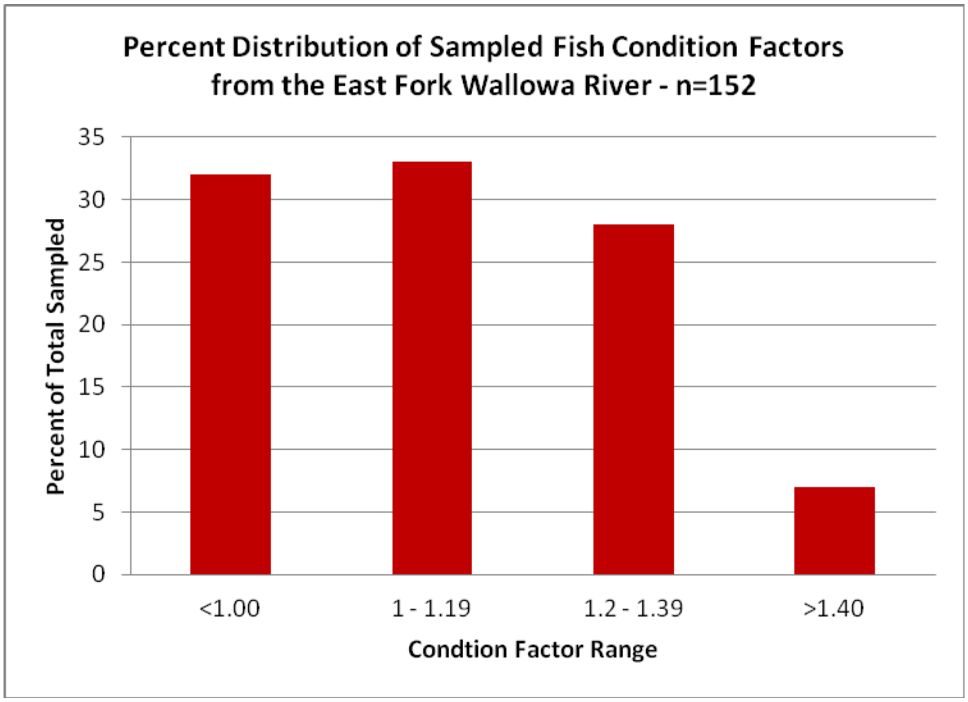
Of the 479 fish captured, 152 were also weighed (32 percent) and characterized with a K-factor (Figure 3.4.4). Of the fish assessed for K-factor, 63 were rainbow trout (1.19 K-factor average), 35 were mountain whitefish (1.04 K-factor average), 32 were bull trout (1.00 K-factor average), and 24 were brook trout (1.25 K-factor average).

Figure 3.4.4 Condition Factors (K) of Fish Sampled from the East Fork Wallowa River.



Each red diamond in Figure 3.4.4 represents an individual fish. Figure 3.4.5 displays the same fitness information in a bar graph. Qualitative values such as poor, fair, excellent, etc. are not expressed within the scale. There is currently no localized set of data with which to compare the present data-set to in order to give the assigned K-factors a more descriptive assessment.

Figure 3.4.5 Percent Distribution of Sampled Fish Condition Factors from the East Fork Wallowa River.



An additional water fall of 23 m (approximate height) exists 100 meters upstream from the anadromous fish barrier in the lower East Fork Wallowa River identified in Figure 3.2.2. The stream segment between these two waterfalls was electrofished for fish presence twice during 2012 field activities, once on August 25 and again on September 25. Three fish were captured during the August 25 survey, and eight fish were captured during the September 25 survey (Table 3.4-2).

Table 3.4-2 Biological information of captured fishes from above anadromous fish barrier on the East Fork Wallowa River.

SPECIES	Sample Size	MEAN LENGTH (mm)	STANDARD DEVIATION	MAXIMUM LENGTH
rainbow trout	1	n/a	n/a	60
brook trout	10	133.3	61.39136747	225

Of the eight brook trout sampled during the September 25 survey, one male was post-spawn and two other males were highly fecund.

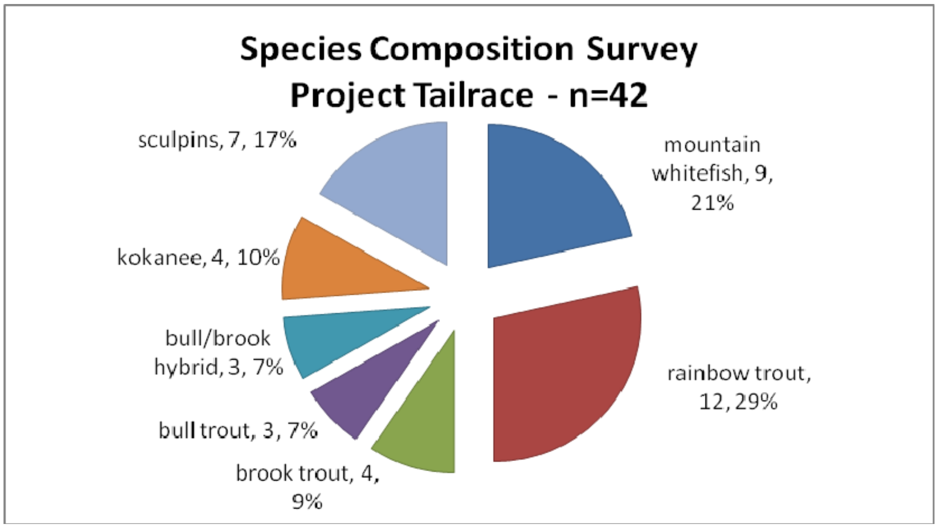
Along with the stream section sampled above the anadromous fish barrier, and the lower reach sampled below the anadromous fish barrier, the Project forebay was also sampled for fish presence on August 22 and September 25. During the August 22 survey the entire forebay was seined. No fish were captured. The forebay was again scheduled to be seined on September 25.

