

# The Nason Creek Fill Removal and Oxbow Enhancement Project (N1)

## 2015 Monitoring Report



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The Nason Creek Fill Removal and Oxbow Enhancement Project ("N1") was completed in October of 2014. The site is located between river mile 3.9 and 4.6 of Nason Creek. Specific construction elements include:

- 1) Remove 1,325 cubic yards of fill near RM 4.6 on river left and remove 1,825 cubic yards of parking lot fill on river right for a total of 0.64 acres of floodplain fill removal. The floodplain fill was placed as part of a historic bridge that crossed over Nason Creek. The bridge washed out in the 1990s but road approach fill (modern use parking lot) on the south side of Nason Creek and bridge abutment fill on the north side remained, resulting in floodplain disconnection on both sides of Nason Creek.
- 2) Install 28 pieces of large wood in the upstream area of a side channel oxbow that CCNRD re-connected in 2007 near RM 3.9.

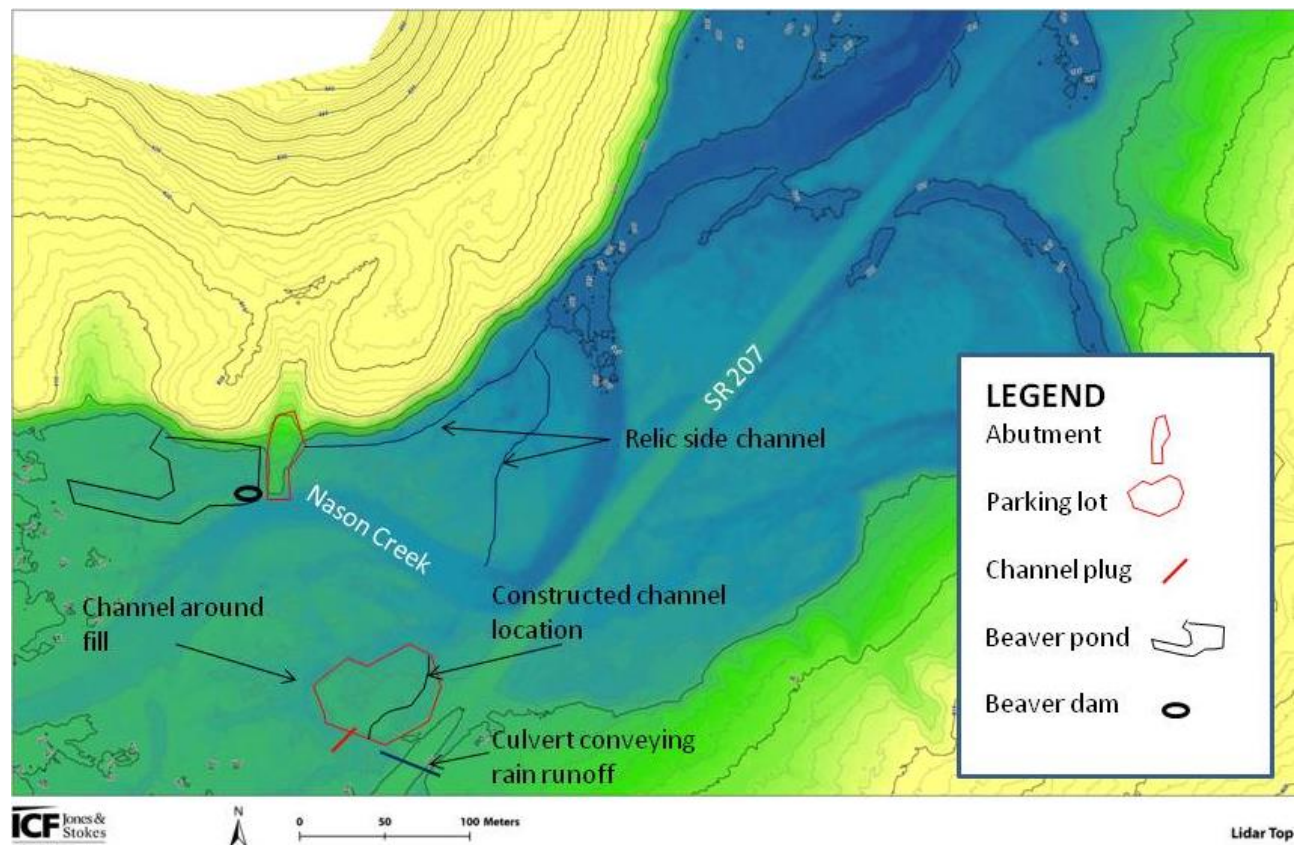
Nason Creek has been identified as the top priority for habitat restoration actions in the Wenatchee watershed and is a major spawning area for spring Chinook and steelhead. The highest priority ecological concern is the lack of peripheral and transitional habitats. The purpose of the Nason Creek Fill Removal and Oxbow Enhancement Project is to address this concern by restoring floodplain function in the fill removal area and improving habitat complexity in the oxbow. Specific project goals are to:

- 1) Restore channel migration potential and natural stream processes near RM 4.6, including enhancing the activation of an existing relic side channel on river left (located just downstream of the project area)
- 2) Remove floodplain fill on river right near RM 4.6 and provide off-channel rearing and refuge in a side channel created through the floodplain.
- 3) Increase in-stream structure to provide fish cover in the 2007 oxbow by altering sediment deposition patterns and thus promoting future vegetation establishment. Since the wood was placed to alter sediment deposition patterns and increase future vegetation establishment, most of the wood placed is intended to be inundated seasonally during the OHW flow elevation (~700-1000 cfs). Wood placement methods did not allow use of mechanized equipment, therefore, the wood was initially designed to remain stable up to the 5 year event with additional stability being provided in the future through vegetation establishment around the large wood structures.
- 4) Re-vegetate work areas.

Figure 1. Restoration elements of the Nason Creek Fill Removal and Oxbow Enhancement Project (N1)



Figure 2. Pre-construction LIDAR of floodplain elements associated with abutment and parking lot removal. “Channel around fill” is also referred to as the “old channel” in this report.





## Monitoring Methods

A portion of this project, the floodplain fill removal near Hwy 207, is being monitored by Tetra-Tech through the SRFB monitoring program to evaluate floodplain enhancement project effectiveness. Tetra Tech has collected 2 seasons of pre-construction data (2013 and 2014) and one season of post-construction data. Tetra Tech has conducted snorkel surveys to document fish use in the floodplain side channel and topographic surveys of site conditions. The fish snorkel data and topography surveys are incorporated into this report. The 2014 Tetra Tech monitoring report is available online at <http://waconnect.paladinpanoramic.com/project/290/39853> and the 2015 results will be incorporated into a report available online at [http://www.rco.wa.gov/doc\\_pages/other\\_pubs.shtml#monitoring](http://www.rco.wa.gov/doc_pages/other_pubs.shtml#monitoring)

Yakama Nation and Department of Ecology conducted snorkel surveys in the 2007 oxbow (large wood enhancement project area located near RM 3.9) to document fish use in 2008 and 2010 (reports available online at <http://waconnect.paladinpanoramic.com/project/290/1888>).

More recently, the Yakama nation has been conducting snorkel surveys in the 2007 oxbow as a reference site for the Lower White Pine re-connection project. Yakama nation 2014 and 2015 snorkel survey data from the 2007 oxbow is included in this report and further described in the CCNRD Lower White Pine monitoring report which is available online at <http://waconnect.paladinpanoramic.com/project/290/14462>.

