Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

PUBLIC AFFAIRS

August 25,2010

In reply refer to: DK-7

Advocates of the West
Attn: Kristin F. Ruether, Attorney
PO Box 1612
Boise, ID 83701

RE: BPA-2010-01944-F/00225-C

Dear Ms. Ruether:

This letter is a final response to the request for information that you made to the U.S. Department of Commerce, National Oceanic and Atmospheric Administration under the Freedom of Information Act (FOIA), 5 U.S.C. 552.

Response:
In response to your request regarding all consultation documents, communications regarding consultation, and monitoring and documentation regarding stream conditions, range conditions, or fish activities within the Pahsimeroi River watershed since July 21, 2008, the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, had forwarded a BPA document for review by BPA, prior to its release under FOIA. Mr. Joe DeHerrera, Wildlife Biologist, has reviewed the attached report and it is released in its entirety.

If you are dissatisfied with this determination, you may appeal within thirty (30) days from the date you received this letter to The Director, Office of Hearings and Appeals, Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585. The appeal must be in writing and both the envelope and letter must be clearly marked "Freedom of Information Act Appeal."

I appreciate the opportunity to assist you. Please contact Laura M. Atterbury, FOIA/Privacy Act Specialist, at 503-230-7305 with any questions about this letter.

Sincerely,

/s/Christina J. Munro
Christina J. Munro
Freedom of Information Act/Privacy Act Officer

Enclosure: Duck Creek Fisheries Report

Duck Creek Fisheries Report

Prepared for:
U.S. Department of Energy
Bonneville Power Administration
Fish and Wildlife Program
P.O. Box 3621
Portland, Oregon 97208-3621

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ABSTRACT

The Idaho Department of Fish and Game's (IDFG) Anadromous Fish Screen Program based in Salmon, Idaho conducts fisheries surveys in tributary streams utilizing electrofishing methodologies to document the distribution, occurrence, and abundance of fish throughout watersheds in the Salmon River Basin. These watershed inventories provide baseline data for monitoring and evaluation assessments of future and existing fisheries improvement projects. Duck Creek is part of a conservation project being implemented to improve fish passage amd instream flow conditions in the Pahsimeroi River and Patterson- Big Springs Creek to benefit anadromous and resident fish. Duck Creek is a spring fed stream that has become functionally disconnected from Patterson- Big Springs Creek because of its interception by the P-09 cross-ditch canal. As a result of this, flows are substantially reduced to upwelling groundwater in the lower half of the watershed, with a flow of 2.2 cfs at the confluence with Patterson- Big Springs Creek. Three sites ranging in length from 100 m to 120 m were sampled with electrofishing methodologies in 2007, two upstream of the cross-ditch intercept and one downstream of the intercept. Fish sampled include three juvenile Chinook salmon *Oncorhynchus tshawytscha* and one steelhead/rainbow trout *Oncorhynchus mykiss*, found only in the two upper electrofishing sites, and 82 brook trout *Salvelinus fontinalis*, found in all three sites. Plans are currently being implemented to eliminate the cross-ditch point of diversion at Patterson- Big Springs Creek with future plans to breach the levee of the cross-ditch canal and reconnect Duck Creek to the confluence with Patterson- Big Springs Creek

INTRODUCTION

The Idaho Department of Fish and Game's (IDFG) Anadromous Fish Screen Program (Screen Program) based in Salmon, Idaho is funded in part by Bonneville Power Administration (BPA) through its Fish & Wildlife Program. In the upper Salmon River basin, fish screening to protect anadromous fish has taken place since the late 1950's. The Screen Program has installed fish screens (~240) and fish passageways on most of the main-stem river corridor diversions on the Salmon River, Lemhi River, Pahsimeroi River, and North and East Fork Salmon Rivers. These larger diversions were direct threats to many salmonids, including: migratory pre-smolt and smolt spring/summer chinook salmon *Oncorhynchus tshawytscha*, steelhead *Oncorhynchus mykiss*, sockeye salmon *Oncorhynchus nerka*, and fluvial bull trout *Salvelinus confluentus*. Most unscreened diversions are currently found throughout both the large and small tributary systems of the main rivers, and number in the hundreds throughout the basin. Unlike most of the main-stem river diversions, which occur on private property, many diversions in the tributaries are located on a combination of private property as well as lands administered by Federal land management agencies, primarily the Bureau of Land Management (BLM) and the US Forest Service (USFS).