Prior to the seining the forebay was snorkeled for fish presence. No fish were observed during the snorkeling survey and therefore the area was not seined.

Project Tailrace Channel

The Project tailrace channel was electrofished four times during the 2012 field season and 42 total fish were captured. The surveys occurred on August 21 according to the relicensing Study Plan, and three times (July 6, August 13, and August 24) due to maintenance on the Project and the subsequent dewatering of the tailrace. For purposes of simplicity in presentation, the data from the four surveys is compiled into one data-set (Figure 3.4.6).

Figure 3.4.6 Species composition survey project tailrace.



The majority of fish captures occurred during the tailrace de-watering event on August 13 (20 of 42 total, or 48 percent). All captured fish were measured for fork length (nearest mm) prior to release (Table 3.4-3). It should be noted that one bull trout/brook trout hybrid which was initially captured and tagged during the August 13 de-watering event was subsequently recaptured in the tailrace during the August 24 de-watering event. All fish captured during tailrace de-watering events were released into the West Fork Wallowa River.

Table 3.4-3 Biological information of tailrace captured fishes.

SPECIES	Sample Size	MEAN LENGTH (mm)	STANDARD DEVIATION	MAXIMUM LENGTH
rainbow trout	11	132	41.79	196
mountain whitefish	9	138	34.54	177
brook trout	4	132	13.88	148
bull trout	3	381	187.77	550
bull/brook hybrid	2	178	53.03	215
kokanee	4	205	9.12	215
sculpin	5	91	30.68	128

Fish labeled as bull trout/brook trout hybrids were confirmed by genetic analysis at the United States Fish and Wildlife Service's Abernathy Conservation Genetics Lab in August 2012.

3.5 Discussion

Based on results listed above, it appears that the bulk of the migratory fish inhabiting the East Fork Wallowa River natural channel below the anadromous fish barrier are confined to the lower 300 m of stream. Around stream meter mark 300 there is an old abandoned United States Geographical Service stream gage site where a concrete apron was poured in the stream channel at an area exhibiting a step/pool habitat characteristic. The small falls created by the concrete apron is approximately 1 m in height, originating from a pool depth of approximately 0.5 m. At flows observed during the time of survey, this small feature is an upstream migration barrier to certain sizes and species of fish as evidenced by the high numbers of fish captured below this point and by lack of any migratory mountain whitefish or kokanee above this point.

The fact that 89 percent of the total number of bull trout captures within the East Fork Wallowa River natural channel were captured upstream of this point suggests, unless at extreme base flow, that this falls is likely not always an upstream migration hindrance to fluvial or adfluvial sized bull trout observed elsewhere within the stream during past surveys. Bull trout appear to have sequestered themselves to the uppermost reaches of the East Fork Wallowa River natural channel in spite of the small upstream migration hindrance and the fact that the stream becomes increasingly higher in gradient in the upstream reaches. Figure 3.4.2 illustrates that moving upstream all other fish species decrease in abundance while bull trout increase. 69 percent of the total bull trout captures within the East Fork Wallowa River occurred above the 600 meter mark, as contrasted to only 12 percent of the total captures of other fish species encountered in the same area.

Given the average size (113 mm) of bull trout captured in the natural channel, it is difficult to assess at what life-stage or what life history these fish may be exhibiting. The most recent bull trout reintroduction within Wallowa Lake came from the Big Sheep Creek subpopulation within the Imnaha River Core Area and Columbia River Distinct Population Segment (USFWS 2002), and it is likely the bull trout residing within the East Fork Wallowa River natural channel originated from this fish population. Previous investigations by ODFW found the mean length of bull trout to be 123 mm during bull trout surveys of Big Sheep Creek in 1992, with fish becoming sexually mature around 160 mm in fork length, suggesting a resident population (Smith and Knox 1992). Conversely, it has been well documented that within-stream distributions of juvenile bull trout have been strongly associated with higher elevation and low water temps (Dunham and Rieman 1999).