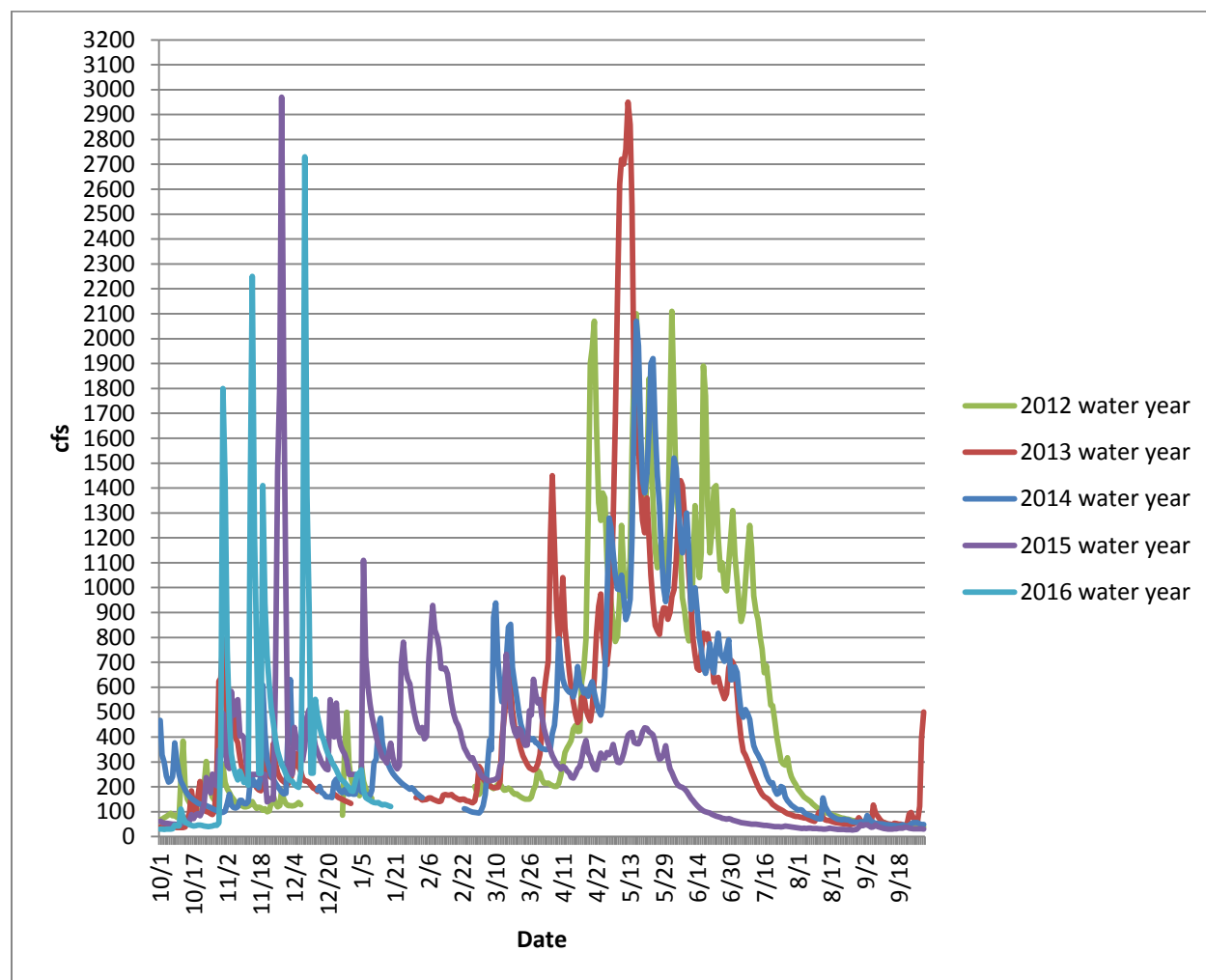
Since the Tetra Tech and Yakama nation fish surveys only cover a portion of the project area and the data they are collecting does not document whether or not the project meets all of the four project goals, CCNRD has developed a monitoring plan to collect supplemental data in the project area. In addition, CCNRD is conducting more extensive vegetation surveys to document compliance with permitting (DOE and Corps) and funding (DOE) requirements. CCNRD has visited the site to photo document high and low flow conditions, conduct vegetation monitoring, and track large wood placed in the oxbow. Monitoring methods are further described below.

### Photo point monitoring (moderate, peak and low flow)

#### *Goals addressed:*

- 1) Restore channel migration potential and natural stream processes on river left, including enhancing activation of the relic side channel located downstream of the project area.*
- 2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right (high and moderate flow photos).*
- 3) Provide fish cover in the 2007 oxbow and potentially alter sediment deposition patterns and promote vegetation establishment.*
- 4) Revegetate the fill removal areas (low flow photos).*

Figure 3. Nason Creek Hydrographs for water years 2012 – 2015. Note 2015 drought conditions.