Federal land management policy decisions, Endangered Species Act (ESA) recovery goals, and the initiation of third party lawsuits allowed under ESA demonstrated the need for a prioritized approach for implementing projects in the tributaries of the Salmon River basin. State and Federal agencies involved in ESA recovery including IDFG, Idaho Department of Water Resources (IDWR), Idaho Governor's Office of Species Conservation (OSC), National Marine Fisheries Service (NMFS), Upper Salmon Basin Watershed Project (USBWP), and the United States Fish and Wildlife Service (USFWS) have developed a prioritized tributary work plan for addressing habitat improvement projects in the upper Salmon River basin. The developed document, "Screening and Habitat Improvement Prioritization for the Upper Salmon Sub-basin" (SHIPUSS), effectively ranks tributaries to prioritize restoration efforts (USBWP Technical Team, 2005). The main goal of SHIPUSS was to create a prioritized list of streams within watersheds to guide screening and habitat improvement projects in the upper Salmon River basin. The SHIPUSS document is used by IDFG, USBWP, and other local interested parties in conjunction with project level prioritization to accomplish screening and habitat objectives. The Screen Program uses SHIPUSS as a guide to implement actions funded by BPA. Priority I streams are those that have the potential to realize immediate, tangible benefits to fish if recovery efforts are directed toward them. Priority II streams are those that will also have tangible benefits, but they may be less substantial or may be delayed for quite some time. There may be other factors limiting the potential of these tributaries, such as chemical contamination from mines and uncooperative landowners. Priority III streams are low priority streams because they have very limited production potential, or will require extremely high levels of effort to restore their productivity. The document lists the middle segment of the Pahsimeroi River and its tributaries as Priority I streams for biological and nonbiological reasons. Duck Creek falls within this reach.

Prior to implementing conservation actions, the Screen Program conducts fisheries surveys in prioritized tributary streams utilizing electrofishing methodologies to document the distribution, occurrence, and abundance of salmonids throughout these watersheds. These initial watershed inventories provide baseline data for monitoring and evaluation assessments of future

and existing fisheries improvement projects. The objective of the surveys is to document the presence of fish species and life histories in the watershed and determine management directions for improving irrigation practices for fisheries benefits. This work includes determination of landowner willingness to participate in future year fisheries improvement projects, mapping irrigation systems, and documentation of seasonal in-stream flows, fish passage issues, and identifying water conservation potential. Irrigation improvements may include improving fish passage, identifying fish screening opportunities, diversion consolidation, diversion elimination, decreasing irrigation conveyance losses, and producing water-savings for increasing in-stream flow.

Consolidation of irrigation diversions reduces the number of times a fish is entrained into canals and decreases the overall cost of screening. Diversion eliminations reduce ditch entrainment potential and eliminate fish passage issues at the typical push-up gravel structures. Conversions from gravity flood irrigation systems to sprinkler systems can reduce irrigation water consumption by up to seventy percent. Water conservation and riparian improvements decrease water temperatures, improve habitat for rearing, and improve available in-stream flow conditions. This tributary wide approach has been found to result in better overall fisheries improvements.

There are numerous fish screens throughout much of the Pahsimeroi River drainage, including Patterson - Big Springs Creek. All of these were constructed and are operated by the Screen Program, funded by the Bonneville Power Authority (BPA). All screens constructed and installed under this program since the early 1990's have been designed to meet NOAA criteria for screening juvenile salmonids, which includes operational guidelines to provide safe passage of downstream migrating juvenile salmonids back into the natural stream channel if they are entrained into the diversion.

The objective of this study was to gain information on the current presence and densities of fish species in Duck Creek, and to document how the operation of the currently existing irrigation system is affecting anadromous fish species native to the Pahsimeroi River watershed.

STUDY AREA

A general description of the landforms and drainage of the Pahsimeroi River watershed is provided in the following excerpt by Young and Harenberg (1973).