It remains to be seen if the bull trout captured within the East Fork Wallowa River natural channel are a resident population, residing in this general area for their entire life-cycle, or if they are simply rearing juveniles from a more migratory life history type (fluvial/adfluvial). Life histories exhibited by the likely donor stock, as well as similarities in fork lengths to this donor stock would suggest these fish are resident bull trout. The capture and observations of larger adfluvial sized individuals from lower in the drainage, Wallowa Lake, and the Project tailrace, suggest otherwise. Refinement of genetic stock assignment of the east Fork Wallowa River local population, as well as additional bull trout migratory data collection will continue to add clarity.

Condition Factors of fish residing within the East Fork Wallowa River natural channel were not expected given the r-squared regression line in Figure 3.4.4. It is generally assumed that Condition Factor increases as fork length increases for healthy resident fishes. The slope of the regression line exhibited suggests otherwise. Given there is no baseline of local Condition Factors with which to compare this data-set to, it is difficult to draw any conclusions.

The fact that no fish were captured or observed during the two Project forebay surveys is inconclusive with respect to fish presence within this area. It is empirically known that fish reside in the East Fork Wallowa River above and below the Project forebay, thus the forebay at a minimum had to act as a migration corridor during some time in the past. The capture of fecund male brook trout in the natural channel below the Project impoundment and above the anadromous fish barrier suggests a self-reproducing resident population. Given the hatchery stocking schedule of Aneroid Lake, it was assumed and validated that rainbow trout would be captured above the anadromous fish barrier as well. It remains unknown if the brook and rainbow trout captured above the abandoned USGS stream gage at stream meter mark 300 are migrating adults from downstream or progeny thereof; or simply fish originating from Aneroid Lake upstream that have migrated downstream throughout the watershed.

A confounding issue to come out of the Project tailrace channel electrofishing surveys is the presence and genetic confirmation of bull trout/brook trout hybrids. During the August 13 dewatering event, five of the twenty fish captured were identified as bull trout. After genetic analysis two of the five fish identified as bull trout were found to in fact be bull trout/ brook trout crosses. The issue is that neither bull trout/ brook trout hybrid exhibited meristics traditionally thought to be unique to hybrid char; that of white “halos” on the dorsal fin or faint vermiculations located dorsally along the fish. The fish visually appeared to be pure strain bull trout. As more bull trout are captured and handled from this area and genetically identified, biologists may discover unique local morphometrics to aid in the identification of these fish.

To date, 17 fish identified in the field as bull trout have been genotyped. 15 were confirmed as pure bull trout. Thirty-eight samples remain unanalyzed. It is likely that more hybrids will be identified after genetic analysis of this sample group. Genetic analysis of the remaining samples will occur in early 2013 with results expected soon thereafter.

Additionally, electrofishing surveys are planned for late July 2013 of the upper portions of the East Fork Wallowa River below the anadromous fish barrier. Surveys will focus on the recapture of 2012 PIT tagged bull trout to assess differences (if any) in spatial distribution.

4.0 EVALUATION OF BULL TROUT USE OF THE PROJECT TAILRACE CHANNEL AND BYPASSED EAST FORK WALLOWA RIVER

4.1 Study Description and Objectives

The following study was proposed to gain a better understanding of the current Wallowa River bull trout population upstream of Wallowa Lake, specifically with concern to waters directly influenced by the Wallowa Falls Hydroelectric Project.   It was anticipated this study would shed light on the current distribution of previously captured bull trout in waters within the Project boundary; specifically, spatial and temporal distribution within the EF Wallowa River natural channel and Project tailrace. Much of the proposed study hinged on the ability to capture and mark a portion of the bull trout population residing in and around Wallowa Lake upstream of the lake outlet with a Passive Integrated Transponder (PIT) tag.

4.2 Existing Information

As mentioned earlier, the Wallowa Lake bull trout population has undergone several major events, from eradication to reintroductions and, prior to PacifiCorp's relicensing studies, was thought to be non-existent in Wallowa Lake and its tributaries.

Bull trout were first observed by PacifiCorp within the Project area on July 12, 2010, during a salvage of the Project tailrace due to a planned de-watering event. Two bull trout were captured (Figure 3.2.1) downstream of the powerhouse, prior to the channel being de-watered, and were subsequently released into the West Fork Wallowa River, per the conditions of PacifiCorp's Oregon State Fish Collection Permit (permit no.15214). During a September 15, 2010 snorkel survey, one bull trout was observed just downstream of the turbine discharge. Later during that same survey, two bull trout were observed in the bypassed section of the East Fork Wallowa River approximately 250 m upstream from the confluence with the West Fork Wallowa River. These fish were observed paired-up near a partially completed redd.

4.3 Methods

Bull trout of sufficient fork length that were captured during seasonal electrofishing surveys from Section 3.0 of this Aquatic Study Report's field activities, as well as during bull trout collection efforts at the head of Wallowa Lake, were marked with half-duplex (HDX) PIT tags and then released. Tagged fish within the Project boundary were monitored using HDX PIT tag antenna arrays constructed within the EF Wallowa River natural channel and the Project tailrace.