The Nason Creek 2015 hydrograph was atypical and reflects a drought year with record low snow pack and record high summer air temperatures (Figure 3). Heavy rains in fall 2014 and 2015 caused several flashy spikes in the Nason Creek hydrograph (Figure 3, purple and light blue line). Therefore, 2015 photo point monitoring reflects these site conditions.

Photo points were established before project construction on April 29<sup>th</sup>, 2014 at a mainstem flow of 488 cfs (DOE gage at the mouth of Nason Creek). In order to compare these conditions with post-project conditions, CCNRD staff visited the site on April 6<sup>th</sup>, 2015 during a similar moderate flow of 325 cfs. Channel (river right) function, floodplain (river left) activation, and condition of large wood placed in the oxbow were recorded.

Due to the low snow pack of 2015, peak flow did not occur during the typical May/June period. However, CCNRD staff visited the site on December 9<sup>th</sup> when heavy rain brought Nason Creek to a high

flow of 2,730 cfs (Figure 3, light blue line). Photo points were repeated and floodplain, channel, and oxbow LWD conditions were recorded during this visit.

CCNRD also repeated photo points on August 20<sup>th</sup>, 2015 at a low mainstem flow of 29 cfs. Conditions of the constructed channel, oxbow LWD, and river left floodplain were recorded.

CCNRD also sub-contracted with Colchuck media to photo-document flows and vegetation establishment in and around the large wood that was placed in the upstream end of the oxbow. These results will be compiled into a video format available in late 2016.

### Topographic Survey

#### *Goals addressed:*

- 1) Restore channel migration potential and natural stream processes on river left, including enhancing activation of the relic side channel.*
- 2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right.*
- 3) Provide fish cover in the 2007 oxbow and potentially alter sediment deposition patterns and promote vegetation establishment.*

ICF International conducted post-construction as-built topographic surveys of the abutment and parking lot fill removal areas to compare post-construction elevations to those shown in the plan set. ICF International also surveyed the abutment fill removal area on river left in fall 2015 to document changes observed during the first season of exposure to high flows. Results of ICF and Tetra Tech topographic surveys are included with this report.

### Fish Use

#### *Goals addressed:*

- 2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right.*
- 3) Provide fish cover in the 2007 oxbow and potentially alter sediment deposition patterns and promote vegetation establishment.*

Tetra Tech conducted pre-construction snorkel surveys on June 17, 2013 and June 25, 2014 at typical ordinary high water (OHW) flow conditions in Nason Creek which were 818 cfs and 734 cfs, respectively. They also conducted post construction snorkel surveys in April 2015 when mainstem flow was around 300 cfs. Since the newly constructed channel is primarily rain-melt fed from the upstream end and backwatered by Nason Creek flows at the downstream end, the snorkel survey sampling was timed a little earlier in the spring when the whole channel was actively flowing.

The Yakama Nation surveyed the 2007 oxbow on March 20 (560 cfs) and August 28, 2014 (64.8 cfs) prior to wood placement. They also surveyed the oxbow post-construction on March 26<sup>th</sup> (733 cfs) and August 6, 2015 (33.2 cfs). Results of all 4 pre-construction snorkel surveys and 3 post-construction snorkel surveys are included in this report.

## Riparian Vegetation Monitoring

### *4) Revegetate the fill removal areas (river right and left).*

Vegetation monitoring documents the re-establishment of floodplain and wetland vegetation following the floodplain fill removal. The HPA permit requires that the project sponsors achieve 80 percent survival of installed plants. Staff also collected data per the Shade Monitoring for the Wenatchee Basin Water Quality Restoration Project (see associated Quality Assurance Project Plan, 2015, for detailed methods) in the parking lot fill removal area. This is a requirement of the Washington Department of Ecology, who partially funded planting efforts. CCNRD staff conducted a stem count of both the river right and river left planted areas on August 20<sup>th</sup>, 2015. Percent survival was calculated by dividing stem count numbers by the number of plants installed following fill removal and side channel excavation in the fall of 2014.

A brush mattress was installed on the high water mark on river left in the abutment removal area. CCNRD staff noted cover and survival of the mattress during the August 20<sup>th</sup>, 2015 visit.

