Assess Current and Potential Salmonid Production in Rattlesnake Creek Associated with Restoration Efforts

Yakama Indian Nation

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Yakama Nation

BPA Project ID Number: 2001-025-00
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Annual Report

For the Period: May to April 2003

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Introduction

This document represents the FY2002 BPA contract *Statement of Work* for the Yakama Nation (YN) portion of the project entitled “Assessment of current and potential salmonid production in Rattlesnake Creek associated with restoration efforts”.

The purpose of the project is to complete detailed surveys of water quality, fish populations, habitat conditions and riparian health in the Rattlesnake Creek sub-basin of the White Salmon River in south central Washington. Results of the surveys will be used to establish Rattlesnake Creek sub-basin baseline environmental factors prior to anticipated removal of Condit Dam in 2006 and enable cost-effective formulation of future watershed restoration strategies.

Objectives, Tasks and Methods

Objective 1. Characterize stream and riparian habitat conditions in the Rattlesnake Creek drainage.

Task 1-a. Measure water quality, water quantity, stream habitat and riparian conditions. [UCD, YN, USGS]

Methods: YN will conduct stream condition inventories (SCI) on Rattlesnake Creek and tributaries to identify and/or quantify key aquatic ecosystem components. Information collected may be useful in assessing and describing existing and potential conditions for aquatic ecosystems, and in responding to specific issue driven stream monitoring questions. SCI were developed over a five year period (1993-98) by fisheries biologists and hydrologists by the USDA in Region 5 with support and sampling design and statistical analysis from the Pacific Southwest Region Research Station (PSWRS). The intensive SCI inventory is designed to provide information that can be used to make reliable comparisons over time or between streams with a reasonable level of statistical confidence.

Once a sensitive stream reach has been identified for an SCI, several attributes will be conducted which include: 1) temperature and water quality, 2) bankfull, 3) large woody debris (LWD), 4) pebble counts, 5) cross-sections, 6) gradient, 7) width/depth, 8) entrenchment and 9) stream flow. The survey segment will include: 1) habitat types, 2) pool, 3) pool tail fines, 4) bank stability, 5) shade and 6) bank angle.

Stream discharge measurements will be taken in SCI sensitive reaches. Sites will be selected that have uniform flow across channel width. Permanent cross-sections will be marked with rebar. Rebar will be anchored in the banks in a fashion to withstand a 100 year flood event. GPS coordinates will be taken on the cross-section to allow repeatable studies. A rain gauge will be located near the mouth of Rattlesnake Creek with another rain gauge being located in the head waters of Rattlesnake Creek. The Rattlesnake drainage is inconsistent with several other drainages. The lower portions of the basin receive considerably more precipitation relative to the headwaters. The SCI reaches will be located on either state or federal lands to prevent restriction of sites in the future.

Progress: Considerable progress has been made collecting information on Rattlesnake Creek Drainage for BPA contract 21009. Two stream condition inventories (SCI) have been completed in the drainage along with a portion of a third SCI in Indian Creek, a tributary to Rattlesnake Creek. Data has been collected for the two reference reaches in Rattlesnake Creek for bankfull, large woody debris (LWD), pebble counts, gradient, width/depths, pools to riffles percent, pool tail fines, bank stability, bank angle, shade and permanent cross-sections set-in with rebar.

Indian Creek SCI has been partially completed with all the listed above except for the width to depths, gradients and permanent cross-sections. Indian Creek SCI starts in legal T.4 N., R.11 E., Sec 32. Hopes of finishing the Indian Creek SCI are by summer 2003. The first of two completed SCI's border the landowner Steve Stampfli's property on the lower portion (confluence with White Salmon River) of Rattlesnake Creek (legal: T.4 N., R.11 E., Sec 30) (Please refer to Appendix A 1-3 for SCI and thermograph locations). The second of the two borders the landowner Frank Marhgraf's property in the middle portion of Rattlesnake Creek (legal: T.4N., R11E., Sec 10). A fourth SCI will be established next summer 2003 up in the head waters of Rattlesnake Creek either on private land or State DNR land. The precise location is still being worked out.