Tangle nets consisting of dyed green 6# monofilament, with depths of approximately 2 meters (m), varying lengths of 25 – 40 m, and varying mesh sizes of 2.5 – 7.5 centimeter (cm) stretch were deployed with boats in Wallowa Lake in June and July to capture bull trout for tagging purposes. Nets were set and allowed to passively fish unattended for up to 1.5 hours. All captured bull trout entangled in nets were retrieved and placed in a live well. Opportunistic angling was also incorporated into the capture survey events.

All captured bull trout were measured to the caudal fork and a small 1 square centimeter (cm) tissue sample (as recommended by the USFWS Abernathy Conservation Genetics Lab standard protocol) was taken from the upper lobe of the caudal fin from each individual for future genetic analysis. Captured bull trout >120 mm and <300 mm in fork length, were tagged with a uniquely coded 13 mm HDX PIT tag in the dorsal sinus, while bull trout >300 mm fork length were tagged with a 23 mm HDX PIT tag, for identification in case of interrogation at any PIT antenna array. PIT tags were inserted, using a tagging syringe or scalpel, just anterior to the dorsal sinus with the tag being gently pushed toward the caudal peduncle.

To interrogate previously tagged bull trout that volitionally moved past PIT antenna arrays, stream-width HDX PIT tag antennae were placed at the mouth of both the Project tailrace channel and the East Fork Wallowa River natural channel. Antennas were specifically placed in shallow areas of each identified location. Per the manufacturer, 13 mm HDX PIT tags have a nominal read-range of 26 inches, while 23 mm tags exhibit a read-range of approximately 32 inches, making shallow stream areas more conducive to higher detection efficiencies. The higher water velocities of shallow riffles also facilitate better fish movement through the antenna array.

In order to determine directionality of fish movement, each PIT array consisted of two antennas multiplexed (synchronized) and spaced approximately two meters apart. Each antenna was comprised of a 10-gauge copper speaker wire looped along the stream bottom (flat-plate design). The loop started from one stream bank, spanned the entire wetted-width of the stream along the stream bottom to the opposite bank, and then looped back along the stream bottom to the original starting point creating a large flattened oval shape. Each 10-gauge copper speaker wire was then connected to an Oregon RFID® RI-Acc-008B antenna tuner unit. Copper twinax communication cable was then run from each tuner unit to an Oregon RFID® RI-RFM-008 reader board and data logger. Antennas were powered by three 12-volt deep-cycle marine batteries attached to each other in parallel; batteries supplied enough power for three weeks of operation.

The PIT antennas at the mouth of the Project tailrace and East Fork Wallowa River natural channel were constructed and powered up on July 12, 2012 (Figure 3.3.1). The East Fork Wallowa River natural channel PIT antenna was turned off and taken out of the stream on November 18, 2012. The Project tailrace channel antenna remained in operation longer and will be removed from the stream on December 31, 2012. The East Fork Wallowa River natural channel antenna experienced no power loss and ran continuous throughout the study period (July 12 – November 18). Except for two days of power loss in September and three days of power loss in November, The Project tailrace antenna also ran continuous throughout the study time-period (July 12 – December 31).

4.4 Results

Netting activities to collect bull trout from Wallowa Lake occurred during two time-periods, over a total of eight days, June 12-15, and July 3-6. Over this study time-period 43 distinct net sets were completed for a total time of 62 hours set time. The shortest soak during the study period was one hour and the longest time a net was allowed to fish was three hours; average set time was 1.5 hours. The bulk of netting locations generally focused within and around the confluence area of the West Fork Wallowa River and the lake. Nets were also set in strategic locations around the lake in an effort to locate holding bull trout.

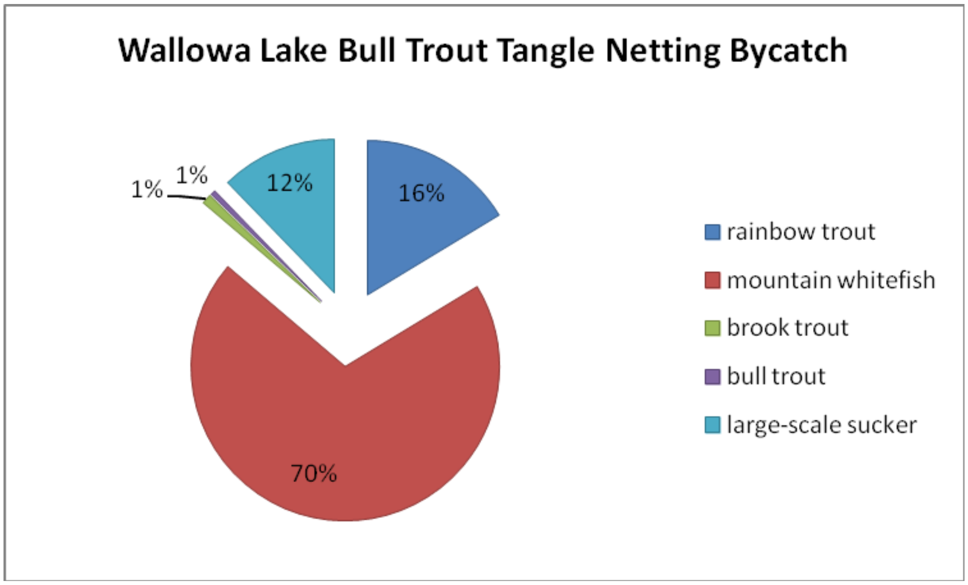
One bull trout was captured during the lake netting effort. The bull trout was captured in the West Fork Wallowa River confluence area on July 4 and measured 378 mm in fork length. After insertion of a PIT tag and sampling of genetic material, the bull trout was released at the point of capture.

