



## **Lower Columbia Tributary Larval Lamprey Monitoring Report, 2016**



**[Cover Photo: An overview of a Wind River exploratory survey site (river km 26.3) where Pacific Lamprey were found in September, 2016]**

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## ABSTRACT

Pacific Lamprey is an invaluable cultural and ecological species that is declining in abundance and distribution throughout their range, including the Lower Columbia tributary watersheds. In an effort to monitor, manage and restore the species, the Yakama Nation Pacific Lamprey Program (YNPLP) has led electrofishing surveys for larval Pacific Lamprey throughout tributary watersheds of the Lower Columbia Basin since 2009. This report highlights our 2016 electrofishing efforts in Rock (near Stevenson, WA), Wind, and the White Salmon watersheds.

A total of seven index sites were surveyed throughout the Lower Columbia tributary watersheds: Rock Creek (n=1), Wind River (n=2), White Salmon River (n=3), and Trout Lake Creek (n=1). Lampreys (either Western Brook or Pacific Lamprey) were present at all seven of the index sites (100%). Pacific Lamprey were confirmed at two of these seven index sites (28.6%).

In Rock Creek, a large area of available Type I (250 m<sup>2</sup>) was present at the mouth of the creek. Larval lampreys were present at this site, but they were too small to identify (26-40 mm). Approximately 2,640 lampreys are estimated to occupy this site. One exploratory site was surveyed upstream of Rock Creek Falls, located at river km 2.3 (to assess if adult Pacific Lamprey are capable of passing over the falls, and if Western Brook Lamprey reside upstream of the falls). No lampreys were present, despite abundant Type I habitat and organic matter (see “Appendix: Additional Site Photos and Maps” for more photogenic details on the habitat here (excellent rearing location for lamprey)).

Two index sites were surveyed in the Wind River. Pacific Lamprey were present at both of the sites (100%). Pacific Lamprey were found as far upstream as river km 26.3. Lamprey density was higher near the mouth (4.2 #/m<sup>2</sup>), compared to the site at river km 26.3 (2.4 #/m<sup>2</sup>). Of the identified lamprey, 100% were Pacific Lamprey at the upper site, compared to only 11% at the site near the mouth.

One exploratory site was surveyed at river km 2.4 (tribal fish camp site). There is a large area of larval habitat at this site (all Type I habitat). This site had the highest survey density in the Wind River (5.8 #/m<sup>2</sup>), as well as the highest estimated number of lampreys (10,500). The ratio of Pacific Lamprey was 36% (higher than the site at the mouth).

In the White Salmon River, we surveyed a total of three index sites. Larval lampreys were present at all three of the surveyed sites (100%), although no Pacific Lamprey were confirmed (0%). Larval densities were highest at river km 13.0 (50.6 #/m<sup>2</sup>). Lamprey habitat was observed to be limited near the old Condit Dam Removal site (river km 5.9) based on observations at our index site at river km 8.8. Two exploratory sites were surveyed in the White Salmon River. Lampreys were present at both of the sites (100%), although no Pacific Lamprey were confirmed. Lamprey were found as far upstream at river km 40.5. One index site was surveyed in Trout Lake Creek (a tributary of the White Salmon River). No Pacific Lamprey were confirmed.

However, the estimated number of lampreys, and the biomass in that site, is the highest in the White Salmon Watershed (17,874, 6,473 g). The biomass density at this site is also relatively high, compared to the rest of the watershed, at 12.95 g/m<sup>2</sup>. At the three exploratory sites in Trout Lake Creek, lampreys were present at all three sites (100%). Lampreys were found as far upstream as river km 13.3. The estimated number of lampreys in Type I habitat was highest (255) at river km 6.6 (1.7 km upstream of the index site with high lamprey densities).

Genetic samples were collected from lampreys in the White Salmon Watershed (25 and 12 from White Salmon River and Trout Lake Creek, respectively). All genetic samples were from smaller larvae (< 50 mm) and could not be identified to species visually. The goal of these genetic samples is to monitor the recolonization of Pacific Lamprey upstream of the Condit Dam removal site.

## METHODS

### Site Choice and Field Survey

Throughout the Yakama Nation Ceded Lands, the YNPLP (Yakama Nation Pacific Lamprey Project) has conducted surveys for larval lampreys (beginning in 2009). Index sites, or long-term repeat monitoring sites, have been established throughout the Ceded Lands. The index sites are spatially distributed within watersheds with the potential to hold Pacific Lamprey. The primary goal of these index sites is to monitor the status and trend of Pacific Lamprey in the lower, middle, and upper reaches of interest watersheds. In addition to the index sites, exploratory sites are established each year to further our knowledge on Pacific Lamprey distribution and habitat availability within each watershed.

For all site types, survey sites were chosen based on aerial images from Google Earth and GIS software and site visits. Sites that had higher chances of being a Type I habitat [such as visibly recognizable areas on aerial image with slow water, shallow channel margin with dark tints (usually indicating fine sediment), backwater eddies, confluence of side channels, behind island bars, and tail end of deposition bars, etc.] were given priority. We determined that targeting the preferred habitat more effectually will provide us with a better framework for evaluating presence/absence, distribution, and relative abundance. Further, due to restricted survey time, the ease of access to a survey site (e.g. sites with public road access, short hikes, or near bridges, or private properties who permit access to the rivers/streams) was a critical issue and strongly considered when choosing sites. By prioritizing accessibility, more ground could be covered throughout the expansive area of interest. Chosen habitat sites were ultimately spatially distributed throughout individual watersheds.

Surveys were focused on Type I (preferred) and/or Type II (acceptable) habitat to provide optimal opportunity to capture the largest number of larval lamprey. Type I habitat primarily consists of fine sand, silt and/or clay and is absent of coarse substrate (gravel/cobble/boulder/bedrock). Type II habitat is coarse shifting sand or other fine substrate mixed with coarse substrate. Type III (unsuitable) habitat consists of no fine sediments and was not surveyed. Type I and II habitat is generally found in backwater areas, point bars, mainstem channel margins, and side channels.

Site surveys were categorized as “Full”, “Short” or “Visit”. During a full survey, both Type I and Type II habitat were surveyed. At short surveys, only Type I habitat (or Type II habitat, in the case of no Type I habitat available) was surveyed. At visited sites, no electrofishing occurred, and were primarily designed to further assess available lamprey habitat in different reaches of a river/stream. In general, a full survey was performed at each index site (to gain the most knowledge possible). A short survey (in general) was conducted at exploratory sites, designed to focus on the best habitat and get a quick assessment of lampreys at the site (habitat availability, density, and presence/absence).



At each electrofished site (index or exploratory), a 50 m reach was measured out which encompassed the most accessible and abundant Type I and Type II larval lamprey habitat. The total area (m<sup>2</sup>) of Type I and Type II larval lamprey habitat was estimated within the 50 m reach. Electrofishing surveys were conducted separately over Type I and Type II habitat, and covered representative areas of each habitat type. At full survey sites, a minimum area of Type I and Type II habitat was surveyed (10 m<sup>2</sup> and 5 m<sup>2</sup>, respectively). At short survey sites, a minimum area of 5 m<sup>2</sup> of either habitat type was surveyed. Sediment type (sand, silt or clay) was recorded for the specific area (1 m<sup>2</sup>) where the most lampreys were observed. The sediment depth (cm), water depth (cm), and plot temperature (°C) were also recorded at this location. If no fish were observed, plot temperature was taken where the best available habitat was observed. Thalweg temperature was also recorded to represent the main channel temperature.

Electrofishing surveys were conducted with an AbP-2 Backpack Electrofisher (ETS Electrofishing Systems Inc., Madison, WI), specially designed for the sampling of larval lampreys, was used to survey available (wetted) larval habitat, using standard survey methods (slow tickle pulse of 3 pulses/sec and fast stunning pulse of 30 pulses/sec, 25% duty cycle, 3:1 burst pulse train, and 125 volts). Another person, equipped with a fine-mesh hand net was also present to help capture any electrofished larvae.

Captured lampreys were separated by habitat type, and tallied by life stage and identified to species (if of identifiable length > 50 mm). For each group of captured lampreys, 15 representative lengths were taken (+/- 1 mm). Four of these lampreys were measured to the nearest 0.01 gram (length and weight was taken on the largest, smallest and two medium sized larvae relative to the site). The combined weights of all captured lampreys were also measured (nearest 0.01 g). Missed larvae were also counted and tallied.

Genetic samples were collected from Pacific Lamprey (> 50 mm) with scissors or 2 mm whole punch (top or bottom of the caudal fin). Lampreys less than 50 mm were generally collected as whole samples (by placement on a genetic sheet or preservation in 70% Ethanol), but efforts were made to take genetic clips from larger unidentifiable larvae (> 35mm) rather than whole samples. Samples were primarily collected in areas where adult Pacific Lamprey translocation efforts are ongoing, or where the distribution of Pacific Lamprey is uncertain.

## **Analysis**

Captured and missed larvae were tallied together and added to the number captured, to determine the total number of observed lampreys from electrofishing for each habitat type. If the number of captured lampreys was less than half of the observed total, the number of captured lampreys was doubled, and used as the final observed total. If the number of captured lampreys was equal to or more than half, the recorded observed number was used as the final observed total (represented by “observed total” in the following report).

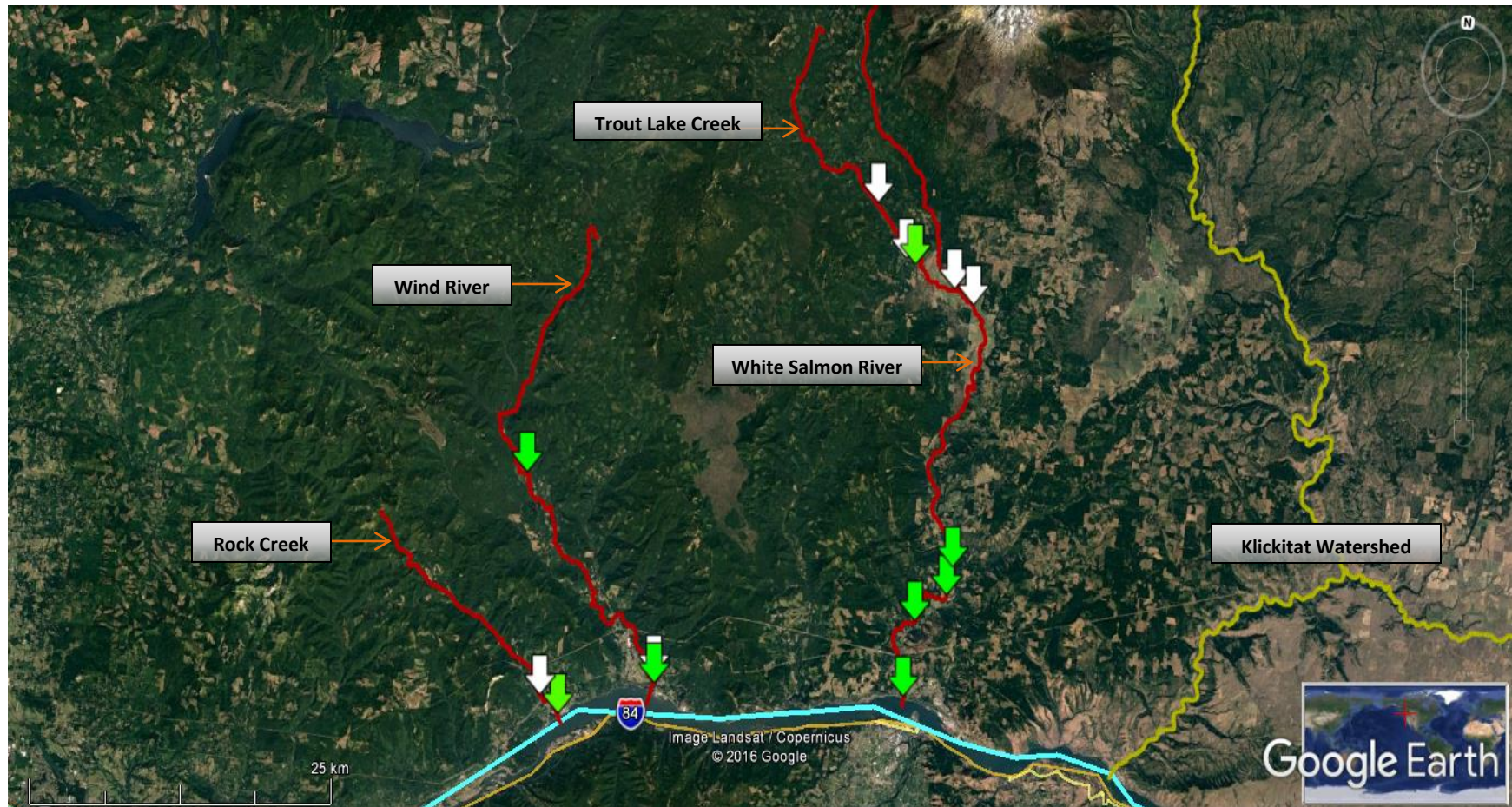
In many cases, survey visibility was less than ideal, and many lampreys went unseen. To account for unseen lamprey, the total number of lampreys observed (final observed total) was adjusted (increased) based on the following 1-5 visibility scale: (1) poor (60%), (2) fair (70%) , (3) good (80%), (4) very good (90%) and (5) excellent (100%). For each survey, the total number of observed lampreys was increased (by the percentage listed above) based on the survey's visibility rank. Survey densities ( $\#/m^2$ ) were calculated using the adjusted observed number of lampreys.