Lower Rattlesnake, Middle Rattlesnake and Indian Creek SCI's have been condensed into final report form and are presented in the pre-mentioned order.

Rattlesnake Creek (Lower) SCI

Rattlesnake Creek, a tributary to the White Salmon River is located in the town of Husum, Washington and enters the White Salmon River from the East. An 875.0 meter (2,870.0 feet) permanent sensitive reach was established in July of 2002. The 2002 SCI started near the confluence with the White Salmon River, precisely at the upstream end of the Hwy 141 Bridge where Rattlesnake Creek flows below.

Channel morphology is Rosgen B3c. The valley is wide enough to provide for limited stream meandering in some stretches (Rosgen, 1996).

To get to the start of the sensitive stream reach head North on Hwy 141 from the confluence of the White Salmon River with the Columbia River. Travel north for seven miles to the town of Husum, Wa. Rattlesnake Creek flows below the first bridge that Hwy 141 goes over. The SCI start is the upstream end of the Hwy 141 Bridge. T4N R11E S31 GPS: 45 47 50N., 121 29 1W.

Monitoring protocol used is found in U.S. Department of Agriculture Stream Condition Inventory Version 4.0, 1998. Exceptions made were: shade – measured with a spherical densiometer; and an YSI water quality meter was used to establish baseline water chemistry data.

Large Woody Debris

A total of 16 pieces of wood were counted in the sensitive reach. This would equate to 18 pieces per kilometer or 1.8 pieces per 100 meter. Minimum debris length was 5.0 m (16.4 ft). Within the sensitive reach there were no aggregates found. Aggregates are noted as 4 or more logs touching with at least one positioned inside of bankfull.

Figures 1-2 provides a summary of the large woody debris found in the sensitive reach of Rattlesnake Creek on 8-21-02. The minimum debris length noted was one half of the average bankfull width, 5 m (16.4 ft). Large woody debris was delineated by diameter and length for comparison. Total number of pieces of wood for diameter classes and length classes were added and a percent was found for each class.

Figure 1.

Figure 2.

Pebble Counts

A Stream Condition Inventory pebble count was conducted at the beginning of the sensitive reach. One hundred points were inventoried to assess substrate composition.

Table 1 shows percent of each size class, and percent embedded, from the pebble count conducted on Rattlesnake Creek.

	%Sand(<2)	%Gravel(2-64)	%Cobbles(64-256)	%Boulders(>256)	%Bedrock
Free	1	37	34	27	0
Embedded	0	0	1	N/A	N/A

(N/A=inherently embedded)

Figure 3 illustrates the results of the Wolman pebble count performed on Rattlesnake Creek on 8-21-02. Size classes, in millimeter, are presented for comparison by particle-size class percent and percent accumulation.

Figure 3.

Cross Sections

Three permanent cross sections were placed within the sensitive reach at 97.0 m (318.2 ft), 562.2 m (1,844.0 ft), and 766.0 m (2,512.5 ft). Three cross sections with 5 width to depth were calculated for mean values as follows. The mean gradient is 1.28%. The mean width to depth ratio is 28.61. The mean entrenchment ratio is 1.84.

Figures 4-6 are of the three permanent cross sections placed in Rattlesnake Creek on 07/25/02, 8/22/03. Stakes were placed on both banks, at equal heights, above the flood plain. Readings were taken from left bank, looking downstream, to right bank at appropriate intervals to characterize the stream. Waters edge (red) and bankfull (yellow) are noted. The (red) circle denotes the thalweg. Four photo points were taken at each SCI permanent cross-section. The four picture angles capture the following: Upstream, Downstream, Left Bank and Right Bank. The SCI start and end have one photo each as well for documentation of the sites (Please refer to Appendix B 1-3).

Figure 4.

Figure 5.

Figure 6.

Width to Depth Ratios

Measurements for five width to depth ratios were taken at 64.0 m (209.9 ft), 242.5 m (795.4 ft), 380.4 m (1,247.7 ft), 650.8 m (2,134.6 ft), and 828.2 m (2,716.5 ft).