Bycatch data from non-target species collected during netting efforts is illustrated in Table 4.4-1 and Figure 4.4.1

Table 4.4-1 Bycatch data from non-target species collected during netting efforts.

SPECIES	Sample Size	MEAN LENGTH (mm)	STANDARD DEVIATION	MAXIMUM LENGTH
rainbow trout	32	297	55.65	381
mountain whitefish	137	297	19.8	375
brook trout	2	n/a	n/a	319
bull trout	1	n/a	n/a	378
large-scale sucker	24	295	52.16	432

Figure 4.4.1 Wallowa Lake bull trout tangle netting bycatch.



Mountain whitefish were the most abundant species encountered. Given the dimensions of deployed nets and their orientation to the lake bottom, it is not surprising mountain whitefish were the most common species caught as they are strongly associated with the benthic region of large water bodies (Pontius and Parker 1973). Given methods identified, fish that typically reside higher in the water column (i.e. rainbow trout) would not be captured at the same rate as benthic oriented species (i.e. bull trout, mountain whitefish, and large-scale sucker, *Catostomus macrocheilus*).

During electrofishing surveys of the East Fork Wallowa River natural channel and dewatering events of the Project tailrace channel, 52 bull trout were captured. Of these 52, fifteen were of appropriate tagging size (>120 mm fork length) and were tagged with an HDX PIT tag (Table 4.4-2). The total number of HDX PIT tagged bull trout during 2012 activities was 16 fish.

Table 4.4-2 PIT tagged bull trout during 2012 field activities.

DATE	SPECIES	PIT#	FL (mm)	CAPTURE LOCATION	NOTES
7/4/2012	BT	A0F657C	378	Wallowa Lake	HDX 23mm tag, tangle net capture, genotyped
8/13/2012	BTxBRKT	591847	215	Tailrace	HDX 13mm, genotyped
8/13/2012	BT	58484B	179	Tailrace	HDX 13mm, genotyped
8/13/2012	BT	A0F65A8	415	Tailrace	HDX 23mm, female, genotyped
8/13/2012	BT	A89AF23	550	Tailrace	HDX 23mm, male, genotyped
8/23/2012	BT	6594848	189	100-200m EFW bypass	HDX 13mm. Not genotyped
8/23/2012	BT	C582635	171	200-300m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C58942B	181	500-600m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C58803D	179	600-700m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C58063A	168	600-700m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C586E5C	191	700-800m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C58921A	151	700-800m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C58524D	155	800-900m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C58924A	245	800-900m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C589C51	169	800-900m EFW bypass	HDX 13mm. Not genotyped
8/24/2012	BT	C588A60	164	800-900m EFW bypass	HDX 13mm. Not genotyped

Of the 16 fish tagged during 2012 field activities, three were detected at one of the two fixed PIT tag antenna arrays. Of the three detected individuals, one was a bull trout/ brook trout hybrid and the two others were genotyped as pure bull trout. All three were captured and tagged from within the Project tailrace channel during an August 13, 2012 dewatering event and released into the West Fork Wallowa River. Detected fish are highlighted in yellow in Table 4.4-2 above.

The interrogated bull trout/brook trout hybrid was first detected moving past the fixed antenna at the mouth of the Project tailrace channel on September 18. This same fish was recorded moving upstream past the tailrace channel antenna and then back downstream on seven more occurrences, September 23, 24; October 15, 16, 19, 28; and November 3 The last known location of this fish was on November 8 as it moved upstream, past the upper-most tailrace antenna.

The other two interrogated bull trout were captured together within the Project tailrace, and after insertion of a PIT tag were released downstream into the West Fork Wallowa River. Upon visual inspection, the larger of the two fish (550 mm fork length) was identified as a male from the large kype (protruding lower jaw), large dorsal "hump", and vivid coloration. The smaller of the two fish (415 mm fork length) was identified in the field as a female from lack of a kype and a more stream-lined body shape. Coloration of the female was also more muted when compared to the male. After genetic analysis, both fish were genotyped as pure bull trout.

The male bull trout (tag #A89AF23) was detected moving upstream past the fixed PIT tag antenna array near the mouth of the East Fork Wallowa River natural channel on August 29. The female bull trout (tag #A0F65A8) that was initially captured and tagged with the male bull trout above, was detected moving upstream past the same fixed PIT tag antenna array in the East Fork Wallowa River natural channel just a few days later, on September 5. The female was later detected on September 22 moving downstream and leaving the system. The male was detected a few days later on September 25 moving downstream also leaving the system. Neither bull trout were interrogated again after these detection events.