## **Results**

### Photo Point Monitoring (Moderate spring flows and peak winter flow)

*Goal 1) Restore channel migration potential and natural stream processes on river left, including enhancing activation of the relic side channel located downstream of the project area.*

Removal of fill on river left provides Nason Creek with access to its floodplain (Figure 4).

Figure 4. Abutment fill removed, river/floodplain connection restored



PP16- April 29<sup>th</sup>, 2014; 488 cfs



PP16 -April 6<sup>th</sup> 2015, 325 cfs





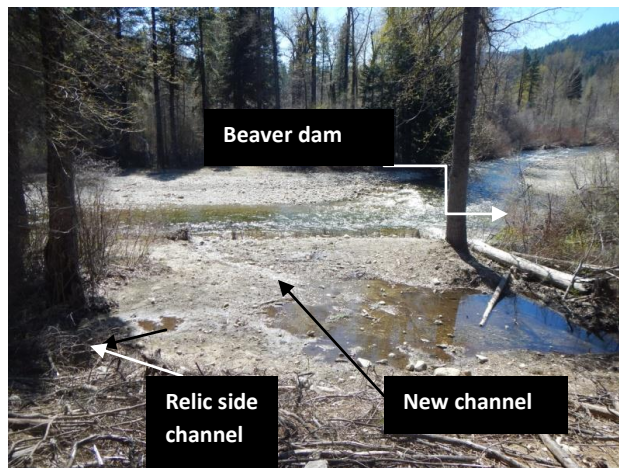
PP7- April 29<sup>th</sup>, 2014; 488 cfs



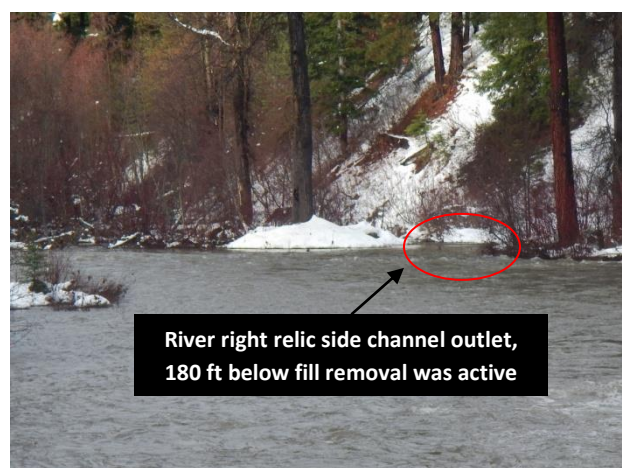
PP7- April 6<sup>th</sup> 2015, 325 cfs

Photo points indicate abutment removal restored natural floodplain processes. Just prior to project construction in summer 2014, beavers built a dam on a tributary to Nason Creek which is located at the upstream end of the abutment (Figure 2). The beaver dam elevated water levels throughout the floodplain just upstream of the abutment fill removal area. Thus, post construction, those flows inundated the project area and a shallow channel formed through the project area. Photo points on April 6<sup>th</sup>, 2015 document water from the beaver pond (Figure 2) flooding the project area and draining back to the mainstem Nason Creek through the brush mattress plantings (Figure 5, PP3). The new channel across the abutment removal area was also observed in December after heavy fall rain (Figure 5, fourth image). During the December 9<sup>th</sup> high flow event, the entire floodplain was flooded and the relic side channel downstream of the project area was activated; water flowed from the beaver ponded area, through the project area, and into the side channel downstream of the project area (Figure 5, right photo). One goal of the floodplain fill removal was to restore activation of this downstream floodplain side channel.

Figure 5. Flooding of abutment removal area (left and bottom) and relic side channel (right).



PP3 April 6<sup>th</sup>, 2015; 325 cfs



December 9<sup>th</sup>, 2015; 2,730 cfs





PP16- April 29<sup>th</sup>, 2014; 488 cfs



December 8<sup>th</sup>, 2015; 848 cfs

*Goal 2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right.*

The parking lot fill removal has resulted in floodplain activation and a return of natural process. Photos from April 6<sup>th</sup>, 2015 (Figure 6) indicate the rain in late March and early April 2015 caused activation of the constructed channel (the upstream end of the channel is activated by precipitation and Nason Creek backwaters the downstream end, see Figure 2). During the high flow event of December 9<sup>th</sup>, the parking lot floodplain was inundated from the river south to the constructed channel, indicating an increase flood storage capacity at the site (Figure 7). December 2015 flood conditions were due to a combination of river flooding and rain runoff.