Figures 7-11 show the five width to depth measurements taken on Rattlesnake Creek on 08/29/02. Depth measurements were made from left bank, looking down stream, to right bank at appropriate intervals to characterize the stream. Water level is marked in red.

Figure 7.

Figure 8.

Figure 9.

Figure 10.

Figure 11.

Pools

Along the sensitive reach, 14 pools were measured. This equates to 16 pools per km or 1.6 pools per 100 m. No pools were evidently formed from wood. Mean residual pool tail crest depth was 0.15 m (.49 ft.). Mean residual max pool depth was 0.72 m (2.36 ft.). Average fines (<2mm) were 17.5 % per pool.

Stream Bank Stability

While this stream was not an optimal candidate for measuring stream bank stability, due to the armoring of the stream, data was recorded nevertheless at 50 points along the survey segment.

Table 2 shows the percentages of stream bank stability for each category, and the percentage of that category that was caused by armoring, for the sensitive reach.

	<u>1(stable)</u>	<u>2(vulnerable)</u>	<u>3(unstable)</u>	
% Stability rating	76	22	2	%
Stability rating due to rocks and boulders	4.0	N/A	N/A	

Stream Shade

Shade measurements were taken at 50 locations within the survey segment. The mean shade was 84.3 percent as measured with a spherical densiometer. Measurements were taken in 90 degree increments at each of the 50 sites and averaged for an overall rating.

Bank Angle

While this stream was deemed not an optimal candidate for bank angle due to the general armoring and road that parallels the southern portion of the stream, data was recorded nevertheless at 50 points in the survey segment. The mean bank angle was 129.07 degrees.

Aquatic Fauna

Aquatic fauna was recorded on the first pass of the survey. Approximately 150 trout < 3 inches and approximately 12 rainbow trout (*Oncorhynchus mykiss*) 6-12 inches in length were noted. Two frogs were observed along with numerous crayfish.

Rattlesnake Creek (Middle) SCI

Rattlesnake Creek, a tributary to the White Salmon River is located in the town of Husum, Washington and enters the White Salmon River from the East. A 1,000.0 meter (3,280.0 feet) permanent sensitive reach was established in September of 2002. The 2002 SCI started along Frank Margrafs property near the intersection of Rattlesnake Creek Rd and Stauch Rd.

Channel morphology is Rosgen B3_c. The valley is wide enough to provide for limited stream meandering in some stretches (Rosgen, 1996).

To get to the start of the sensitive stream reach head North on Hwy 141 from the confluence of the White Salmon River with the Columbia River. Travel north for seven miles to the town of Husum, Wa. Once in the town of Husum take a right on Oak Ridge Rd and go 1.5 miles before taking another right onto Rattlesnake Creek Rd. Head Northeast 4.0 miles to the intersection of Rattlesnake Creek Rd. and Stauch Rd. The SCI start is located upstream of the bridge (from the intersection) approximately 240 m. T4N R11E S10 GPS: 45 50 42N., 121 24 45W.

Monitoring protocol used is found in U.S. Department of Agriculture Stream Condition Inventory Version 4.0, 1998. Exceptions made were: shade – measured with a spherical densiometer; and an YSI water quality meter was used to establish baseline water chemistry data.

Large Woody Debris

A total of 32 pieces of wood were counted in the sensitive reach. This would equate to 32 pieces per kilometer or 3.2 pieces per 100 meter. Minimum debris length was 5.0 m (16.4 ft). One aggregate was found within the sensitive reach which consisted of 7 pieces. Aggregates are noted as 4 or more logs touching with at least one positioned inside of bankfull.

Figures 12-13 provides a summary of the large woody debris found in the sensitive reach of Rattlesnake Creek on 9-19-02. The minimum debris length noted was one half of the average bankfull width, 5 m (16.4 ft). Large woody debris was delineated by diameter and length for comparison. Total number of pieces of wood for diameter classes and length classes were added and a percent was found for each class.

Figure 12.

Figure 13.