4.5 Discussion

It appears the two large bull trout captured and tagged together from within the Project tailrace channel were indeed paired up. Their respective times of migration in and out of the East Fork Wallowa River natural channel were too similar to simply be coincidental. As no large bull trout redds were observed during cursory redd surveys in 2012, it is unknown if the pair were successful in spawning.

As no redds were observed within the Project tailrace channel during cursory redd surveys in 2012, the intent of the interrogated hybrid bull trout/brook trout within this system is unknown. The Project tailrace channel is known to have cooler water temps during August and September than both the West Fork Wallowa River and East Fork Wallowa River natural channel. It could prove to be a place of thermal refugia for cold-water seeking salmonids during the base flow, warm water time of the year. Due to its stable flow regime, the Project tailrace may also function as fluvial over-wintering habitat. Additional data downloads from the tailrace PIT antenna scheduled for early January 2013 may add clarity to bull trout use of this waterway.

The fact that no bull trout tagged from areas originating in the upper portion of the East Fork Wallowa River natural channel were detected moving downstream past the fixed PIT tag antenna array at the mouth adds confidence to the assumption that these fish may in fact be exhibiting a resident life-history. It's hoped additional recapture efforts in 2013 will add clarity to the life history and life-stage these bull trout in the upper East Fork Wallowa River natural channel are exhibiting. It is anticipated that additional migration data collected in 2013 from the East Fork Wallowa River natural channel fixed PIT antenna array will also contribute to the life-history assessment of this population.

5.0 RELATIVE ABUNDANCE AND COMPOSITION OF MACROINVERTEBRATE SPECIES RESIDING IN WATERS IN AND AROUND THE PROJECT

5.1 Study Description and Objectives

The following study was proposed to gain an understanding of the current aquatic macroinvertebrate species occupying the East Fork Wallowa River above the Project forebay and within the East Fork Wallowa River natural channel. This study provided information on the composition of aquatic macroinvertebrates in the study stream sections as well as relative abundance of identified species in catch per unit of effort (CPUE).

5.2 Methods

A Surber Sampler® was used to obtain a sample of aquatic macroinvertebrates residing at specified representative riffle locations within the study stream. Standard protocols when using a Surber Sampler® were employed in order to obtain a consistent sample of macroinvertebrates from each sample site (Surber 1936). A representative riffle habitat type was sampled once at the following three locations of the East Fork Wallowa River natural channel; 1) in the East Fork Wallowa River above the Project forebay, 2) in the high gradient portion of the natural channel, 3) in the low gradient portion of the natural channel near its confluence with the West Fork Wallowa River.

To remove water, large pieces of gravel and detrital material from the macroinvertebrate sample, the contents of the Surber Sampler® collection cup was filtered with a 500 micron mesh sieve. The sample was then placed in a bottle and preserved with 95 percent ethanol for later lab analysis.

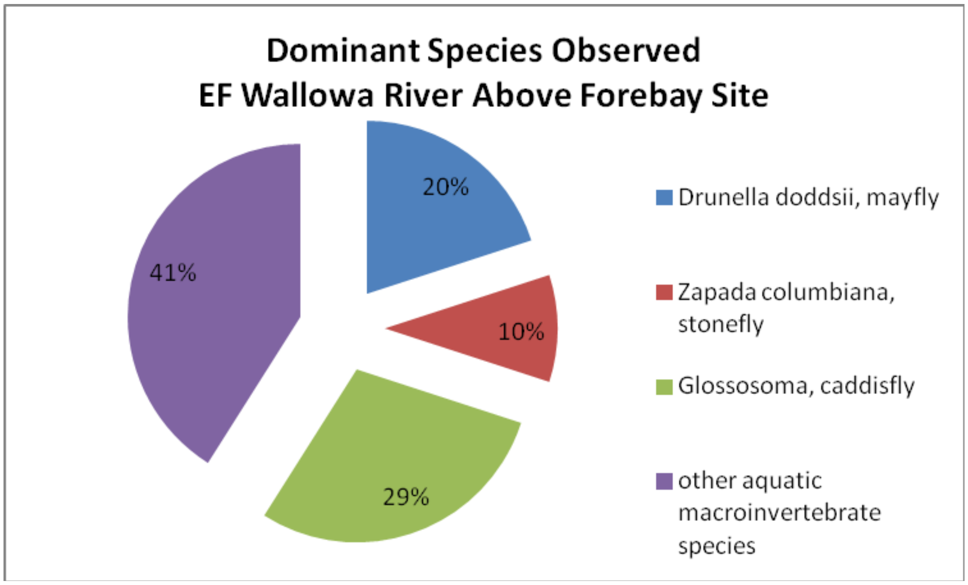
Each sample was sent to the Aquatic Biology Associates lab in Corvallis, OR for analysis. Analysis consisted of identifying all macroinvertebrate species present in each sample to Genus as well as enumerating all macroinvertebrates within each sample.