To calculate the number of lampreys within each 50 m reach, survey densities were extrapolated over their respective habitat type (estimated area within the 50 m reach) to arrive at the total number of lampreys for each habitat type. The estimated number from both habitat types was then summed together for an estimated total number of lampreys by site. The number of Pacific Lamprey within a 50 m reach was calculated from the Pacific Lamprey ratio (from identified lampreys) multiplied by the total number of lampreys estimated to reside within the reach.

A condition factor for each site was calculated by averaging the condition factor for each of the fish measured by both length and weight. The average weight of the captured lamprey (total weight g/# weighed) was calculated for each site. In the event, that not all of the captured lampreys were weighed together, the average capture weight was multiplied by the total number of captured lampreys.

To arrive at an estimated biomass within a 50 m reach, the electrofishing density (by mass) was calculated separately for captured and missed lampreys. The biomass densities for captured and missed lampreys was summed together to get the total biomass density for the survey. The estimated final biomass density was then extrapolated over the respective habitat type. The estimated biomass for each habitat type was then summed together to arrive at a total site biomass(g).

## RESULTS



**Map 1. Overview of Lower Columbia River Tributaries; streams of survey interest in 2016 are highlighted by the red line and other streams are highlighted yellow. Surveys occurred in September, 2016. Index sites (green arrows) and exploratory sites where electrofishing occurred (white arrows) are shown.**



## Rock Creek Watershed (near Stevenson, WA)



**Map 2.** Overview of all surveyed sites in the Rock Creek, north of Stevenson, WA (red line) in September, 2016, displaying index sites (green arrows) and surveyed exploratory sites (white arrows) where electrofishing occurred. Rock Creek Falls is at river km 2.3 (not shown on map).

### Index Sites – Rock Creek (near Stevenson, WA)

- One index site was surveyed in Rock Creek (near the mouth at river km 0.8). Lampreys were present at this site, but they were too small to identify (26-40 mm). An estimated 2,640 lampreys are estimated to occupy this site within a 50 m reach.

**Table 1.** Larval lamprey habitat details from index sites surveyed in the Rock Creek. Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.

Site Type	Stream	River KM	Date	Survey Type	% Type I in 50 m	% Type II in 50 m	Type I Habitat Type	Primary Fine Sediment (Type I)	Primary Fine Sediment (Type II)	Plot Temp °C (Best)	Thalweg Temp °C
Index	Rock	0.8	9/29/16	Short	29%	71%	Main	Sand	-	17.5	17.5

**Table 2.** Survey details, separated by habitat type, for Rock Creek index sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.

Site Type	Stream	River KM	Habitat Type Surveyed	Shock Time (sec)	Shock Area (m <sup>2</sup> )	# Captured	# Observed	Survey Visibility (1-5)	Total # Observed (Adjusted)	E-Fish Density (#/m <sup>2</sup> )
Index	Rock	0.8	Type I	631	11.5	25	85	2	121	10.6
Index	Rock	0.8	Type II	0	-	-	-	-	-	-
<b>Site Summary</b>		<b>0.8</b>	-	<b>631</b>	<b>12</b>	<b>25</b>	<b>85</b>	-	<b>121</b>	<b>10.6</b>
<b>Habitat Summary</b>		-	Type I	<b>631</b>	<b>12</b>	<b>25</b>	<b>85</b>	-	<b>121</b>	<b>10.6</b>
			Type II	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	-	-	-

**Table 3.** Measurement details of captured lampreys, separated by habitat type, for Rock Creek index sites surveyed in September, 2016 (sites without lampreys are excluded). The summary rows are a sum of presented values, except for mean weight, mean length and mean condition factor, which are a mean of presented values, and min and max length, which are the lowest and highest value, respectively.

Site Type	Stream	River KM	Habitat Type Surveyed	# Weighed	Total Weight of Captured (g)	Mean Weight of Captured (g)	Min. Length (mm)	Max. Length (mm)	Mean Length (mm)	Mean Condition Factor
Index	Rock	0.8	Type I	25	2.3	0.09	26	40	33	0.892
Index	Rock	0.8	Type II	-	-	-	-	-	-	-
<b>Site Summary</b>		<b>0.8</b>	-	<b>25</b>	<b>2.3</b>	<b>0.09</b>	<b>26</b>	<b>40</b>	<b>33</b>	<b>0.892</b>
<b>Habitat Summary</b>		-	Type I	<b>25</b>	<b>2.3</b>	<b>0.09</b>	<b>26</b>	<b>40</b>	<b>33</b>	<b>0.892</b>
			Type II	-	-	-	-	-	-	-

**Table 4.** Lamprey population and biomass estimates within a 50 m reach, separated by habitat type, for Rock Creek index sites surveyed in September, 2016. “Estimated # of Pacific Lamprey” is calculated based on the identified ratio of Pacific Lamprey (to Western Brook Lamprey) generally > 50 mm in length. Summary rows are a sum of presented values, except for e-fish density and mean weight of captured, which are a mean of presented values.

Site Type	Stream	River KM	Habitat Type	50 m Habitat Area (m <sup>2</sup> )	E-Fish Density (#/m <sup>2</sup> )	Estimated # in 50 m	Estimated # of Pacific Lamprey in 50 m	Mean Weight of Cap. (g)	Estimated Mass Density (g/m <sup>2</sup> )	Estimated Mass (g) in 50 m
Index	Rock	0.8	Type I	250	10.6	2640	-	0.09	0.53	132.7
Index	Rock	0.8	Type II	600	-	-	-	-	-	-
<b>Site Summary</b>		<b>0.8</b>	-	<b>850</b>	<b>10.6</b>	<b>2640</b>	-	<b>0.09</b>	<b>0.53</b>	<b>132.7</b>
<b>Habitat Summary</b>		-	Type I	<b>250</b>	<b>10.6</b>	<b>2640</b>	-	<b>0.09</b>	<b>0.53</b>	<b>132.7</b>
			Type II	<b>600</b>	-	-	-	-	-	-

## Additional Index Site Observations

- **River km 0.8:** Google Earth river km points are not exact. This site is located at the mouth of Rock Creek, river km 0.1 (accessed from the fairgrounds in Stevenson, WA). Further upstream the channel splits. Type I habitat was most abundant where the two channels merge into a large pool.

## Exploratory Sites – Rock Creek (near Stevenson, WA)

- One exploratory site was surveyed upstream of Rock Creek Falls (to see if Pacific Lamprey are passing over the falls, and if Western Brook Lamprey reside upstream of the falls). No lamprey were present, despite abundant Type I habitat and organic debris (see “Appendix: Additional Site Photos and Maps” for more details on the habitat here.

**Table 5. Larval lamprey habitat details from exploratory sites surveyed in the Rock Creek. Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.**

Site Type	Stream	River KM	Date	Survey Type	% Type I in 50 m	% Type II in 50 m	Type I Habitat Type	Primary Fine Sediment (Type I)	Primary Fine Sediment (Type II)	Plot Temp °C (Best)	Thalweg Temp °C
Expl.	Rock	3.2	9/29/16	Short	100%	0%	0	0	-	-	-

**Table 6. Survey details, separated by habitat type, for Rock Creek exploratory sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.**

Site Type	Stream	River KM	Habitat Type Surveyed	Shock Time (sec)	Shock Area (m2)	# Captured	# Observed	Survey Visibility (1-5)	Total # Observed (Adjusted)	E-Fish Density (#/m2)
Expl.	Rock	3.2	Type I	1679	35	0	0	5	-	-
Expl.	Rock	3.2	Type II	0	-	-	-	-	-	-
<b>Site Summary</b>		<b>3.2</b>	<b>-</b>	<b>1679</b>	<b>35</b>	<b>0</b>	<b>0</b>		<b>-</b>	
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>1679</b>	<b>35</b>	<b>0</b>	<b>0</b>		<b>-</b>	
			<b>Type II</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>			

### **Additional Exploratory Site Observations**

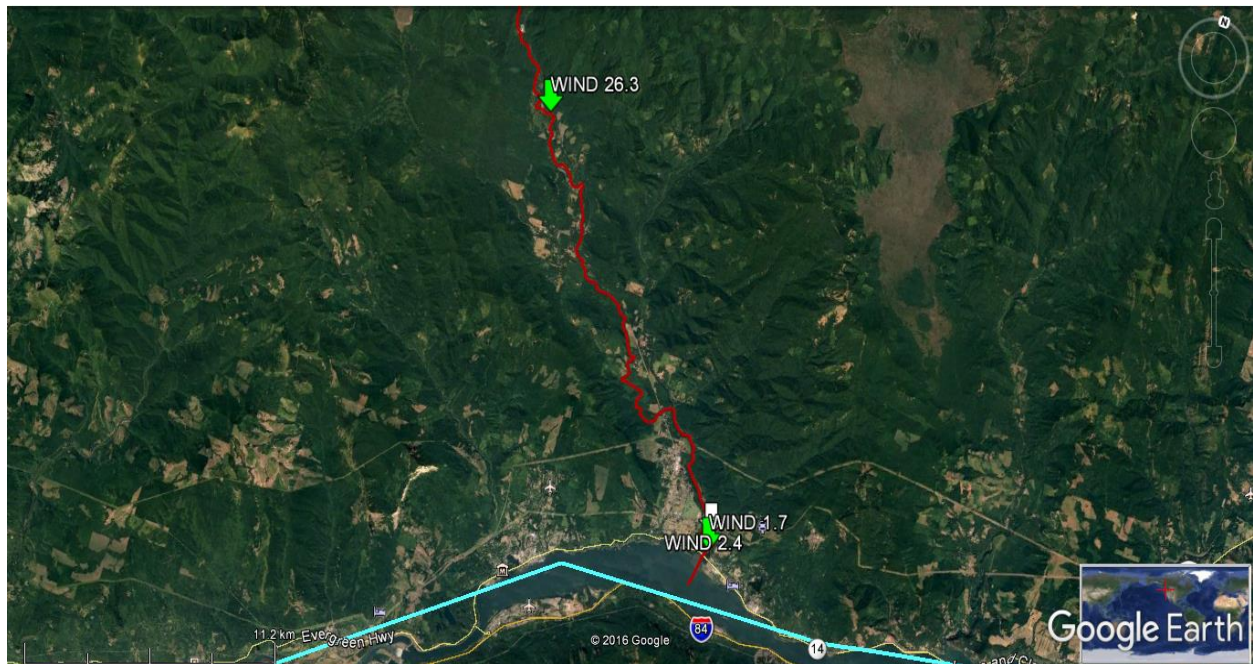
- **River km 3.2:** This site is upstream of Rock Creek Falls, accessed from a dirt road off of Aalvik Road. There is abundant Type I habitat mixed with large amounts of organic debris – lamprey paradise (or so it appears)! Water clarity was excellent. The goal of this site was to explore the upper distribution of lampreys (upstream of Rock Creek Falls), and to confirm if Pacific Lamprey are able to navigate over Rock Creek Falls.





Map 3. Displayed is the distribution of Unknown Lamprey <50 mm (blue), Pacific Lamprey (red) and Western Brook Lamprey (green) in Rock Creek from September, 2016 electrofishing surveys. Species ratio of lampreys is based on captured and measured data only. Also shown is the estimated number of lampreys at each surveyed site (within a 50 m reach). Index sites are labeled by green arrows, exploratory sites labeled by white arrows, and sites where no electrofishing surveys labeled by purple arrows. River km 3.2 is upstream of Rock Creek Falls. \* Species ratio calculated from counted and identified fish (no lengths taken).

## Wind River Watershed



**Map 4.** Overview of all surveyed sites in the Wind River (red line) in September, 2016 displaying index sites (green arrows) and surveyed exploratory sites where electrofishing occurred (white arrows). Rock Creek Falls is at river km 2.3 (not shown on map).

### Index Sites – Wind River

- Two index sites were surveyed in the Wind River. Pacific Lamprey were present at both of the sites (100%). Pacific Lamprey were found as far upstream at river km 26.3. Lamprey density was higher near the mouth (4.2 #/m<sup>2</sup>), compared to the site at river km 26.3 (2.4 #/m<sup>2</sup>).