Pebble Counts

A Stream Condition Inventory pebble count was conducted at the beginning of the sensitive reach.

One hundred points were inventoried to assess substrate composition.

Table 3 shows percent of each size class, and percent embedded, from the pebble count conducted on Rattlesnake Creek.

	%Sand(<2)	%Gravel(2-64)	%Cobbles(64-256)	%Boulders(>256)	%Bedrock
Free	1	28	63	8	0
Embedded	0	0	0	N/A	N/A

(N/A=inherently embedded)

Figure 14 illustrates the results of the Wolman pebble count performed on Rattlesnake Creek on 8-21-02. Size classes, in millimeter, are presented for comparison by particle-size class percent and percent accumulation.

Figure 14.

Cross Sections

Three permanent cross sections were placed within the sensitive reach at 30.0 m (98.4 ft), 415.8 m (1,363.8 ft), and 907.1 m (2,975.3 ft). Three cross sections with 5 width to depth were calculated for mean values as follows. The mean gradient is <2.0%. The mean width to depth ratio is 36.27. The mean entrenchment ratio is 1.62.

Figures 15-17 are of the three permanent cross sections placed in Rattlesnake Creek on 09/19/02, 9/20/03. Stakes were placed on both banks, at equal heights, above the flood plain. Readings were taken from left bank, looking downstream, to right bank at appropriate intervals to characterize the stream. Waters edge (red) and bankfull (yellow) are noted. The (red) circle denotes the thalweg. Four photo points were taken at each SCI permanent cross-section. The four picture angles capture the following: Upstream, Downstream, Left Bank and Right Bank. The SCI start and end have one photo each as well for documentation of the sites (Please refer to Appendix B figures 4-6).

Figure 15.

Figure 16.

Figure 17.

Width to Depth Ratios

Measurements for five width to depth ratios were taken at 64.0 m (209.9 ft), 242.5 m (795.4 ft), 380.4 m (1,247.7 ft), 650.8 m (2,134.6 ft), and 828.2 m (2,716.5 ft).

Figures 18-22 show the five width to depth measurements taken on Rattlesnake Creek on 09/19/02. Depth measurements were made from left bank, looking down stream, to right bank at appropriate intervals to characterize the stream. Water level is marked in red.

Figure 18.

Figure 19.

Figure 20.

Figure 21.

Figure 22.

Pools

Along the sensitive reach, 12 pools were measured. This equates to 12 pools per km or 1.2 pools per 100 m. No pools were evidently formed from wood. Mean residual pool tail crest depth was 0.12 m (.39 ft.). Mean residual max pool depth was 0.68 m (2.23 ft.). Average fines (<2mm) were 6.0 % per pool.

Stream Bank Stability

The stream was measured for stream bank stability; data was recorded at 50 points throughout the survey segment.

Table 4 shows the percentages of stream bank stability for each category, and the percentage of that category that was caused by armoring, for the sensitive reach.

	1(stable)	2(vulnerable)	3(unstable)	
% Stability rating	84	10	6	%
Stability rating due to rocks and boulders	0	N/A	N/A	

Stream Shade

Shade measurements were taken at 50 locations within the survey segment. The mean shade was 77.9 percent as measured with a spherical densiometer. Measurements were taken in 90 degree increments at each of the 50 sites and averaged for an overall rating.

Bank Angle

Data was recorded throughout the sensitive stream segment to assess the mean bank angle. The mean bank angle was 139.4 degrees.

Aquatic Fauna

Aquatic fauna was recorded on the first pass of the survey. Approximately 300 trout < 2 inches and approximately 5 rainbow trout (*Oncorhynchus mykiss*) 4-7 inches in length were noted. Seven frogs were observed. Two Rattlesnakes were observed and respected!

Indian Creek SCI

Indian Creek, a tributary to the Rattlesnake Creek is located a .5 miles East of the town of Husum, Washington and enters the Rattlesnake Creek from the South. A 542.0 meter (1,778.0 feet) permanent sensitive reach was established in August of 2002. The 2002 SCI started along state land and continues upstream on state property.