Figure 6. River right constructed channel was activated on April 6<sup>th</sup>, 2015 due to rain runoff.



Constructed channel looking towards outlet



Inlet flow into constructed channel



Figure 7. Floodplain activation occurred on December 9<sup>th</sup> due to mainstem flooding and rain runoff



PP11- pre-construction, April 29<sup>th</sup>, 2014; 488 cfs



PP11-December 9<sup>th</sup>, 2015; 2,730 cfs

Figure 8. Water in old channel around parking lot pre and post project



PP15 - April 29<sup>th</sup>, 2014; mainstem 488 cfs



PP 15 - April 6<sup>th</sup>, 2015; mainstem 325 cfs

3) *Provide fish cover in the 2007 oxbow and potentially alter sediment deposition patterns and promote vegetation establishment.*

As planned, most of the large wood added to the oxbow was above water levels on April 6<sup>th</sup> at a mainstem flow of 325 cfs, although the perimeter pieces provided fish cover (Figure 9). High water flood events in the late fall and early winter of 2015 (estimated 25 year event in Icicle Creek but the Nason gage does not record high flows) caused relocation of approximately 10 pieces of wood (Figure 10). Almost all the remaining wood was inundated on the December 9<sup>th</sup> flood event, at a mainstem flow of 2,730 cfs (Figure 10).



Figure 9. 2007 Oxbow pre and post construction.



Pre-construction, April 29<sup>th</sup>, 2014; 488 cfs

PP1 April 6<sup>th</sup>, 2015; 325 cfs

Figure 10. 2007 Oxbow after late fall and early winter floods caused wood to shift.



PP1 December 8<sup>th</sup>, 2015; 848 cfs

PP1 December 9<sup>th</sup>, 2015; 2,730 cfs

Additional vegetation establishment and images of the wood at a variety of flows will be compiled into video in 2016.

#### Low Flow Monitoring

As designed, the constructed channel, right bank and left bank floodplain fill removal areas were dry at low flow (Figures 11 and 12; August 20<sup>th</sup>, 2015 mainstem flow of 29 cfs).

*1) Restore channel migration potential and natural stream processes on river left, including enhancing activation of the relic side channel (Figure 2) downstream of the project area.*

Water pathways on the left bank floodplain, although dry, were apparent in areas that had flood water on April 6<sup>th</sup>, 2015 (Figure 11). The beaver dammed tributary on the west side of the left bank floodplain was active at low flow (Figure 11 3<sup>rd</sup> photo).



Figure 11. Low flow conditions on river right floodplain, August 20<sup>th</sup>, 2015; 29 cfs



PP18 – pre construction, April 29, 2014; 488 cfs



PP 18 – Aug 20, 2015; 29cfs flood pathways apparent



Aug 20, 2015; 29cf - Beaver dam tributary active

*Goal 2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right.*

No erosion or sediment deposition issues were observed in the right bank constructed channel (Figure 12). Low flow photos also document vegetation establishment in the first year.

Figure 12. River left floodplain (parking lot fill removal) at low flow, pre and post construction.



PP 18 – preconstruction, April 29<sup>th</sup>, 2014



PP18 – post construction, August 20<sup>th</sup>, 2015

*Goal 3) Provide fish cover in the 2007 oxbow and potentially alter sediment deposition patterns and promote vegetation establishment.*

Extreme low flow conditions were observed in the 2007 oxbow and as anticipated, the wood placed was above water during low flow monitoring at 29 cfs in Nason Creek. There was not even flow over the grade control log at the oxbow inlet (Figure 13, PP1). Future survey at low flow will indicate any accumulated sediment around wood.