Table 7. Larval lamprey habitat details from index sites surveyed in the Wind River. Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel.; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.

Site Type	Stream	River KM	Date	Survey Type	%	%	Type I Habitat Type	Primary	Primary	Plot	Thal-
					Type I in 50 m	Type II in 50 m		Fine Sediment (Type I)	Fine Sediment (Type II)	Temp °C (Best)	weg Temp °C
Index	Wind	1.7	9/28/16	Short	0.5	0.5	Edge	Silt	-	18.1	18.1
Index	Wind	26.3	9/28/16	Short	0.4917	0.5083	Edge	Sand	-	12.8	13.0

Table 8. Survey details, separated by habitat type, for the Wind River index sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.

			Habitat	Shock	Shock	#	#	Survey	Total #	E-Fish
Site		River	Type	Time	Area	Captu-	Observed	Visibility	Observed	Density
Type	Stream	KM	Surveyed	(sec)	(m2)	red		(1-5)	(Adjusted)	(#/m2)
Index	Wind	1.7	Type I	525	8	9	20	1	33	4.2
Index	Wind	26.3	Type I	575	10	12	24	5	24	2.4
Index	Wind	1.7	Type II	0	-	-	-	-	-	-
Index	Wind	26.3	Type II	0	-	-	-	-	-	-
Site Summary		1.7	-	525	8	9	20	-	33	4.2
		26.3		575	10	12	24		24	2.4
Habitat Summary			Type I	1100	18	21	44	-	57	3.3
			Type II	-	-	-	-		-	-



**Table 9. Measurement details of captured lampreys, separated by habitat type, for the Wind River index sites surveyed in September, 2016 (sites without lampreys are excluded). The summary rows are a sum of presented values, except for mean weight, mean length and mean condition factor, which are a mean of presented values, and min and max length, which are the lowest and highest value, respectively.**

Site Type	Stream	River KM	Habitat Type Surveyed	# Weighed	Total Weight of Captured (g)	Mean Weight of Captured (g)	Min. Length (mm)	Max. Length (mm)	Mean Length (mm)	Mean Condition Factor
Index	Wind	1.7	Type I	9	10.9	1.21	65	108	90	0.942
Index	Wind	26.3	Type I	12	52.6	4.38	81	153	135	1.147
Index	Wind	1.7	Type II	-	-	-	-	-	-	-
Index	Wind	26.3	Type II	-	-	-	-	-	-	-
<b>Site Summary</b>		<b>1.7</b>	<b>-</b>	<b>9</b>	<b>10.9</b>	<b>1.21</b>	<b>65</b>	<b>108</b>	<b>90</b>	<b>0.942</b>
		<b>26.3</b>		<b>12</b>	<b>52.6</b>	<b>4.38</b>	<b>81</b>	<b>153</b>	<b>135</b>	<b>1.147</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>21</b>	<b>63.5</b>	<b>2.80</b>	<b>65</b>	<b>153</b>	<b>112</b>	<b>1.044</b>
			<b>Type II</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

**Table 10. Lamprey identification details, separated by habitat type, for the Wind River index sites surveyed in September, 2016. The summary rows are a sum of presented values except for % values, which are a weighted average.**

Site Type	Stream	River KM	Habitat Type	# Identified	# of Pacific	# of Western Brook	% Pacific	% Western Brook	% of Cap. Identified
Index	Wind	1.7	Type I	9	1	8	11%	89%	100%
Index	Wind	26.3	Type I	12	12	0	100%	0%	100%
Index	Wind	1.7	Type II	-	-	-	-	-	-
Index	Wind	26.3	Type II	-	-	-	-	-	-
<b>Site Summary</b>		<b>1.7</b>	<b>-</b>	<b>9</b>	<b>1</b>	<b>8</b>	<b>11%</b>	<b>89%</b>	<b>100%</b>
		<b>26.25</b>		<b>12</b>	<b>12</b>	<b>0</b>	<b>100%</b>	<b>0%</b>	<b>100%</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>21</b>	<b>13</b>	<b>8</b>	<b>62%</b>	<b>38%</b>	<b>100%</b>
			<b>Type II</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

**Table 11. Lamprey population and biomass estimates within a 50 m reach, separated by habitat type, for the Wind River index sites surveyed in September, 2016. “Estimated # of Pacific Lamprey” is calculated based on the identified ratio of Pacific Lamprey (to Western Brook Lamprey) generally > 50 mm in length. Summary rows are a sum of presented values, except for e-fish density and mean weight of captured, which are a mean of presented values.**

Site Type	Stream	River KM	Habitat Type	50 m Habitat Area (m2)	E-Fish Density (#/m2)	Estimated # in 50 m	Estimated # of Pacific Lamprey in 50 m	Mean Weight of Cap. (g)	Estimated Mass Density (g/m2)	Estimated Mass (g) in 50 m
Index	Wind	1.7	Type I	250	4.2	1042	116	1.21	2.94	735
Index	Wind	26.3	Type I	59	2.4	142	142	4.38	7.51	443
Index	Wind	1.7	Type II	250	-	-	-	-	-	-
Index	Wind	26.3	Type II	61	-	-	-	-	-	-
<b>Site Summary</b>		<b>1.7</b>	<b>-</b>	<b>500</b>	<b>4.2</b>	<b>1042</b>	<b>116</b>	<b>1.21</b>	<b>2.94</b>	<b>735</b>
		<b>26.3</b>		<b>120</b>	<b>2.4</b>	<b>142</b>	<b>142</b>	<b>4.38</b>	<b>7.51</b>	<b>443</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>309</b>	<b>3.3</b>	<b>1183</b>	<b>257</b>	<b>2.80</b>	<b>5.23</b>	<b>1178</b>
			<b>Type II</b>	<b>311</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

## Additional Index Site Observations

- **River km 1.7:** Google Earth river km points are not exact. This site is located near the mouth of the Wind River (river km 0.5) at the public boat launch dock. Type I habitat is abundant throughout the large, expansive river mouth. Aquatic vegetation was abundant, and deep water made survey efforts difficult.
- **River km 26.3:** This site is located off of Wind River Highway south of Hollis Creek Road. This site is a side channel of the Wind River. There is abundant Type I habitat at and lampreys were found both within the stream and within the Wind River.

## Exploratory Sites – Wind River

- One exploratory site was surveyed at river km 2.4 (tribal fish camp site). There is a large area of larval habitat at this site (all Type I habitat). This site had the highest survey density in the Wind River, as well as the highest estimated number of lampreys 10,500 within a 50 m reach. The ratio of Pacific Lamprey were 36% (higher than the site at the mouth).

**Table 12. Larval lamprey habitat details from exploratory sites surveyed in the Wind River. Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.**

Site Type	Stream	River KM	Date	Survey Type	%	%	Type I Habitat Type	Primary Fine Sediment (Type I)	Primary Fine Sediment (Type II)	Plot Temp °C (Best)	Thal- weg Temp °C
					Type I in 50 m	Type II in 50 m					
Expl.	Wind	2.4	9/28/16	Short	100%	0%	Edge	Silt	-	-	-

**Table 13. Survey details, separated by habitat type, for Rock Creek exploratory sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.**

Site		River KM	Habitat	Shock	Shock	#	#	Survey	Total #	E-Fish
Type	Stream		Type Surveyed	Time (sec)	Area (m2)	Captur- ed	Observed	Visibility (1-5)	Observed (Adjusted)	Density (#/m2)
Expl.	Wind	2.4	Type I	323	6	14	28	3	35	5.8
Expl.	Wind	2.4	Type II	0	-	-	-	-	-	-
Site Summary		2.4	-	323	6	14	28	-	35	5.8
Habitat Summary		-	Type I	323	6	14	28	-	35	5.8
			Type II	-	-	-	-	-	-	-

**Table 14. Lamprey identification details, separated by habitat type, for the Wind River exploratory sites surveyed in September, 2016. The summary rows are a sum of presented values except for % values, which are a weighted average.**

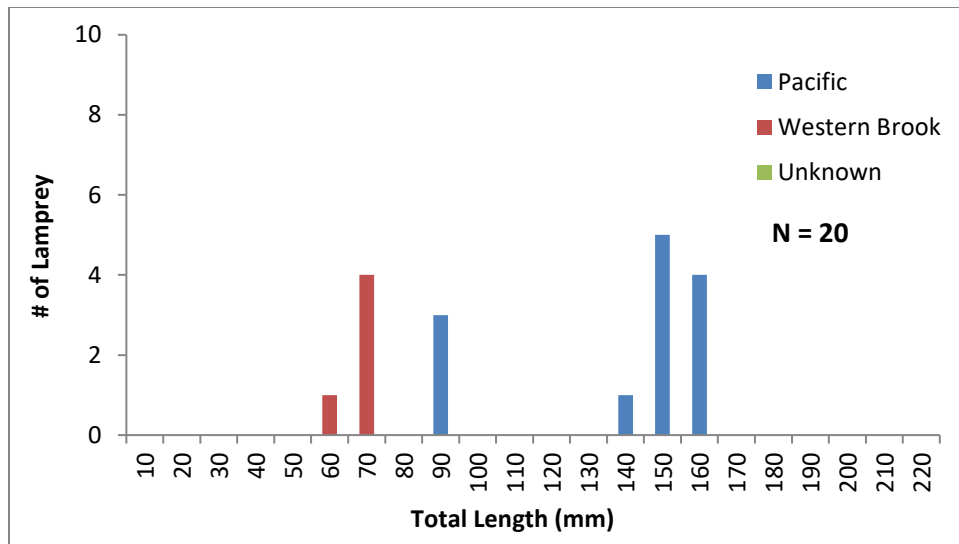
Site Type	Stream	River KM	Habitat Type	# Identified	# of Pacific	# of Western Brook	% Pacific	% Western Brook	% of Cap. Identified
Expl.	Wind	2.4	Type I	11	4	7	36%	64%	79%
Expl.	Wind	2.4	Type II	-	-	-	-	-	-
<b>Site Summary</b>		<b>2.4</b>	<b>-</b>	<b>11</b>	<b>4</b>	<b>7</b>	<b>36%</b>	<b>64%</b>	<b>79%</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>11</b>	<b>4</b>	<b>7</b>	<b>36%</b>	<b>64%</b>	<b>79%</b>
			<b>Type II</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

**Table 15. Lamprey population and biomass estimates within a 50 m reach, separated by habitat type, for the Wind River exploratory sites surveyed in September, 2016. “Estimated # of Pacific Lamprey” is calculated based on the identified ratio of Pacific Lamprey (to Western Brook Lamprey) generally > 50 mm in length. Summary rows are a sum of presented values, except for e-fish density and mean weight of captured, which are a mean of presented values.**

Site Type	Stream	River KM	Habitat Type	50 m		Estimated # in 50 m	Estimated # of Pacific Lamprey in 50 m	Mean Weight of Cap. (g)	Estimated Mass Density (g/m2)	Estimated Mass (g) in 50 m
				Habitat Area (m2)	E-Fish Density (#/m2)					
Expl.	Wind	2.4	Type I	1800	5.8	10500	3818	-	-	-
Expl.	Wind	2.4	Type II	0	-	-	-	-	-	-
<b>Site Summary</b>		<b>2.4</b>	<b>-</b>	<b>1800</b>	<b>5.8</b>	<b>10500</b>	<b>3818</b>		<b>-</b>	
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>1800</b>	<b>5.8</b>	<b>10500</b>	<b>3818</b>		<b>-</b>	
			<b>Type II</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>			