To get to the start of the sensitive stream reach head North on Hwy 141 from the confluence of the White Salmon River with the Columbia River. Travel north for seven miles to the town of Husum, Wa. Once in the town of Husum take a right on Indian Creek Rd. Travel approximately 2 miles to the end of the road (Road has been permanently decommissioned). The SCI start is located at the cattle guard which denotes state land. T4N R11E S32 GPS: 45 47 25N., 121 27 20W.

Monitoring protocols used are found in U.S. Department of Agriculture Stream Condition Inventory Version 4.0, 1998. Exceptions made were: shade – measured with a spherical densiometer; and an YSI water quality meter was used to establish baseline water chemistry data.

Large Woody Debris

A total of 83 pieces of wood were counted in the sensitive reach. This would equate to 153 pieces per kilometer or 15.3 pieces per 100 meter. Minimum debris length was 2.0 m (6.6 ft). Nine aggregates were found within the sensitive reach which consisted of 41 pieces. Aggregates are noted as 4 or more logs touching with at least one positioned inside of bankfull.

Figures 23-24 provides a summary of the large woody debris found in the sensitive reach of Rattlesnake Creek on 8-23-02. The minimum debris length noted was one half of the average bankfull width, 2 m (6.6 ft). Large woody debris was delineated by diameter and length for comparison. Total number of pieces of wood for diameter classes and length classes were added and a percent was found for each class.

Figure 23.

Figure 24.

Pebble Counts

A Stream Condition Inventory pebble count was conducted at the beginning of the sensitive reach.

One hundred points were inventoried to assess substrate composition.

Table 5 shows percent of each size class, and percent embedded, from the pebble count conducted on Rattlesnake Creek.

	%Sand(<2)	%Gravel(2-64)	%Cobbles(64-256)	%Boulders(>256)	%Bedrock
Free	6	40	37	11	0
Embedded	0	0	6	N/A	N/A

(n/a=inherently embedded)

Figure 25 illustrates the results of the Wolman pebble count performed on Indian Creek on 8-23-02. Size classes, in millimeter, are presented for comparison by particle-size class percent and percent accumulation.

Figure 25.

Pools

Along the sensitive reach, 12 pools were measured. This equates to 22 pools per km or 2.2 pools per 100 m. 17 percent of the pools were wood formed. Mean residual pool tail crest depth was 0.05 m (.16 ft.). Mean residual max pool depth was 0.28 m (0.92 ft.). Average fines (<2mm) were 30.3 % per pool tail out.

Stream Bank Stability

The stream was measured for stream bank stability; data was recorded at 50 points throughout the survey segment.

Table 6 shows the percentages of stream bank stability for each category, and the percentage of that category that was caused by armoring, for the sensitive reach.

	1(stable)	2(vulnerable)	3(unstable)	
% Stability rating	66	20	14	%
Stability rating due to rocks and boulders	0	N/A	N/A	

Stream Shade

Shade measurements were taken at 50 locations within the survey segment. The mean shade was 97.7 percent as measured with a spherical densiometer. Measurements were taken in 90 degree increments at each of the 50 sites and averaged for an overall rating.

Bank Angle

Data was recorded throughout the sensitive stream segment to assess the mean bank angle. The mean bank angle was 115.3 degrees.

Aquatic Fauna

Aquatic fauna was recorded on the first pass of the survey. Approximately 14 trout < 3 inches and approximately 8 cutthroat trout (*Oncorhynchus clarki*) 4-8 inches in length were noted. Three frogs were observed. Angry bees were plentiful.

Flow Measurements were taken every two weeks through August and September 2002 to assess late summer flows. The SCI (Middle) (approximately at river mile (RM) 6.3) Rattlesnake Creek had a mean 1.4 cubic feet per second (cfs) flow. While inspecting much of the middle and lower reaches of Rattlesnake Creek from both public and private property with permission, no intermittent (sub-surface) flows were discovered. Surface flows existed throughout the middle and lower reaches of the river. Surface flows were observed in Indian Creek from approved access reaches as well. A gauging station was established in Rattlesnake Creek in the lower SCI reach. This gauge was established by Underwood Conservation District (UCD) and flow data (cfs) should be utilized from this gauge. Flows are too large and flashy to assess by human means throughout much of the winter. The UCD stream gauge will be a great addition to continuously monitor flows in the lower Rattlesnake Creek.