> "The Pahsimeroi River drainage is in the Northern Rocky Mountain physiographic province (Fenneman, 1931**,** p 1) and is typical of the basins common to this province. Like other catchments in this province, the Pahsimeroi River basin consists of a valley (flat or plain) surrounded by a rim of mountains (fig 3). The basin trends north-northwest and is bounded by the Lemhi Range on the northeast, which rises to an altitude of 10,971 feet, and by the Lost River Range on the southwest, which rises to an altitude of 12,662 feet at Borah Peak, the highest point in Idaho The divide between the Pahsimeroi and Little Lost River basins is formed by the Donkey Hills which rise to an altitude of 9,550 feet.
>
> The valley floor has an average altitude of about 5,500 feet and ranges in width from less than 1 mile near its mouth to over 10 miles at its widest point. The valley is characterized by well-developed alluvial fans that extend from the mountain fronts to near the center of the valley floor where they coalesce.
>
> The Pahsimeroi River drains an area of about 845 square miles and is tributary to the Salmon River. The river is about 50 miles long from the point where it meets the valley floor at an altitude of about 7,800 feet to its confluence with the Salmon River at an altitude of

about 4,600 feet. Although the Pahsimeroi River is an intermittent stream in some of its upper reaches, ground-water inflow sustains a year-long flow throughout most of its reach.

Major tributaries to the Pahsimeroi River include Morgan, Morse, Falls, Patterson, Big, and Goldburg Creeks which drain the western slopes of the Lemhi Range; and Lawson, Sulphur, Meadow, Grouse, and Doublespring Creeks which drain the eastern slopes of the Lost River Range. Because of extensive irrigation diversions and large natural percolation losses to the coarse alluvium of the valley, these tributaries contribute surface water directly to the Pahsimeroi River only during periods of high surface-water runoff."

The hydrology of the Pahsimeroi River drainage is a dynamic system in regards to the surface and groundwater characteristics from its headwaters to its confluence with the Salmon River. Surface flows disappear into the aquifer in the headwater areas of the watershed and resurface as several springs arising from the valley flow within the area between Patterson - Big Springs Creek and the mainstem of the Pahsimeroi River. One of the spring creek tributaries is Duck Creek, which historically was a tributary to Patterson - Big Springs Creek. Several decades ago a diversion was built on Patterson - Big Springs Creek, upstream of the Duck Creek confluence, to divert water to the mainstem of the Pahsimeroi River to supplement flows for irrigation uses. This cross-ditch intercepts and captures the water from Duck Creek, increasing the supplementation flows in the cross-ditch. Downstream of this point of interception, the Duck Creek stream channel regains some spring flow before it reaches its confluence with Patterson - Big Springs Creek. The point of interception of Duck Creek at the cross-ditch canal is an earthen dike creating a barrier to the upstream and downstream migration of fish between lower and upper Duck Creek (Photo 1, Figure 1). The lower reach, accessible to fish from Patterson - Big Springs Creek, is approximately 1,020 m in length. The upper reach, accessible to fish that enter the cross-ditch from its point of diversion on Patterson - Big Springs Creek, measures approximately 800 m in length.

Fishery Resources

Historically, spawning and rearing habitat was probably supported within the watershed for at least two federally-listed anadromous fish species, spring/summer Chinook salmon *Oncorhynchus tshawytscha* and steelhead *O. mykiss*. Along with all other waters of the upper Salmon River watershed, Duck Creek was designated as critical habitat for Snake River spring and summer Chinook salmon on December 28, 1993 (58 CFR 68543) and for steelhead on February 16, 2000 (64 CFR 5740). It has probably also supported resident and fluvial forms of westslope cutthroat trout *O. clarki* and threatened bull trout *Salvelinus confluentus*, and there may be a resident population of rainbow trout *O. mykiss*. Other native species suspected to be present in Duck Creek include mottled sculpin *Cottus bairdii*, shorthead sculpin *C. confusus*, redside shiner *Richardsonius balteatus*, longnose dace *Rhinichthys cataractae*, speckled dace *R. osculus*, northern pikeminnow *Ptychocheilus oregonensis* and bridgelip sucker *Catostomus columbianus*. It is also possible that pacific lamprey *Lampetra tridentata* were once present in Duck Creek. The only fish species known to have been stocked in the Pahsimeroi River since at least 1967 are steelhead, and spring and summer Chinook salmon. There are no records of any fish being stocked into Duck Creek.

Juvenile Chinook salmon were sampled by electrofishing in the Fall of 2006 from Patterson - Big Springs Creek, at a site immediately downstream of the PBSC-03 irrigation diversion, which is approximately 300 m upstream of the cross-ditch canal diversion (IDFG, unpublished data). It is suspected that the dam at the PBSC-03 diversion is a barrier to the

upstream migration of juvenile salmonids, so there may be no juvenile Chinook salmon upstream of this site on Patterson - Big Springs Creek unless adult fish are successfully crossing this dam prior to spawning.