5.3 Results

Macroinvertebrate samples were collected from the upper East Fork Wallowa River above the Project forebay, a riffle within the 500 m stream section of the lower East Fork Wallowa River natural channel below the anadromous barrier, and from the East Fork Wallowa River natural channel at its confluence with the West Fork Wallowa River on August 23, 2012. Samples were sent to Aquatic Biology Associates for analysis in October 2012. Each sample was analyzed for species composition and associated species relative abundance within the sample as expressed in the table in Appendix A.

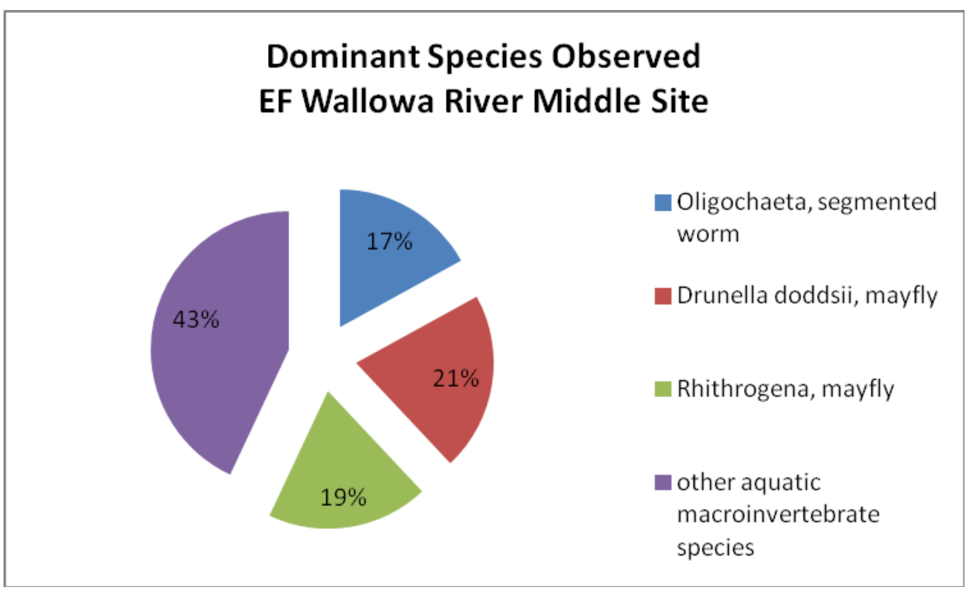
The sample from the East Fork Wallowa River above the Project forebay was dominated by Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) with the three most prevalent species expressed in Figure 5.3.1. In all, 36 different aquatic macroinvertebrate species were identified and enumerated from this sample.

Figure 5.3.1. The three most dominant aquatic macroinvertebrate species observed within the sample taken from above the Project forebay.

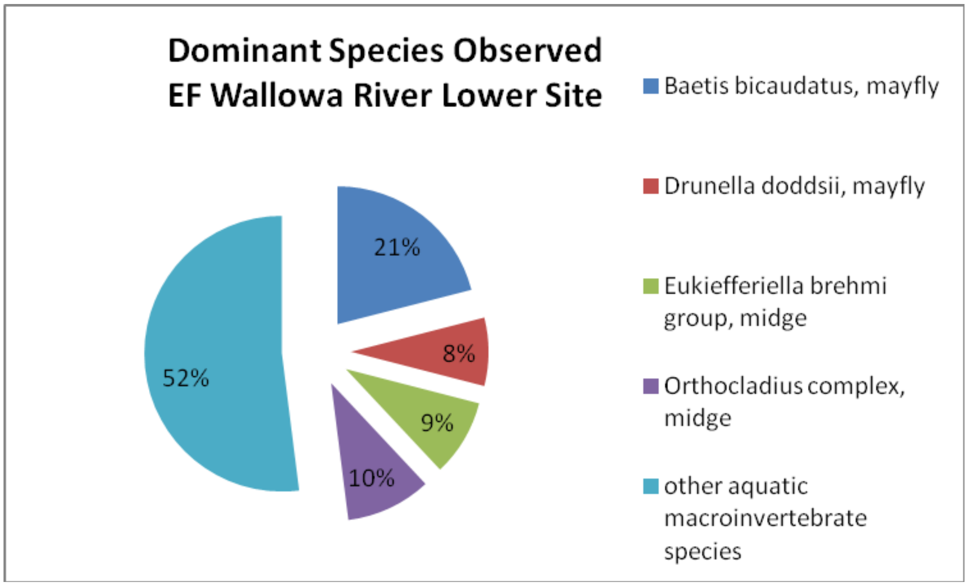


The sample taken from the East Fork Wallowa River natural channel in the indentified 500 m stream section was dominated by mayflies, stoneflies, caddisflies, Chironomidae (true flies, midges), and Diptera (true flies). In all 40 different species were identified from within this sample. The three most dominant species observed are identified within Figure 5.3.2.

Figure 5.3.2. The three most dominant aquatic macroinvertebrate species observed within the sample taken from the mid East Fork Wallowa River natural channel.