Water quality parameters were taken every two weeks in the drainage and included dissolved oxygen (DO), pH, TDS and nitrates. Temperatures were taken throughout the winter every 30 minutes by optic stowaway data loggers (Please refer to Appendix C 1-9 for ambient and water temperature graphs). The data loggers recorded temperatures from 12/19/02 through 4/27/03 except for P6RS1 and P7RS1 which recorded from 1/9/03 through 4/26/03. P6RS and P7RS were located on private lands and authorization needed to be obtained. Temperatures have been calculated for the single highest (max) temperature and single lowest (min) temperature. An average was taken for the winter period (12-20-02 through 3-20-03) to find the mean for the winter season. Mean temperatures were calculated using the dates stated above for all sites except P6RS and P7RS, which are from 1-9-03 through 3-20-03 (see table 7). Water quality data was taken at all sites throughout winter except for P7RS1. Mean values can be seen in table 8.

Table 7.

Thermo-pod ID#	Ambient Temp Husum	Ambient Temp Head-waters	P1IND	P2RS	P3RS	P4RS	P5Pank	P6RS	P7RS
Max (*C)	17.72	23.93	8.23	8.84	8.73	11.00	10.86	7.61	7.30
Min (*C)	-4.69	-11.51	2.14	1.36	1.39	.21	.07	.23	.08
Winter Avg. Temp (*C)	2.27	2.25	5.51	5.13	4.87	3.68	3.70	4.27	4.16

* All temperatures in Table 7 are in Celsius.

Table 8.

Location/Pod:	P1Ind	P2RS	P3RS	P4RS	P5Pank	P6RS
Nitrates ppm	< .2	< .2	< .2	< .2	< .2	< .2
DO mg/l	11.20	11.47	9.27	8.58	9.94	8.68
pH	7.68	7.80	7.53	6.96	6.97	7.10
TDS ppm	46.0	44.0	52.0	41.0	N/A	30.0

* P6RS1 water quality was taken within the road right away, 100 feet below the thermograph location.

Precipitation gauges were installed in the drainage to monitor precipitation both at the confluence and in the head waters. The precipitation gauges went online December 7, 2002. Each precipitation gauge has an optic ambient temperature data logger attached under each unit in a solar shield (see figure 26).

Data collected from the precipitation gauges 29.08 inches of rain fell in the confluence of Rattlesnake Creek from 12/19/03 through 4/27/03, whereas 26.06 inches fell in the head in the same time period (Please refer to Appendix D 1-2).

shows
waters

Figure 26.

Bibliography

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Appendices

Appendix A

Stream Condition Inventories (SCI) and Thermograph Locations

Appendix B

Stream Condition Inventories Site Documentation

Rattlesnake Creek (Lower) SCI Photos

SCI Start

SCI X-1 Upstream

SCI X-1 Downstream

SCI X-1 Left Bank

SCI X-1 Right Bank

SCI X-2 Upstream

SCI X-2 Downstream

SCI X-2 Left Bank

SCI X-2 Right Bank

SCI X-3 Upstream

SCI X-3 Downstream

SCI X-3 Left Bank

SCI X-3 Right Bank

SCI End

Rattlesnake Creek (Middle) SCI Photos

SCI Start

SCI X-1 Upstream

SCI X-1 Downstream

SCI X-1 Left Bank

SCI X-1 Right Bank

SCI X-2 Upstream

SCI X-2 Downstream

SCI X-2 Left Bank

SCI X-2 Right Bank

SCI X-3 Upstream

SCI X-3 Downstream

SCI X-3 Left Bank

SCI X-3 Right Bank

SCI End

Appendix C

Ambient and Water Temperature Graphs

Thermograph (P7RS1) Below Castle Springs

Appendices C-9

Appendix D

Precipitation Data