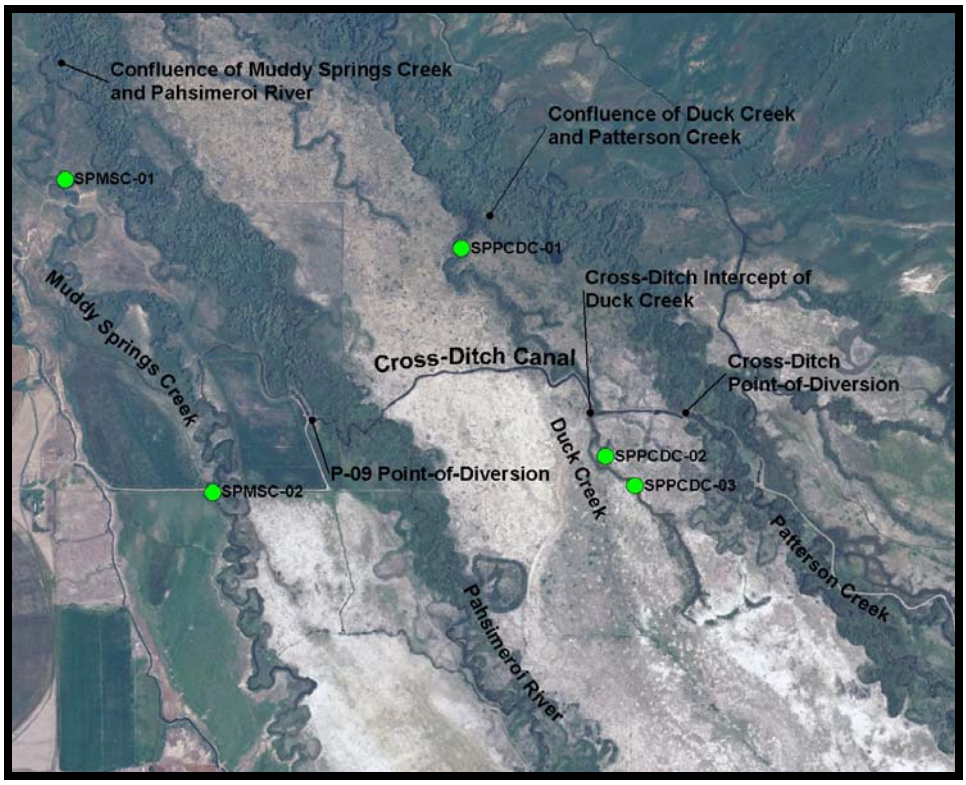

Figure 1. Aerial photograph of Duck Creek and adjacent Muddy Springs Creek watershed and locations of sites electrofished in 2007.

Photo 1. Confluence of Duck Creek (center right) and cross-ditch intercept.

METHODOLOGY

Fishery Surveys

Fish presence and abundances were documented by utilization of backpack electrofishing methodologies in the summer of 2007. Sample sites were selected from within the lower and upper reaches of Duck Creek. The downstream boundary of each site was recorded with a GIS device providing a Universal Transverse Mercator location set to North American Datum 27 metric units.

Electrofishing sites were at least 100 m long with a block net set at the upper and lower boundaries. Fish were sampled by using a Smith-Root backpack LR-24 battery powered electrofisher with an electrical wave form set between 40 Hz and 50 Hz, pulse widths ranging from 3.0 ms to 4.6 ms, and the voltages set between 300 V and 400 V. All settings were within the guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act (NMFS 2000).

The total amount of time that the electrofisher was activated was recorded in seconds for each pass at each sample site. The sampling crew consisted of one person electrofishing with two to three people netting stunned fish, depending on stream size. The crew worked their way upstream through the sample site, electrofishing as much habitat as possible, with all fish sampled being put into a five-gallon bucket of water with an aerator. After the completion of each electrofishing pass, most salmonids were measured for fork-length (mm) and weight (g), and all other fish species were enumerated. Juvenile Chinook salmon were enumerated and released without measuring to reduce handling stress. Before handling, all fish were anesthetized with a concentrated 30 g/L solution diluted to 90 mg/L of MS-222 to reduce stress and prevent injury. In between passes, fish were held in recovery live-wells, and released back into the sample site after completion of all passes and processing.