The sample taken from the lower East Fork Wallowa River natural channel was dominated by mayflies, stoneflies, caddisflies, midges, and true flies. In all 50 different species were identified from within this sample. The most dominant species observed are identified within Figure 5.3.3.



5.4 Discussion

Taxon richness and diversity increased within the three samples collected the further downstream the sample location. Percent composition of species intolerant to higher water temperatures and lower dissolved oxygen levels also increased in the downstream samples when compared to the samples taken from upstream. 41 percent of the lowermost sample was comprised of highly tolerant midges and flies (Friemuth and Bass 1994) compared to only eight percent of the mid sample and four percent from the uppermost sample taken from above the Project forebay. Conversely, 40 percent of the sample gathered from above the Project forebay consisted of highly intolerant caddisflies (Gallepp 1977). The proportion of intolerant caddisfly diminished downstream in the middle and lower sample sites, ten and eight percent respectively.

Though tolerant taxon increased in samples taken from lower in the stream reach, all three samples collected were dominated by moderate to highly intolerant aquatic macroinvertebrate species, indicative of high water quality. 93 percent of the upper sample, 69 percent of the middle sample, and 52 percent of the lower sample consisted of caddisflies, mayflies, or stoneflies known to have stringent habitat requirements in terms of low water temperatures and high dissolved oxygen content (Lillehammer 1988 and Whitney 1939).

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APPENDIX A

	Water body Station	E.F. Wallowa River Lower	E.F. Wallowa River Middle	E.F. Wallowa River Above Forebay
Taxon	Common name	Abundance	Abundance	Abundance
Turbellaria	flat worms	29	151	54
Nemata	round worms	14	22	
Oligochaeta	segmented worms	458	613	
Ostracoda	seed shrimp		11	
Acari	mites	14	22	
Ameletus	mayflies		11	11
Acentrella turbida	mayflies	43		
Baetis bicaudatus	mayflies	1631	204	151
Caudatella hystrix	mayflies	358	22	
Drunella coloradensis	mayflies	114	22	11
Drunella doddsii	mayflies	658	742	570
Drunella grandis/spinifera	mayflies	72	22	11
Ephemerella dorothea infrequens	mayflies			11
Ephemerella tibialis	mayflies	172	54	
Cinygmula	mayflies	43	22	11
Epeorus albertae group	mayflies	100	22	75
Epeorus grandis group	mayflies	129	22	65
Rhithrogena	mayflies	143	678	183
Capniidae	stoneflies	29	32	11
Chloroperlidae	stoneflies	14		
Paraperla	stoneflies			11
Leuctridae	stoneflies		22	
Zapada cinctipes	stoneflies	14	54	
Zapada columbiana	stoneflies	43	54	291
Zapada oregonensis group	stoneflies	14	22	
Doroneuria	stoneflies	43	86	11
Isoperla	stoneflies		11	54
Megarcys	stoneflies	29	11	
Yoraperla brevis	stoneflies			11
Taeniopterygidae	stoneflies	72	11	75
Glossosoma	caddisflies	114	151	850

Taxon	Water body / Station / Common name	E.F. Wallowa River Lower Abundance	E.F. Wallowa River Middle Abundance	E.F. Wallowa River Above Forebay Abundance
Glossosoma	caddisflies	14		
Parapsyche elsis	caddisflies	29	97	118
Ecclisomyia	caddisflies		11	11
Dolophilodes	caddisflies	14	75	11
Rhyacophila atrata group	caddisflies		11	11
Rhyacophila brunnea/vemna group	caddisflies	43		11
Rhyacophila hyalinata group	caddisflies	14		32
Rhyacophila narvae	caddisflies			11
Rhyacophila vagrita	caddisflies	114		
Rhyacophila vagrita	caddisflies	14		11
Neophylax	caddisflies			22
Neothremma	caddisflies			22
Oligophlebodes	caddisflies			43
Heterlimnius corpulentus	riffle beetles			11
Clinocera	dance flies	72		
Neoplasta	dance flies	43	11	
Glutops	higher flies	14	108	
Prosimulium	black flies	29		
Prosimulium	black flies			11
Simulium	black flies	114		
Dicranota	crane flies		11	
Limnophila	crane flies		11	
Chironomidae	midges	100	22	65
Brillia	midges	14		
Chaetocladius	midges		11	
Cricotopus nostocicola	midges	14		
Diamesa	midges	57		
Eukiefferiella brehmi group	midges	673	22	
Eukiefferiella claripennis group	midges	372		32
Eukiefferiella devonica group	midges	329		
Micropsectra	midges	14	22	
Orthocladius	midges	43		

	Water body Station	E.F. Wallowa River Lower Abundance	E.F. Wallowa River Middle Abundance	E.F. Wallowa River Above Forebay Abundance
Taxon	Common name			
Orthocladius complex	midges	859		11
Orthocladius (Euorthocladius)	midges	100		
Pagastia	midges	172		
Stempellinella	midges		22	
Thienemanniella	midges	14		
Tvetenia bavarica group	midges	215	65	32