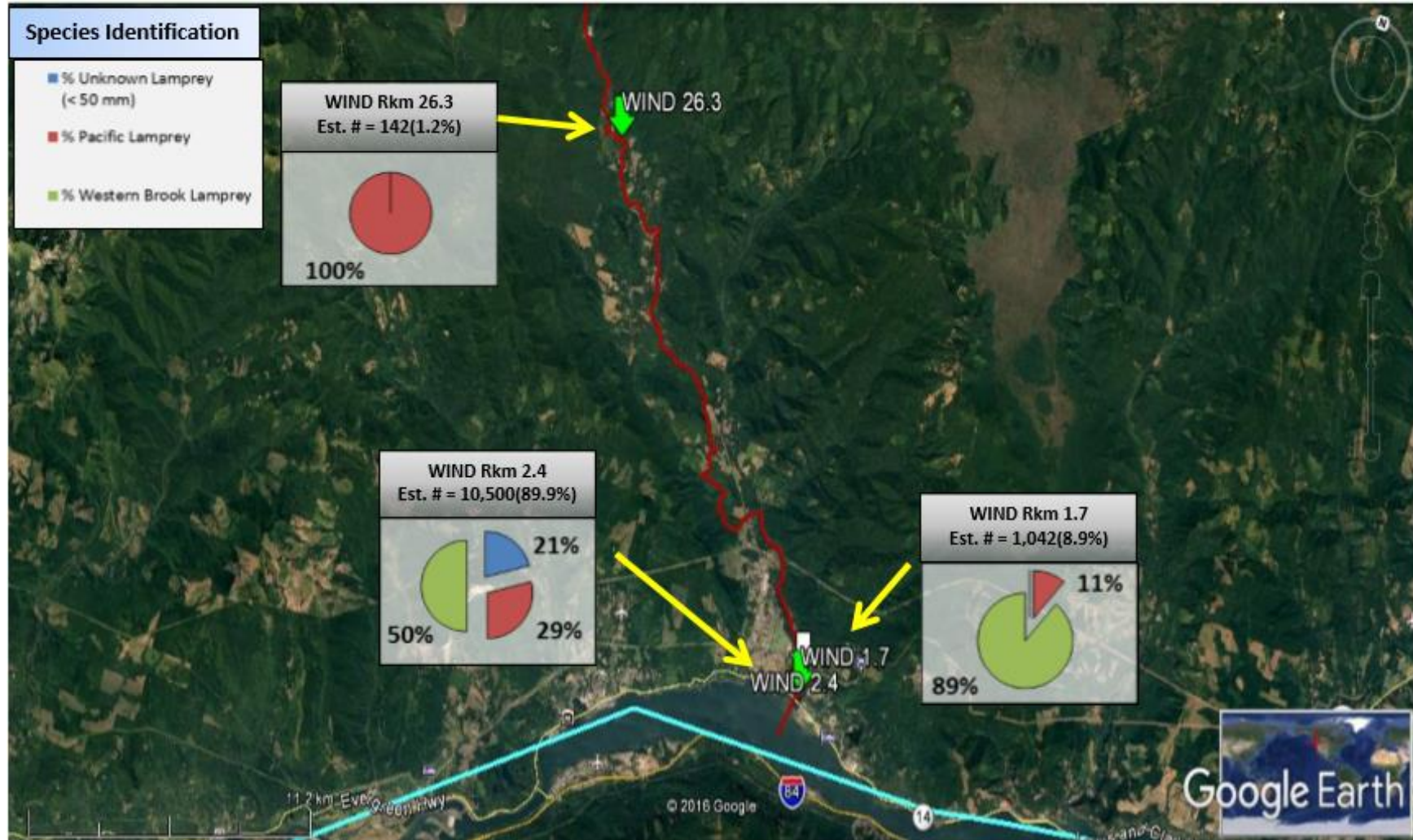
#### Additional Exploratory Site Observations

- **River km 2.4:** This site is located at the tribal fishing site. This reach of river is a large, deep pool. We were able to access at the dock, left bank, and shock in the shallow water near the bank. The deep water hindered survey visibility and capture of larval lampreys.



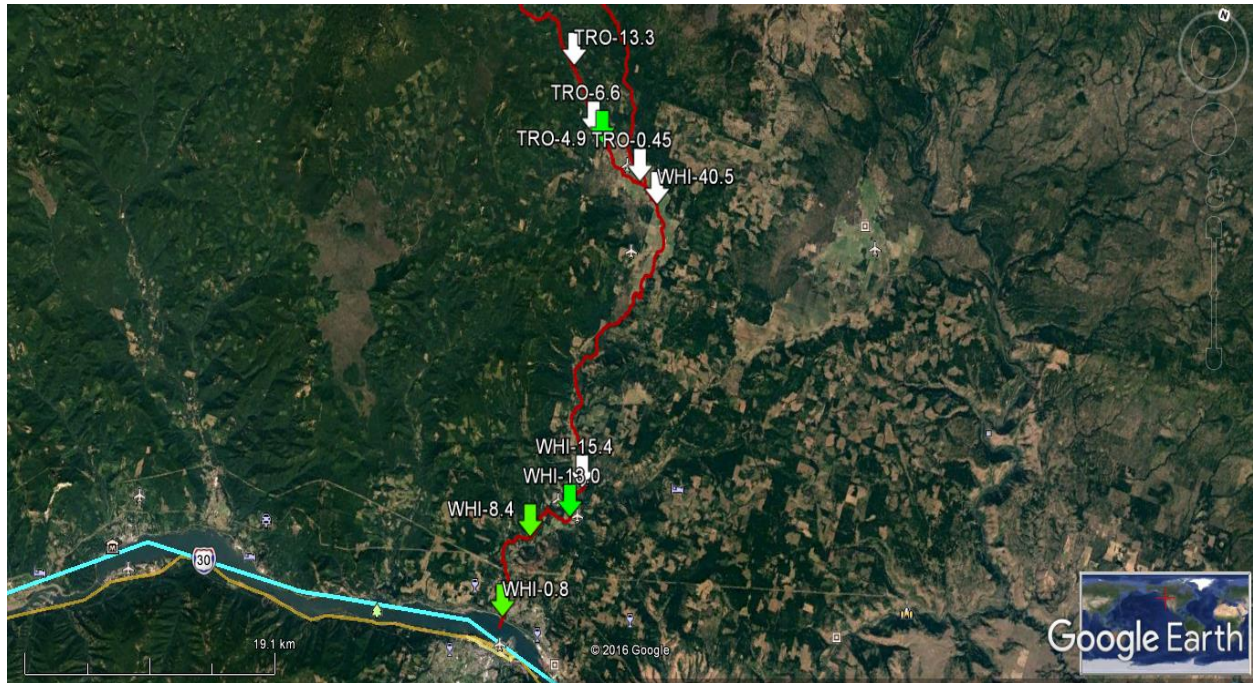
**Figure 4. Histogram of all measured lampreys captured during electrofishing surveys, separated by species (“PA”= Pacific Lamprey (blue), “UN”=Unknown Lamprey <50 mm (green)), in the Trout Lake Creek in September, 2016.**





**Map 5.** Displayed is the distribution of Unknown Lamprey <50 mm (blue), Pacific Lamprey (red) and Western Brook Lamprey (green) in the Wind River from September, 2016 electrofishing surveys. Species ratio of lampreys is based on captured and measured data only. Also shown is the estimated number of lampreys at each surveyed site (within a 50 m reach). Index sites are labeled by green arrows, exploratory sites labeled by white arrows, and sites where no electrofishing surveys labeled by purple arrows. \* Species ratio calculated from counted and identified fish (no lengths taken).

## White Salmon Watershed



**Map 6. Overview of all surveyed sites in the White Salmon River Watershed (red line) in September, 2016, displaying index sites (green arrows) and surveyed exploratory sites (white arrows) where electrofishing occurred. Trout Lake Creek branches off to the left on the top of the map (red line also).**

### Index Sites – White Salmon River

- In the White Salmon River, we surveyed a total of three index sites. Larval lampreys were present at all three of the surveyed sites (100%), although no Pacific Lamprey were present (0%). Larval densities were highest at river km 13.0 (50.6 #/m<sup>2</sup>).

**Table 16. Larval lamprey habitat details from index sites surveyed in the White Salmon River. Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.**

Site Type	Stream	River KM	Date	Survey Type	% Type I in 50 m	% Type II in 50 m	Type I Habitat Type	Primary Fine Sediment (Type I)	Primary Fine Sediment (Type II)	Plot Temp °C (Best)	Thalweg Temp °C
Index	White Salmon	0.8	9/7/16	Short	60%	40%	Edge	Clay	-	12.9	-
Index	White Salmon	8.4	9/7/16	Full	33%	67%	Edge	Sand	Sand	11.0	10.0
Index	White Salmon	13.0	9/9/16	Full	63%	38%	Edge	Sand	-	10.0	9.0

**Table 17. Survey details, separated by habitat type, for the White Salmon River index sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.**

Site Type	Stream	River KM	Habitat Type Surveyed	Shock Time (sec)	Shock Area (m2)	# Captured	# Observed	Survey Visibility (1-5)	Total # Observed (Adjusted)	E-Fish Density (#/m2)
Index	White Salmon	0.8	Type I	837	13	4	8	3	10	0.8
Index	White Salmon	8.4	Type I	300	4	0	-	1	-	-
Index	White Salmon	13.0	Type I	416	9	164	410	4	456	50.6
Index	White Salmon	0.8	Type II	0	0	0	-	-	-	-
Index	White Salmon	8.4	Type II	375	6	5	10	2	10	1.7
Index	White Salmon	13.0	Type II	236	4	14	28	5	28	7.0
<b>Site Summary</b>		<b>0.8</b>		<b>837</b>	<b>13</b>	<b>4</b>	<b>8</b>		<b>10</b>	<b>0.8</b>
		<b>8.4</b>	<b>-</b>	<b>675</b>	<b>10</b>	<b>5</b>	<b>10</b>	<b>-</b>	<b>10</b>	<b>1.7</b>
		<b>13.0</b>		<b>652</b>	<b>13</b>	<b>178</b>	<b>438</b>		<b>484</b>	<b>28.8</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>1553</b>	<b>26</b>	<b>168</b>	<b>418</b>	<b>-</b>	<b>466</b>	<b>25.7</b>
			<b>Type II</b>	<b>611</b>	<b>10</b>	<b>19</b>	<b>38</b>		<b>38</b>	<b>4.3</b>

**Table 18. Measurement details of captured lampreys, separated by habitat type, for the White Salmon River index sites surveyed in September, 2016 (sites without lampreys are excluded). The summary rows are a sum of presented values, except for mean weight, mean length and mean condition factor, which are a mean of presented values, and min and max length, which are the lowest and highest value, respectively.**

Site Type	Stream	River KM	Habitat Type Surveyed	# Weighed	Total Weight of Captured (g)	Mean Weight of Captured (g)	Min. Length (mm)	Max. Length (mm)	Mean Length (mm)	Mean Condition Factor
Index	White Salmon	0.8	Type I	0	-	-	71	154	130	-
Index	White Salmon	8.4	Type I	0	-	-	-	-	-	-
Index	White Salmon	13.0	Type I	164	109.5	0.67	28	139	68	1.056
Index	White Salmon	0.8	Type II	-	-	-	-	-	-	-
Index	White Salmon	8.4	Type II	-	-	-	12	69	44	-
Index	White Salmon	13.0	Type II	14	1.6	0.11	32	49	37	0.960
<b>Site Summary</b>		<b>0.8</b>		<b>0</b>	<b>-</b>	<b>-</b>	<b>71</b>	<b>154</b>	<b>130</b>	<b>-</b>
		<b>8.4</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>12</b>	<b>69</b>	<b>44</b>	<b>-</b>
		<b>13.0</b>		<b>178</b>	<b>111.1</b>	<b>0.39</b>	<b>28</b>	<b>139</b>	<b>53</b>	<b>1.008</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>164</b>	<b>109.5</b>	<b>0.67</b>	<b>28</b>	<b>154</b>	<b>99</b>	<b>1.056</b>
			<b>Type II</b>	<b>14</b>	<b>1.6</b>	<b>0.11</b>	<b>12</b>	<b>49</b>	<b>41</b>	<b>0.960</b>

**Table 19. Lamprey identification details, separated by habitat type, for The White Salmon River index sites surveyed in September, 2016. The summary rows are a sum of presented values except for % values, which are a weighted average.**

Site Type	Stream	River KM	Habitat Type	# Identified	# of Pacific	# of Western Brook	% Pacific	% Western Brook	% of Cap. Identified
Index	White Salmon	0.8	Type I	4	0	4	0%	100%	100%
Index	White Salmon	8.4	Type I	-	-	-	-	-	-
Index	White Salmon	13	Type I	136	0	136	0%	100%	83%
Index	White Salmon	0.8	Type II	0	0	0	-	-	-
Index	White Salmon	8.35	Type II	2	0	2	0%	100%	40%
Index	White Salmon	13	Type II	0	0	0	-	-	0%
<b>Site Summary</b>		<b>0.8</b>		<b>4</b>	<b>0</b>	<b>4</b>	<b>0%</b>	<b>100%</b>	<b>100%</b>
		<b>8.35</b>	<b>-</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0%</b>	<b>100%</b>	<b>40%</b>
		<b>13</b>		<b>136</b>	<b>0</b>	<b>136</b>	<b>0%</b>	<b>100%</b>	<b>76%</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>140</b>	<b>0</b>	<b>140</b>	<b>0%</b>	<b>100%</b>	<b>83%</b>
			<b>Type II</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0%</b>	<b>100%</b>	<b>11%</b>



**Table 20. Lamprey population and biomass estimates within a 50 m reach, separated by habitat type, for the White Salmon River index sites surveyed in September, 2016. “Estimated # of Pacific Lamprey” is calculated based on the identified ratio of Pacific Lamprey (to Western Brook Lamprey) generally > 50 mm in length. Summary rows are a sum of presented values, except for e-fish density and mean weight of captured, which are a mean of presented values.**