Multiple passes of electrofishing effort were made where we felt that we had low sampling efficiency to increase the probability of sampling all species present. Densities of fish were reported as the total number of each species sampled in the first pass of electrofishing per 100 m^2 of habitat. Population estimates were made only on salmonid species if there were a decreasing number of fish sampled in each successive pass. Estimates of the population were made using the Microfish 3.0 computer software package (Van Deventer and Platts, 1985).

Habitat Surveys

Total area of each electrofishing site was calculated from the average of wetted stream width measurements taken every 20 m throughout the length of the sample site. The approximate percentage of instream habitat classified as pool, riffle, run or pocket water was estimated from visual observations. Bank and riparian conditions were given a general rating for providing cover, shading and stability. Elevations of the sites sampled were acquired off of topographical maps. Water temperatures were measured at each site with a hand-held thermometer at the time fish samples were taken. Stream gradient was measured by dividing the rise in elevation as measured with a sight level by total length of the sample site. Total streamflow (discharge) measurements were made with a SonTek FlowTracker Handheld Acoustic Doppler Velocimeter (ADV) manufactured by SonTek/YSI Inc. The transducer was

mounted on a top-setting rod and used to measure at least ten velocities across a transect, total discharges were automatically computed by the ADV.

RESULTS

Fishery Surveys

A total of three sites were sampled with electrofishing methodologies in the Duck Creek watershed in 2007 (Figure 1). The lowermost site was approximately 100 m upstream of the Duck Creek confluence with Patterson - Big Springs Creek and the uppermost site was approximately 400 m upstream of the cross-ditch intercept. Collectively all sites encompassed 320 m of stream length and 1,338 m^2 of sampled stream habitat (Table 1). The lowermost site was surveyed on June 12, 2007 and the two uppermost sites were surveyed on June 4, 2007.

Two passes of electrofishing effort were made on the lowermost site and a single pass of electrofishing effort was made on the two upper sites (Table 2). Fish species sampled include juvenile Chinook salmon, steelhead/rainbow trout, brook trout *Salvelinus fontinalis*, and shorthead sculpin.

Chinook Salmon

A total of three juvenile Chinook salmon were sampled from the two uppermost electrofishing sites on Duck Creek in two passes of electrofishing (Table 3). These fish probably entered upper Duck Creek from the cross-ditch canal, which they accessed through the point of diversion from Patterson - Big Springs Creek. Juvenile Chinook salmon have been documented to be present in Patterson - Big Springs Creek up to the PBSC-03 diversion dam (IDFG, unpublished data), which is within 300 m upstream of the cross-ditch canal point of diversion.

Steelhead/Rainbow Trout

A single juvenile steelhead/rainbow trout was sampled from electrofishing site SPPCDC-02 (Table 4). This fish was 150 mm (fork length) and weighed 46 grams. It may have entered upper Duck Creek from the cross-ditch canal, which they accessed through the point of diversion from Patterson - Big Springs Creek. Juvenile steelhead/rainbow trout have been documented to be present in Patterson - Big Springs Creek up to the PBSC-03 diversion dam (IDFG, unpublished data), which is within 300 m upstream of the cross-ditch canal point of diversion.

Brook Trout

Brook trout were the most abundant salmonid species sampled with 82 specimens captured in a total of four passes of electrofishing at all three sites combined. Electrofishing site SPPCDC-02 was found to have the highest density of brook trout sampled with 9.1 fish sampled per 100 m^2 of habitat in the first pass of electrofishing (Table 5). Utilizing the multi-pass depletion method of estimating populations (Van Deventer and Platts, 1985), the total population of brook trout at site SPPCDC-01 was estimated to be 44 fish (± 30). The largest brook trout sampled was 160 mm in fork length, which was from electrofishing site SPPCDC-01 (Table 6).

Sculpin

A total of 204 sculpin were sampled in four passes of electrofishing effort at all sites combined. A subsample of five fish were preserved in formalin and later identified as shorthead sculpin.

Habitat Surveys

Duck Creek has a perennial flow of water throughout most of its length, except for a few meters downstream of the cross-ditch canal intercept, where all of the water from the upper half of the watershed is diverted into the canal. The amount of water being diverted was measured to be 3.8 cfs on June 4, 2007 (Table 7). Lower Duck Creek regains some flow from groundwater seepage a short distance downstream of the cross-ditch canal (Photo 12). A measurement of flow near the mouth of Duck Creek indicated that the natural stream channel regained 2.2 cfs of flow downstream of this intercept on June 12, 2007 (Table 7).

Since most of the flow in Duck Creek is from spring water, there is almost no channel or stream bank scouring, and water depth is homogeneous across most of the channel throughout most of the length of the watershed. This results in most of the instream habitat being composed of runs with no pools, very few riffles or pocket water (Table 7). The bank condition at the lowermost site was rated as good because of the abundance of willows within the riparian area providing shading and bank stability. The upper watershed has fewer willows with the stream bank dominated by grasses and sedges.

DISCUSSION

Fishery Surveys

Chinook Salmon

The presence of juvenile Chinook salmon in upper Duck Creek indicates that the upper watershed is accessible to anadromous fish probably coming up from the cross-ditch canal. Duck Creek currently provides early rearing habitat for the species, even though fish must take a circuitous route from Patterson - Big Springs Creek into the cross-ditch canal to access Duck Creek. Although juvenile Chinook salmon have been documented to be present in Patterson - Big Springs Creek (IDFG, unpublished data), none were found in lower Duck Creek, near its confluence with Patterson - Big Springs Creek. It is suspected that this may be because flows within this reach of Duck Creek are substantially lower than they are in Patterson - Big Springs Creek (2.2 cfs at electrofishing site SPPCDC-01). Eliminating the cross-ditch canal and reconnecting lower and upper Duck Creek would combine flows from the two stream segments and may accumulate to as much as 6.0 cfs. This increase in flow and reconnection of the upper and lower reaches would provide a significant improvement to existing early rearing habitat in Duck Creek.

Steelhead/Rainbow Trout

Only one *O. mykiss* was found in the three Duck Creek electrofishing sites combined. Several *O. mykiss* were sampled from nearby Patterson - Big Springs Creek in 2006. Those fish ranged in size from 60 mm up to 270 mm in fork length (IDFG, unpublished data), indicating that there may be a mixed stock of juvenile steelhead and resident rainbow trout present. Further investigation would be required to determine this. The reconnection and combined flows of lower and upper Duck Creek should increase the volume of flow of the stream and possibly increase the suitability of habitat for *O. mykiss* throughout the system.

Brook Trout

Brook trout were the most abundant salmonid species found in Duck Creek, present in large numbers at all three sites electrofished. Brook trout were also found in large numbers in nearby Patterson - Big Springs Creek in the Fall of 2006 (IDFG, unpublished data).

Sculpin

The sculpin species identified from a subsample taken for later identification were all shorthead sculpin, which has been found to be the most prevalent species sampled from Salmon River tributaries by the IDFG Anadromous Fish Screen Program.

Habitat Surveys

The cross-ditch canal intercept is the most significant habitat feature affecting the distribution of fish in Duck Creek. Plans are currently being implemented to eliminate the point of diversion to the cross-ditch canal at Patterson - Big Springs Creek and to eliminate the P-09 diversion, transferring water rights to a downstream pumping location on the Pahsimeroi River. Future plans include breaching the cross-ditch canal where it currently intercepts Duck Creek and transfers its water to the Pahsimeroi River. This would probably restore flows to approximately 6.0 cfs at the Duck Creek confluence and provide access to the entire Duck Creek watershed to upstream migrating fish from Patterson - Big Springs Creek. The estimated total length of continuous stream habitat available to fish would be 1,820 m.

Muddy Springs Creek is an adjacent spring fed tributary that historically flowed into the Pahsimeroi River upstream of the Patterson - Big Springs Creek confluence. The two spring-fed tributaries have been intercepted by the cross-ditch canal and the P-09 ditch. The elimination of the P-09 diversion and ditch in 2008 would allow Muddy Springs Creek water to reconnect with its lower previously disconnected reach, and flow into the Pahsimeroi River at its historic confluence.

REFERENCES

National Marine Fisheries Service. 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act.

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ACKNOWLEDGEMENTS

Dustin Allen, and Tim Westfall gathered most of the fisheries field data. Greg Lowell gathered the flow data.

Table 1. Characteristics of electrofishing sites in Duck Creek watershed, 2007.