Site Type	Stream	River KM	Habitat Type	50 m		Estimated # of Pacific Lamprey in 50 m	Mean Weight of Cap. (g)	Estimated Mass Density (g/m2)	Estimated Mass (g) in 50 m
				Habitat Area (m2)	E-Fish Density (#/m2)				
Index	White Salmor	0.8	Type I	1800	0.8	1385	0	-	-
Index	White Salmor	8.35	Type I	6	-	-	-	-	-
Index	White Salmor	13	Type I	25	50.6	1265	0	0.67	21.44
Index	White Salmor	0.8	Type II	1200	-	-	-	-	-
Index	White Salmor	8.35	Type II	12	1.7	20	0	-	-
Index	White Salmor	13	Type II	15	7.0	105	0	0.11	0.56
<b>Site Summary</b>		<b>0.8</b>		<b>3000</b>	<b>0.8</b>	<b>1385</b>	<b>0</b>	<b>-</b>	<b>0</b>
		<b>8.35</b>	<b>-</b>	<b>18</b>	<b>1.7</b>	<b>20</b>	<b>0</b>	<b>-</b>	<b>0</b>
		<b>13</b>		<b>40</b>	<b>28.8</b>	<b>1370</b>	<b>0</b>	<b>0.39</b>	<b>11.00</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>1831</b>	<b>25.7</b>	<b>2650</b>	<b>0</b>	<b>0.67</b>	<b>21.44</b>
			<b>Type II</b>	<b>1227</b>	<b>4.3</b>	<b>125</b>	<b>0</b>	<b>0.11</b>	<b>0.56</b>

### Additional Index Site Observations

- **River km 0.8** – Located at the mouth of the River and accessed from Cook-Underwood Rd, the site was located on the massive sediment load that collected after the Condit Dam removal. Type I habitat was abundant, along with large amounts of aquatic vegetation. Due to location and popularity, this was a highly trafficked public site and only a few lampreys were observed.
- **River km 8.4:** Located at the public access site, known as Northwestern Park since the Condit Dam removal, at the end of a trail that leads to the river. The sediment present was composed of fine and coarse sand with small amounts of organic matter that collected behind large boulders. Only a few small and medium sized lampreys were observed with no other organisms in this highly trafficked public area. There is limited habitat in this reach of the White Salmon River (near the Condit Dam removal site), so this site will be kept as an index site until a better site is found.
- **River km 13.0:** This site was located in Husum approximately 20m below the Husum St. Bridge. The sediment that collected was composed of fine and coarse sand in one area and mostly silt in another that collected along woody debris. Young of the year and identifiable Westernbrook lamprey were abundant at this site and a giant pacific salamander was also observed. Husum is a high traffic area due to the outtake areas for the white water rafting companies that are located there.

## Exploratory Sites - White Salmon River

- Two exploratory sites were surveyed in the White Salmon River. Lampreys were present at both of the sites (100%), although no Pacific Lamprey were found. Lampreys were found as far upstream at river km 40.5.

**Table 21. Larval lamprey habitat details from exploratory sites surveyed in the White Salmon River. Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.**

Site Type	Stream	River KM	Date	Survey Type	% Type I in 50 m	% Type II in 50 m	Type I Habitat Type	Primary Fine Sediment (Type I)	Primary Fine Sediment (Type II)	Plot Temp °C (Best)	Thalweg Temp °C
Expl.	White Salmon	15.4	9/7/16	Short	67%	33%	Edge	Sand	-	9.1	8.8
Expl.	White Salmon	40.5	9/8/16	Short	25%	75%	Edge	Sand	-	10.2	10.2

**Table 22. Survey details, separated by habitat type, for the White Salmon River exploratory sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.**

Site Type	Stream	River KM	Habitat Type Surveyed	Shock Time (sec)	Shock Area (m2)	# Captured	# Observed	Survey Visibility (1-5)	Total # Observed (Adjusted)	E-Fish Density (#/m2)
Expl.	White Salmon	15.4	Type I	612	10	51	102	5	102	10.2
Expl.	White Salmon	40.5	Type I	426	7	6	12	3	15	2.1
Expl.	White Salmon	15.4	Type II	0	-	-	-	-	-	-
Expl.	White Salmon	40.5	Type II	0	-	-	-	-	-	-
<b>Site Summary</b>		<b>15.4</b>	<b>-</b>	<b>1038</b>	<b>17</b>	<b>57</b>	<b>114</b>	<b>-</b>	<b>117</b>	<b>6.2</b>
		<b>40.5</b>		<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>		<b>-</b>	<b>-</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>1038</b>	<b>17</b>	<b>57</b>	<b>114</b>	<b>-</b>	<b>117</b>	<b>6.2</b>
			<b>Type II</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>		<b>-</b>	<b>-</b>

**Table 23. Lamprey identification details, separated by habitat type, for the Wind River exploratory sites surveyed in September, 2016. The summary rows are a sum of presented values except for % values, which are a weighted average.**

Site Type	Stream	River KM	Habitat Type	# Identified	# of Pacific	# of Western Brook	% Pacific	% Western Brook	% of Cap. Identified
Expl.	White Salmon	40.5	Type I	4	0	4	0%	100%	67%
Expl.	White Salmon	40.5	Type II	0	-	-	-	-	-
<b>Site Summary</b>		<b>40.5</b>	<b>-</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>100%</b>	<b>0%</b>	<b>67%</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0%</b>	<b>100%</b>	<b>67%</b>
			<b>Type II</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

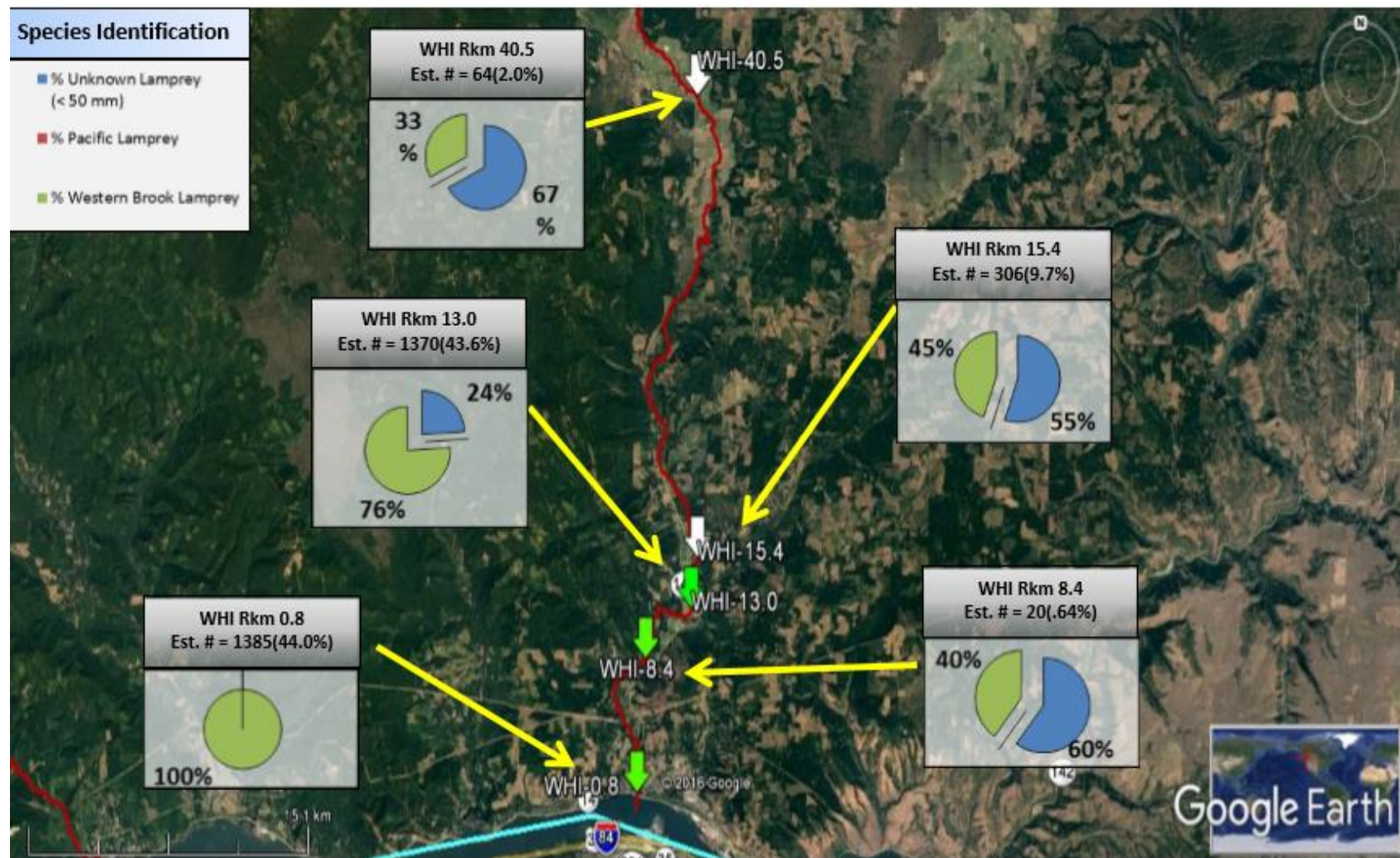
**Table 24. Lamprey population and biomass estimates within a 50 m reach, separated by habitat type, for the White Salmon River exploratory sites surveyed in September, 2016. “Estimated # of Pacific Lamprey” is calculated based on the identified ratio of Pacific Lamprey (to Western Brook Lamprey) generally > 50 mm in length. Summary rows are a sum of presented values, except for e-fish density and mean weight of captured, which are a mean of presented values.**

Site Type	Stream	River KM	Habitat Type	50 m Habitat Area (m2)	E-Fish Density (#/m2)	Estimated # in 50 m	Estimated # of Pacific Lamprey in 50 m	Mean Weight of Cap. (g)	Estimated Mass Density (g/m2)	Estimated Mass (g) in 50 m
Expl.	White Salmor	40.5	Type I	30	2.1	64	0	-	-	-
Expl.	White Salmor	40.5	Type II	90	-	-	-	-	-	-
<b>Site Summary</b>		<b>40.5</b>	<b>-</b>	<b>120</b>	<b>2.1</b>	<b>64</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>30</b>	<b>2.1</b>	<b>64</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
			<b>Type II</b>	<b>90</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

#### Additional Exploratory Site Observations

- **River km 15.4:** This site was located off of Glacier Orchard Rd., outside of Husum, and was accessed by crossing private property after gaining permission. The site was located approximately 10m downstream of the bridge crossing the river and was composed of fine and coarse sand compacted on top of bedrock with aquatic vegetation growing along the bank. The lamprey observed were composed mostly of small and medium size classes and some aquatic insects were observed.
- **River km40.5:** This side was located approximately 1.6km downstream of the Trout Lake Creek confluence and was accessed off of River Rd in Trout Lake. The sample area was composed of fine and coarse sand along the bank of a pool that had decreased visibility in some areas due to water movement and shade. Only three lampreys were observed which included two larvae and a transformer. The area was located across the river from private property and appears to have little human traffic.





Map 7. Displayed is the distribution of Unknown Lamprey <50 mm (blue), Pacific Lamprey (red) and Western Brook Lamprey (green) in the White Salmon River from September, 2016 electrofishing surveys. Species ratio of lampreys is based on captured and measured data only. Also shown is the estimated number of lampreys at each surveyed site (within a 50 m reach). Index sites are labeled by green arrows, exploratory sites labeled by white arrows, and sites where no electrofishing surveys labeled by purple arrows. \* Species ratio calculated from counted and identified fish (no lengths taken).

## Trout Lake Creek - White Salmon River Tributaries

### Index Sites – Trout Lake Creek

- One index site was surveyed in Trout Lake Creek (a tributary of the White Salmon River). No Pacific Lamprey were identified. However, the estimated number of lampreys, and the biomass in that site within a 50 m reach, is the highest in the White Salmon Watershed (17,874, 6,473 g). The biomass density at this site is also relatively high, compared to the rest of the watershed, at 12.95 g/m<sup>2</sup>.