Site ID	Site Start UTM E (Z 12)	Site Start UTM N (Z 12)	Elevation (m)	Site Length (m)	Site Area (m^2)
SPPCDC-01	266133	4942633	1,493	120	372
SPPCDC-02	266515	4942036	1,500	100	460
SPPCDC-03	266594	4941951	1,500	100	506

Table 2. Electrofishing survey data for sites sampled in Duck Creek watershed, 2007.

Site ID	Survey Date	Survey Time	Number of Electrofishing Passes	Total Time Electrofished (Seconds)		Waveform Settings		
				Pass 1	Pass 2	Volts	Freq (Hz)	Pulse Width (mSec.)
SPPCDC-01	6/12/2007	1130	2	968	985	300	40	3.0
SPPCDC-02	6/4/2007	1230	1	932		400	50	4.6
SPPCDC-03	6/4/2007	1350	1	1,044		400	50	4.6

Table 3. Densities of juvenile Chinook salmon in Duck Creek electrofishing sites, 2007.

Site ID	Number of Electrofishing Passes	Total Chinook Sampled	Number of Chinook Pass 1	Number of Chinook Pass 2	Number of Chinook 1st Pass/100m²
SPPCDC-01	2	0	0	0	0.0
SPPCDC-02	1	2	2		0.4
SPPCDC-03	1	1	1		0.2

Table 4. Densities of steelhead/rainbow trout (RBT) in Duck Creek electrofishing sites, 2007.

Site ID	Number of Electrofishing Passes	Total RBT Sampled	Number of RBT Pass 1	Number of RBT Pass 2	Number of RBT 1st Pass/100m²
SPPCDC-01	2	0	0	0	0.0
SPPCDC-02	1	1	1		0.2
SPPCDC-03	1	0	0		0.0

Table 5. Densities of brook trout (EBT) in Duck Creek electrofishing sites, 2007.

Site ID	Number of Electrofishing Passes	Total EBT Sampled	Number of EBT Pass 1	Number of EBT Pass 2	Number of EBT 1st Pass/100m²	Population Estimate of EBT ± 95% CI	Density Estimate of EBT/100m²	Capture Probability
SPPCDC-01	2	31	19	12	5.1	44 ± 30	11.8	0.449
SPPCDC-02	1	42	42		9.1			
SPPCDC-03	1	9	9		1.8			

Table 6. Length frequencies of brook trout sampled from the Duck Creek watershed, 2007.

Fork Length (mm)	SPPCDC-01	SPPCDC-02	SPPCDC-03
40	2	4	
50	9	12	1
60	12	20	5
70	6	3	2
80		1	1
90			
100		1	
110			
120			
130	1		
140			
150		1	
160	1		
Total Measured:	31	42	9

Table 7. Habitat characteristics of sites electrofished in the Duck Creek watershed, 2007.

Site ID	Survey Date	Average Width (m)	% Pool	% Run	% Pocket Water	% Riffle	Bank Condition	Water Temp (°C)	Gradient (%)	Stream Flow (cfs)
SPPCDC-01	6/12/2007	3.1		80	10	10	good	14	0.69	2.2
SPPCDC-02	6/4/2007	4.6		90	5	5	fair	14	0.25	3.8
SPPCDC-03	6/4/2007	5.1		90	5	5	fair	11	0.35	

Photo 2. Juvenile Chinook salmon sampled from electrofishing site SPPCDC-02 June 4, 2007.

Photo 3. Juvenile steelhead/rainbow trout sampled from electrofishing site SPPCDC-02 June 4, 2007.

Photo 4. Brook trout sampled from electrofishing site SPPCDC-01 June 12, 2007.

Photo 5. Shorthead sculpin sampled from electrofishing site SPPCDC-01 June 12, 2007.

Photo 6. Lower boundary of electrofishing site SPPCDC-01 June 12, 2007.

Photo 7. Upper boundary of electrofishing site SPPCDC-01 June 12, 2007.

Photo 8. Lower boundary of electrofishing site SPPCDC-02 June 4, 2007.

Photo 9. Upper boundary of electrofishing site SPPCDC-02 June 4, 2007.

Photo 10. Upper boundary of electrofishing site SPPCDC-03 June 4, 2007.

Photo 11. Photograph of cross-ditch canal dike and head of lower Duck Creek (center left) historic channel.

Photo 12. Habitat photograph of lower Duck Creek, June 12, 2007.