**Table 25. Larval lamprey habitat details from index sites surveyed in Trout Lake Creek. Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.**

Site Type	Stream	River KM	Date	Survey Type	% Type I in 50 m	% Type II in 50 m	Type I Habitat Type	Primary Fine Sediment (Type I)	Primary Fine Sediment (Type II)	Plot Temp °C (Best)	Thalweg Temp °C
Index	Trout Lake	4.9	9/8/16	Full	57%	43%	Edge	Silt	-	12.5	12.3

**Table 26. Survey details, separated by habitat type, for the Trout Lake Creek index sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.**

Site Type	Stream	River KM	Habitat Type Surveyed	Shock Time (sec)	Shock Area (m2)	# Captured	# Observed	Survey Visibility (1-5)	Total # Observed (Adjusted)	E-Fish Density (#/m2)
Index	Trout Lake	4.9	Type I	502	12	185	370	4	411	35.7
Index	Trout Lake	4.9	Type II	333	7	0	0	5	-	-
<b>Site Summary</b>		<b>4.9</b>	<b>-</b>	<b>835</b>	<b>19</b>	<b>185</b>	<b>370</b>	<b>-</b>	<b>411</b>	<b>35.7</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>502</b>	<b>12</b>	<b>185</b>	<b>370</b>		<b>411</b>	<b>35.7</b>
			<b>Type II</b>	<b>333</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>

**Table 27. Measurement details of captured lampreys, separated by habitat type, for the Trout Lake Creek index sites surveyed in September, 2016 (sites without lampreys are excluded). The summary rows are a sum of presented values, except for mean weight, mean length and mean condition factor, which are a mean of presented values, and min and max length, which are the lowest and highest value, respectively.**

Site Type	Stream	River KM	Habitat Type Surveyed	# Weighed	Total Weight of Captured (g)	Mean Weight of Captured (g)	Min. Length (mm)	Max. Length (mm)	Mean Length (mm)	Mean Condition Factor
Index	Trout Lake	4.9	Type I	185	97.7	0.53	23	115	62	1.037
Index	Trout Lake	4.9	Type II	-	-	-	-	-	-	-
<b>Site Summary</b>		<b>4.9</b>	<b>-</b>	<b>185</b>	<b>98</b>	<b>0.53</b>	<b>23</b>	<b>115</b>	<b>62</b>	<b>1.037</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>185</b>	<b>98</b>	<b>0.53</b>	<b>23</b>	<b>115</b>	<b>62</b>	<b>1.037</b>
			<b>Type II</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

**Table 28. Lamprey identification details, separated by habitat type, for Trout Lake Creek index sites surveyed in September, 2016. The summary rows are a sum of presented values except for % values, which are a weighted average.**

Site Type	Stream	River KM	Habitat Type	# Identified	# of Pacific	# of Western Brook	% Pacific	% Western Brook	% of Cap. Identified
Index	Trout Lake	4.9	Type I	115	0	115	0%	100%	62%
Index	Trout Lake	4.9	Type II	0	-	-	0%	0%	-
<b>Site Summary</b>		<b>4.9</b>	<b>-</b>	<b>115</b>	<b>0</b>	<b>115</b>	<b>0%</b>	<b>100%</b>	<b>62%</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>115</b>	<b>0</b>	<b>115</b>	<b>0%</b>	<b>100%</b>	<b>62%</b>
			<b>Type II</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

**Table 29. Lamprey population and biomass estimates within a 50 m reach, separated by habitat type, for Trout Lake Creek index sites surveyed in September, 2016. “Estimated # of Pacific Lamprey” is calculated based on the identified ratio of Pacific Lamprey (to Western Brook Lamprey) generally > 50 mm in length. Summary rows are a sum of presented values, except for e-fish density and mean weight of captured, which are a mean of presented values.**

Site Type	Stream	River KM	Habitat Type	50 m Habitat Area (m2)	E-Fish Density (#/m2)	Estimated # in 50 m	Estimated # of Pacific Lamprey in 50 m	Mean Weight of Cap. (g)	Estimated Mass Density (g/m2)	Estimated Mass (g) in 50 m
Index	Trout Lake	4.9	Type I	500	35.7	17874	0	0.53	12.95	6473
Index	Trout Lake	4.9	Type II	370	-	-	-	-	-	-
<b>Site Summary</b>		<b>4.9</b>	<b>-</b>	<b>870</b>	<b>35.7</b>	<b>17874</b>	<b>0</b>	<b>0.53</b>	<b>12.95</b>	<b>6473</b>
<b>Habitat Summary</b>		<b>-</b>	<b>Type I</b>	<b>500</b>	<b>35.7</b>	<b>17874</b>	<b>0</b>	<b>0.53</b>	<b>12.95</b>	<b>6473</b>
			<b>Type II</b>	<b>370</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

## Additional Index Site Observations

- **River km 4.9:** This site was located at the end of Lake Rd. and had a largest abundance of habitat observed in Trout Lake Creek, which included the bank, the center of the main channel and many other parts of the braided channels. Aquatic vegetation was abundant near the center of the channel and in some areas was so dense it decreased visibility. Aquatic insects and worms were overserved along with high densities of lamprey consisting of a majority of small and medium size classes. This area is a public access point for hiking trails and lake access so it is highly trafficked.

## Exploratory Sites – Trout Lake Creek

- At the three exploratory sites in Trout Lake Creek, lampreys were present at all three sites (100%). Lampreys were found as far upstream at river km 13.3. The estimated number of lampreys in Type I habitat was highest at river km 6.6 (1.7 km upstream of the index site with high lamprey densities) within a 50 m reach. The density in Type I at river km 6.6 slightly less than the index site at river km 4.9 (25.8 #/m<sup>2</sup>)

**Table 29. Larval lamprey habitat details from exploratory sites surveyed in the Trout Lake Creek.** Under “Survey Type”, a “Full” indicates that both Type I and Type II habitat were electrofished (when available); “Short” indicates that either Type I or Type II habitat was surveyed; “Visited” indicates that the site was visited but no electrofishing occurred. The percent of larval habitat shown is the ratio between available Type I and Type II habitat, and excludes Type III (unusable) habitat within the 50 m survey reach. Under “Type I Habitat Type”, “Side Chan.” indicates that the primary survey location (for Type I habitat) was in a side channel; “Edge” indicates this occurred on the edge of the main channel; “Main” indicates this took place within the main channel. Plot temp was taken where the most lampreys were found, and thalweg temp was taken in the main channel flow.

Site Type	Stream	River KM	Date	Survey Type	% Type I in 50 m	% Type II in 50 m	Type I Habitat Type	Primary Fine Sediment	Primary Fine Sediment	Plot Temp °C	Thalweg Temp °C
					(Type I)	(Type II)		(Best)			
Expl.	Trout Lake	0.5	9/8/16	Short	5%	95%	Edge	Sand	-	16.0	16.0
Expl.	Trout Lake	6.6	9/8/16	Short	45%	55%	Edge	Sand	-	14.3	13.3
Expl.	Trout Lake	13.3	9/8/16	Short	93%	7%	Side Chan.	Silt	-	12.0	12.7

**Table 30. Survey details, separated by habitat type, for Trout Lake Creek exploratory sites surveyed in September, 2016. The total number of lampreys observed was adjusted (increased) based on the following 1-5 visibility scale (estimated % visibility in parenthesis): (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). Survey densities (#/m<sup>2</sup>) were calculated using the adjusted observed number of lampreys. The summary rows are a sum of presented values, except for e-fish density which is a mean of presented values.**

Site Type	Stream	River KM	Habitat Type Surveyed	Shock Time (sec)	Shock Area (m2)	# Captured	# Observed	Survey Visibility (1-5)	Total # Observed (Adjusted)	E-Fish Density (#/m2)
Expl.	Trout Lake	0.5	Type I	238	3	31	62	3	78	25.8
Expl.	Trout Lake	6.6	Type I	387	5	21	51	5	51	10.2
Expl.	Trout Lake	13.3	Type I	302	5	5	10	5	10	2.0
Expl.	Trout Lake	0.5	Type II	0	-	-	-	-	-	-
Expl.	Trout Lake	6.6	Type II	0	-	-	-	-	-	-
Expl.	Trout Lake	13.3	Type II	0	-	-	-	-	-	-
<b>Site Summary</b>		<b>0.5</b>		<b>238</b>	<b>3</b>	<b>31</b>	<b>62</b>		<b>78</b>	<b>25.8</b>
		<b>6.6</b>	-	<b>387</b>	<b>5</b>	<b>21</b>	<b>51</b>	-	<b>51</b>	<b>10.2</b>
		<b>13.3</b>		<b>302</b>	<b>5</b>	<b>5</b>	<b>10</b>		<b>10</b>	<b>2.0</b>
<b>Habitat Summary</b>		-	<b>Type I</b>	<b>927</b>	<b>13</b>	<b>57</b>	<b>123</b>	-	<b>139</b>	<b>12.7</b>
			<b>Type II</b>	-	-	-	-	-	-	-

**Table 31. Lamprey identification details, separated by habitat type, for the Wind River exploratory sites surveyed in September, 2016. The summary rows are a sum of presented values except for % values, which are a weighted average.**

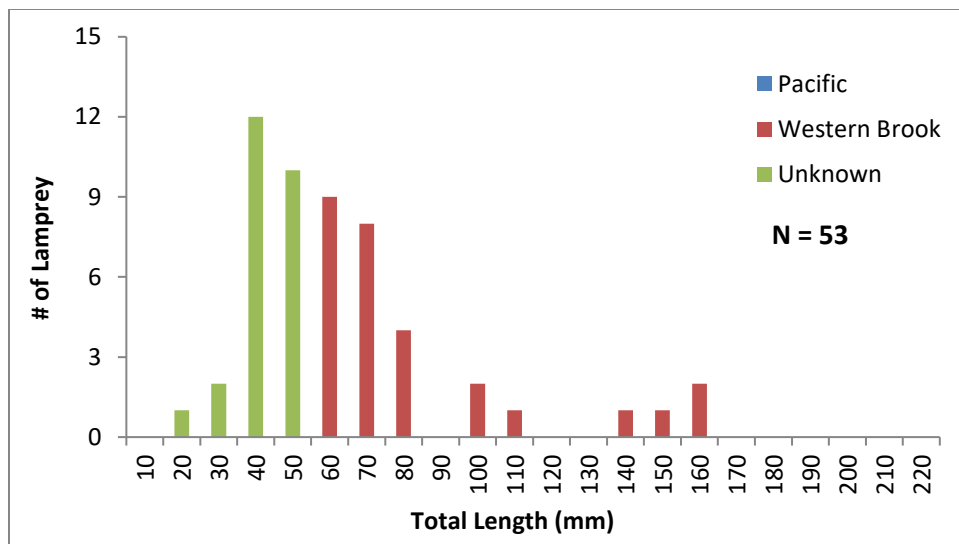
Site Type	Stream	River KM	Habitat Type	# Identified	# of Pacific	# of Western Brook	% Pacific	% Western Brook	% of Cap. Identified
Expl.	Trout Lake	0.5	Type I	25	0	25	0%	100%	81%
Expl.	Trout Lake	6.6	Type I	0	0	0	-	-	-
Expl.	Trout Lake	13.3	Type I	5	0	5	0%	100%	-
Expl.	Trout Lake	0.5	Type II	0	-	-	-	-	-
Expl.	Trout Lake	6.6	Type II	0	-	-	-	-	-
Expl.	Trout Lake	13.3	Type II	0	-	-	-	-	-
<b>Site Summary</b>		<b>0.5</b>		<b>25</b>	<b>0</b>	<b>25</b>	<b>0%</b>	<b>100%</b>	<b>81%</b>
		<b>6.6</b>	-	<b>0</b>	-	-	-	-	-
		<b>13.3</b>		<b>5</b>	<b>0</b>	<b>5</b>	<b>0%</b>	<b>100%</b>	<b>100%</b>
<b>Habitat Summary</b>		-	<b>Type I</b>	<b>30</b>	<b>0</b>	<b>30</b>	<b>0%</b>	<b>100%</b>	<b>53%</b>
			<b>Type II</b>	-	-	-	-	-	-

**Table 32. Lamprey population and biomass estimates within a 50 m reach, separated by habitat type, for Trout Lake Creek exploratory sites surveyed in September, 2016. “Estimated # of Pacific Lamprey” is calculated based on the identified ratio of Pacific Lamprey (to Western Brook Lamprey) generally > 50 mm in length. Summary rows are a sum of presented values, except for e-fish density and mean weight of captured, which are a mean of presented values.**

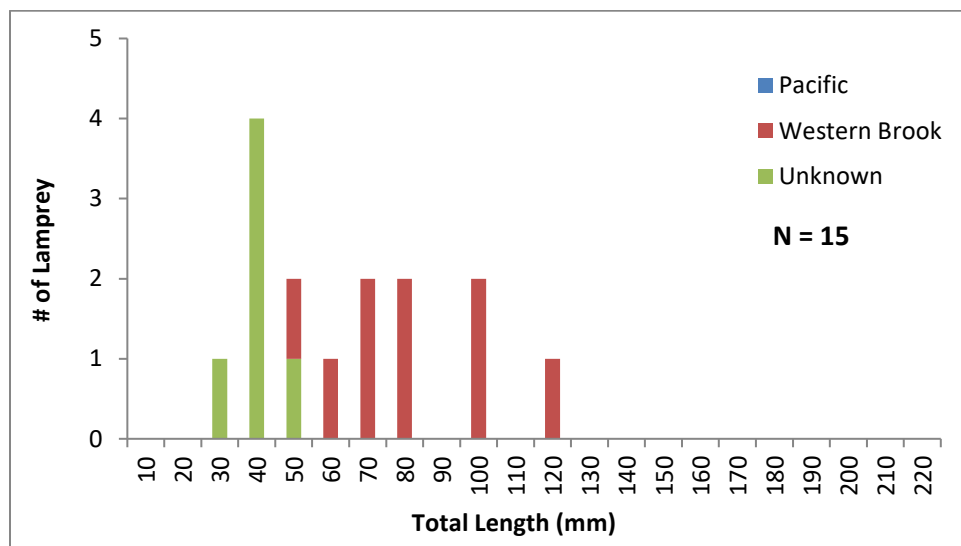
Site Type	Stream	River KM	Habitat Type	50 m		Estimated # in 50 m	Estimated # of Pacific Lamprey in 50 m	Mean Weight of Cap. (g)	Estimated Mass Density (g/m2)	Estimated Mass (g) in 50 m
				Habitat Area (m2)	E-Fish Density (#/m2)					
Expl.	Trout Lake	0.5	Type I	3	25.8	78	0	-	-	-
Expl.	Trout Lake	6.6	Type I	25	10.2	255	0	-	-	-
Expl.	Trout Lake	13.3	Type I	13.5	2.0	27	0	-	-	-
Expl.	Trout Lake	0.5	Type II	60	-	-	-	-	-	-
Expl.	Trout Lake	6.6	Type II	30	-	-	-	-	-	-
Expl.	Trout Lake	13.3	Type II	1	-	-	-	-	-	-
<b>Site Summary</b>		<b>0.5</b>	-	<b>63</b>	<b>25.8</b>	<b>78</b>	<b>0</b>			
		<b>6.6</b>		<b>55</b>	<b>10.2</b>	<b>255</b>	<b>0</b>		-	
		<b>13.3</b>		<b>15</b>	<b>2.0</b>	<b>27</b>	<b>0</b>			
<b>Habitat Summary</b>		-	<b>Type I</b>	<b>42</b>	<b>12.7</b>	<b>360</b>	<b>0</b>			
			<b>Type II</b>	<b>91</b>	<b>-</b>	<b>-</b>	<b>-</b>		-	

#### Additional Exploratory Site Observations

- **River km 0.5:** This site was accessed through the bridge on Old Creamery Rd. approximately 0.4km above the White Salmon confluence, along private property. The survey was located along the bank in a small strip and was composed of compacted sand spread between cobble and bedrock. Few lampreys were found but included larvae and one transformer while other aquatic insects were observed.
- **River km 6.6:** This site was accessed by crossing through the Elk Meadows RV Park outside of Trout Lake off of Trout Creek Rd. which is a highly trafficked area. The Creek only 2-3m in width, which was much smaller than the previous site at River km 4.9, and the sediment collected along both sides of the banks. Only a few lampreys were observed along with other small aquatic insects.
- **River km 13.3:** This site was located at the end of road NF-010, off of Trout Creek Rd., that leads to a private out of commission campsite. The habitat surveyed was at the mouth of a small channel that was being fed by a small trickle of a spring and was composed of a coarse sand pool that had an abundance of algae growing along the bottom. Only a few lampreys were seen including one transformer and other aquatic insects and worms were observed. The area showed evidence of a seasonal washout and although the campsite was out of commission, there appeared to be moderate traffic in the area.



**Figure 3. Histogram of all measured lampreys captured during electrofishing surveys, separated by species (“PA”= Pacific Lamprey (blue), “UN”=Unknown Lamprey <50 mm (green)), in the White Salmon River in September, 2016.**



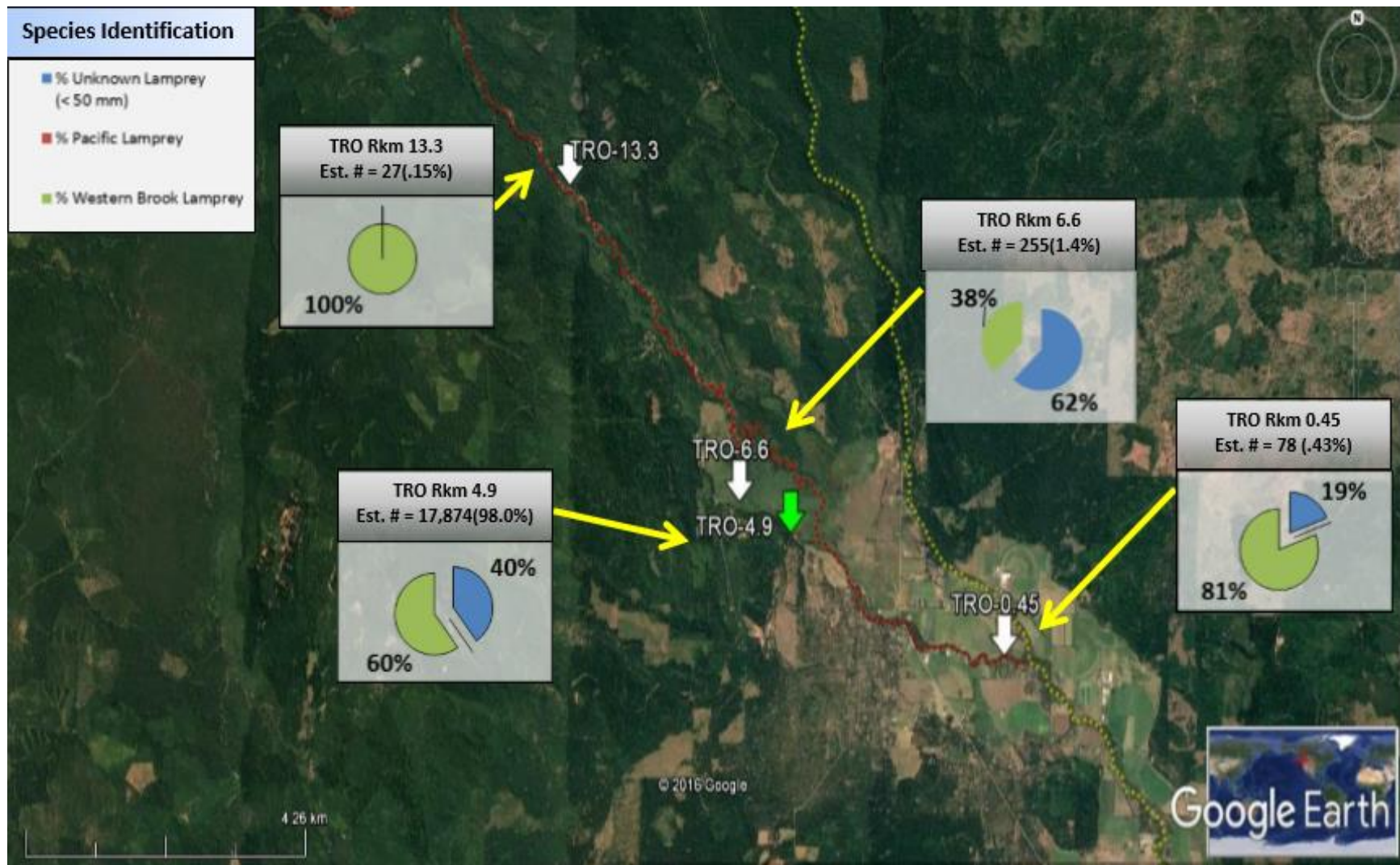
**Figure 4. Histogram of all measured lampreys captured during electrofishing surveys, separated by species (“PA”= Pacific Lamprey (blue), “UN”=Unknown Lamprey <50 mm (green)), in the Trout Lake Creek in September, 2016.**



## Genetic Samples from the White Salmon Watershed

**Table 33. Genetic samples collected from the White Salmon Watershed (White Salmon River and Trout Lake Creek) in September, 2016.**

<b>Stream Name</b>	<b>River KM</b>	<b>Collection Date</b>	<b># of Pacific Samples (Larvae)</b>	<b># of Pacific Samples (Macro.)</b>	<b># of Western Brook Samples</b>	<b># Unknown Species Samples (&lt; 50 mm)</b>	<b>Primary Collection Purpose</b>
White Salmon	8.4	9/7/16	0	0	0	3	Species Identification
White Salmon	13.0	9/9/16	0	0	0	12	Species Identification
White Salmon	15.4	9/7/16	0	0	0	10	Species Identification
Trout Lake	4.9	9/8/16	0	0	0	12	Species Identification
<b>Total</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>37</b>	



Map 8. Displayed is the distribution of Unknown Lamprey <50 mm (blue), Pacific Lamprey (red) and Western Brook Lamprey (green) in Trout Lake Creek from September, 2016 electrofishing surveys. Species ratio of lampreys is based on captured and measured data only. Also shown is the estimated number of lampreys at each surveyed site (within a 50 m reach). Index sites are labeled by green arrows, exploratory sites labeled by white arrows, and sites where no electrofishing surveys labeled by purple arrows. \* Species ratio calculated from counted and identified fish (no lengths taken).



## Appendix: Additional Site Maps and Photos

### Rock Creek (Near Stevenson, WA)



**Map A1.** Site map of Rock Creek index site at river km 0.8 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site. The small red dots indicate stream distance of 100 m.



**Photo A1.** Rock Creek index site at river km 0.8; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/sand (right) from 2016 survey.





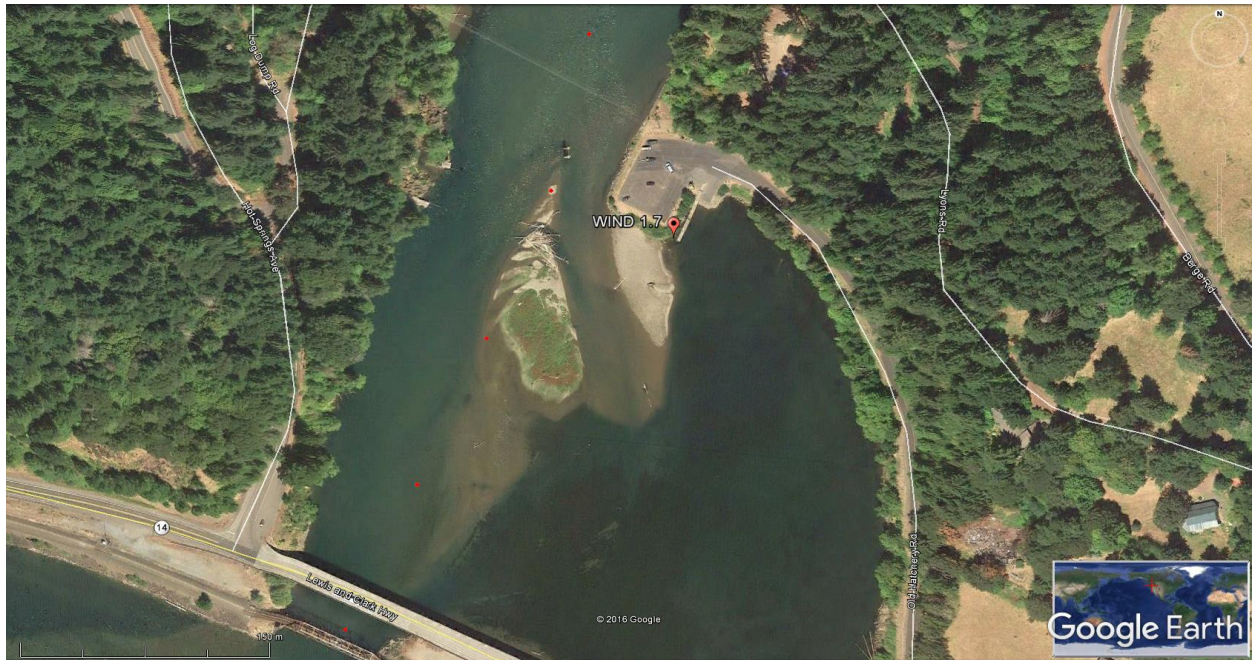
**Map 2. Site map of Rock Creek exploratory site at river km 3.2 (surveyed in September 2016); white balloon indicates that no lamprey were present at this site. The small red dots indicate stream distance of 100 m. (upstream of Rock Creek Falls)**



**Photo A2. Rock Creek exploratory site at river km 3.2; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/sand/organic debris (right) from 2016 survey.**



### Wind River Mainstem



**Map A3.** Site map of Wind River index site at river km 1.7 (surveyed in September, 2016); red balloon indicates presence of Pacific Lamprey. The small red dots indicate stream distance of 100 m.



**Photo A3.** Wind River index site at river km 1.7; overview of Type I habitat (left) and close-up of best Type I habitat (right) from 2016 survey.





**Map A4.** Site map of Wind River exploratory site at river km 2.4 (surveyed in September, 2016); red balloon indicates presence of Pacific Lamprey. The small red dots indicate stream distance of 100 m.



**Photo A4.** Wind River exploratory site at river km 2.4; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/clay (right) from 2016 survey.





**Map A5.** Site map of Wind River index site at river km 26.3 (surveyed in September, 2016); red balloon indicates presence of Pacific Lamprey. The small red dots indicate stream distance of 100 m.



**Photo A5.** Wind River index site at river km 26.3; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/sand (right) from 2016 survey.



## White Salmon River Mainstem



**Map A6.** Site map of White Salmon River index site at river km 0.8 (surveyed in September, 2016); green balloon indicates all captured lamprey were > 50 mm and identified as Western Brook Lamprey. The small red dots indicate stream distance of 100 m.



**Photo A6.** White Salmon River index site at river km 0.8; overview of Type I habitat (left) and close-up of best Type I habitat (right) from 2016 survey.



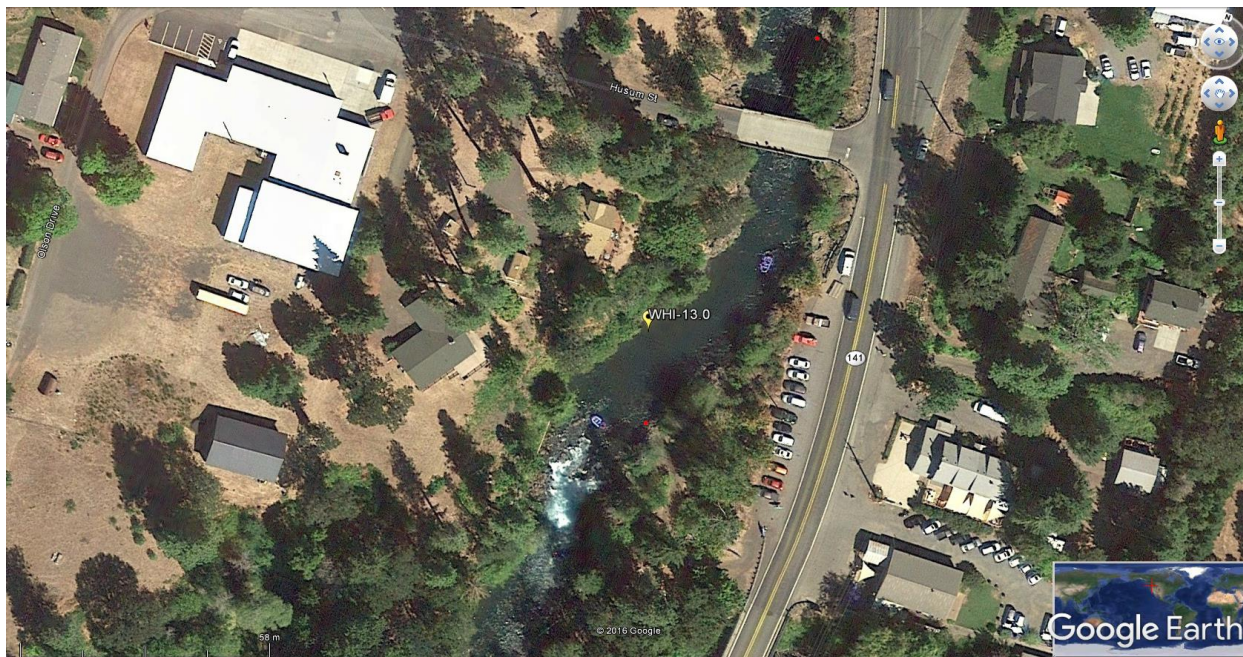


**Map A7. Site map of White Salmon River index site at river km 8.35 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site. The small red dots indicate stream distance of 100 m.**



**Photo A7. White Salmon River index site at river km 8.35; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of coarse sand (right) from 2016 survey.**





**Map A8.** Site map of White Salmon River index site at river km 13.0 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site. The small red dots indicate stream distance of 100 m.



**Photo A8.** White Salmon River index site at river km 13.0; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/clay/organic debris (right) from 2016 survey.





**Map A9. Site map of White Salmon River exploratory site at river km 15.4 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site. The small red dots indicate stream distance of 100 m.**

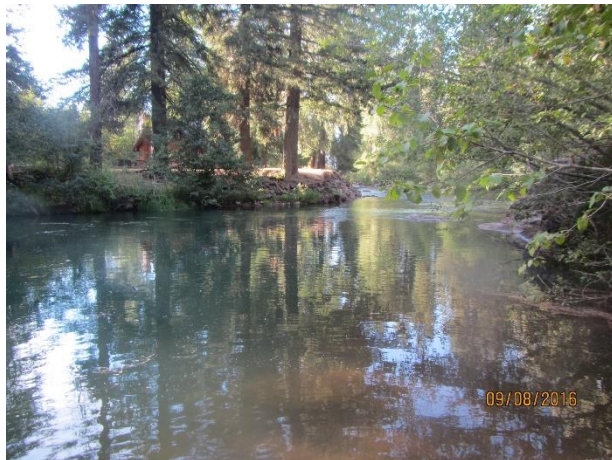


**Photo A9. White Salmon River exploratory site at river km 15.4; upstream (left) and downstream (right) view of habitat from 2016 survey.**





**Map A10.** Site map of White Salmon River exploratory site at river km 40.5 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site. The small red dots indicate stream distance of 100 m.

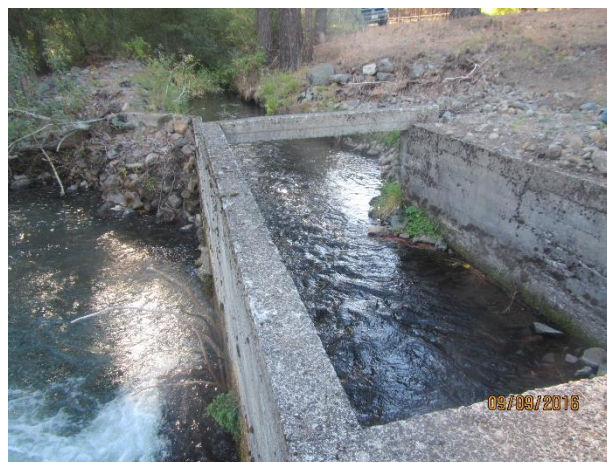
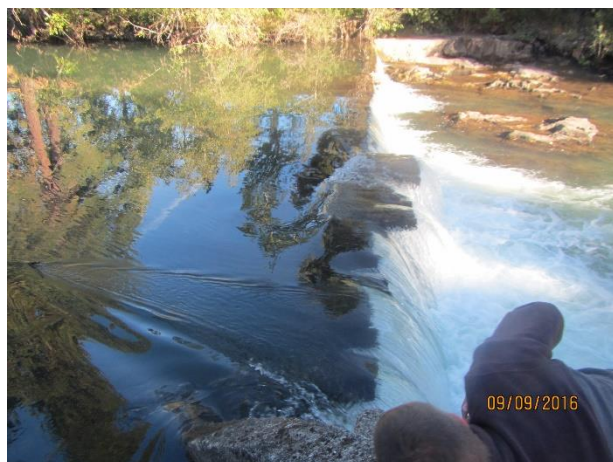


**Photo A9.** White Salmon River exploratory site at river km 40.5; overview of habitat (left) and close-up of best Type I habitat sediment composed of silt/sand/organic debris (right) from 2016 survey.





**Map A11.** Site map of White Salmon River exploratory site at river km 41.0 (visited in September, 2016); purple balloon indicates that no electrofishing survey took place in 2016. The small red dots indicate stream distance of 100 m.



**Photo A10.** White Salmon River exploratory site at river km 41.0; overview (left) and (right) from 2016 survey.



## White Salmon River Tributaries

### Trout Lake Creek



**Map A12.** Site map of Trout Lake Creek exploratory site at river km 0.45 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site. The small red dots indicate stream distance of 100 m.



**Photo A11.** Trout Lake Creek exploratory at river km 0.45; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/clay/sand (right) from 2016 survey.





**Map A13.** Site map of Trout Lake Creek exploratory site at river km 3.0 (visited in September, 2016); purple balloon indicates that no electrofishing survey took place in 2016. The small red dots indicate stream distance of 100 m.



**Photo A12.** Trout Lake Creek exploratory site at river km 3.0; overview of Type I habitat (left) and close-up of habitat/diversion weir (right) from 2016 survey.





**Map A14.** Site map of Trout Lake Creek index site at river km 4.9 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site.



**Photo A13.** Trout Lake Creek index site at river km 4.9; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/sand (right) from 2016 survey.





**Map A15.** Site map of Trout Lake Creek exploratory site at river km 6.6 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site.



**Photo A14.** Trout Lake Creek exploratory site at river km 6.6; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/sand/organic debris (right) from 2016 survey.





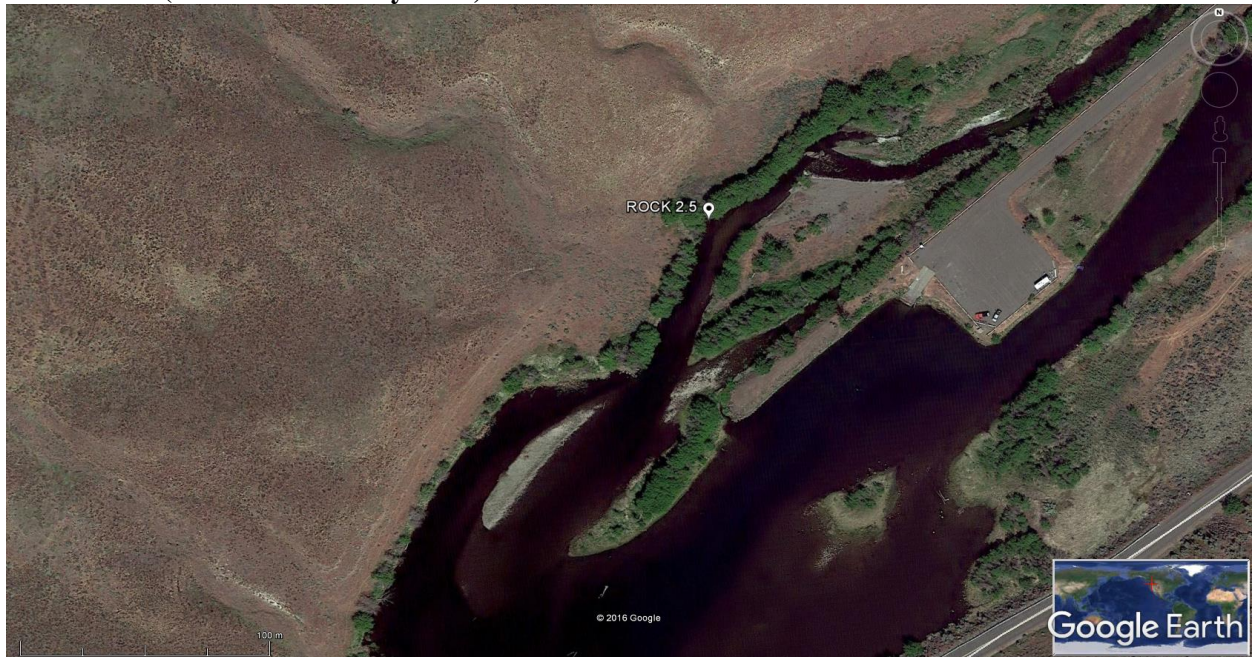
**Map A16.** Site map of Trout Lake Creek exploratory site at river km 13.3 (surveyed in September, 2016); yellow balloon indicates that lamprey of unknown species (<50 mm) were present at this site. The small red dots indicate stream distance of 100 m.



**Photo A15.** Trout Lake Creek exploratory site at river km 13.3; overview of habitat (left) and close-up of best habitat (right) from 2016 survey.



**Rock Creek (North of John Day Dam)**



**Map A17. Site map of Rock Creek exploratory site at river km 2.5 (surveyed in September 2016); white balloon indicates that no lamprey were present at this site.**



**Photo A16. Rock Creek exploratory site at river km 2.5; overview of Type I habitat (left) and close-up of best Type I habitat sediment composed of silt/sand (right) from 2016 survey.**





**Map A18. Site map of Rock Creek exploratory site at river km 6.3 (visited in September, 2016); purple balloon indicates that no electrofishing survey took place in 2016.**



**Photo A17. Rock Creek exploratory site at river km 6.3; upstream (left) and downstream (right) views of dry creek bed from 2016 survey.**