Figure 13. Post construction low flow conditions in the 2007 oxbow



PP1, Aug 20, 2015; 29cfs



PP2, Aug 20, 2015; 29cfs



## Topographic Survey

*Goal 1) Restore channel migration potential and natural stream processes on river left, including enhancing activation of the relic side channel downstream of the project area.*

A fall 2014 as-built topographic survey was completed and is available upon request (Figures 16-18 are from the as-built survey). The fall 2015 topographic survey conducted on river left near RM 4.6 documents changes observed on site following the first season of high flows (Figure 14). The surveys indicate approximately a 0.4 ft reduction in elevation and formation of a shallow channel through the abutment fill removal area.

Figure 14. 2015 Topographic survey of abutment removal area. Black lines –September, 2014; Red lines – October, 2015

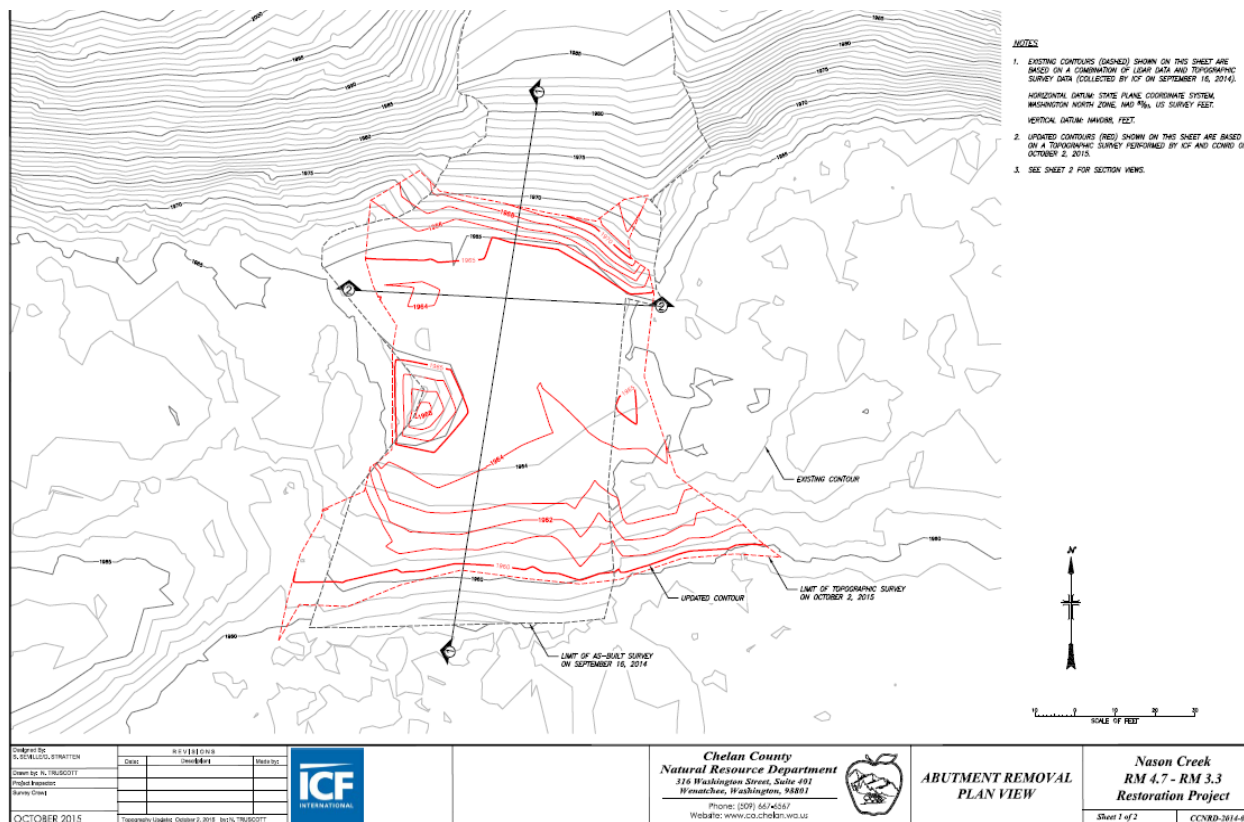


Figure 15. Photos depict the flooding in the project area and the breach in the brush mattress shows the shallow channel outlet to Nason Creek that is visible in the survey above (Figure 15).

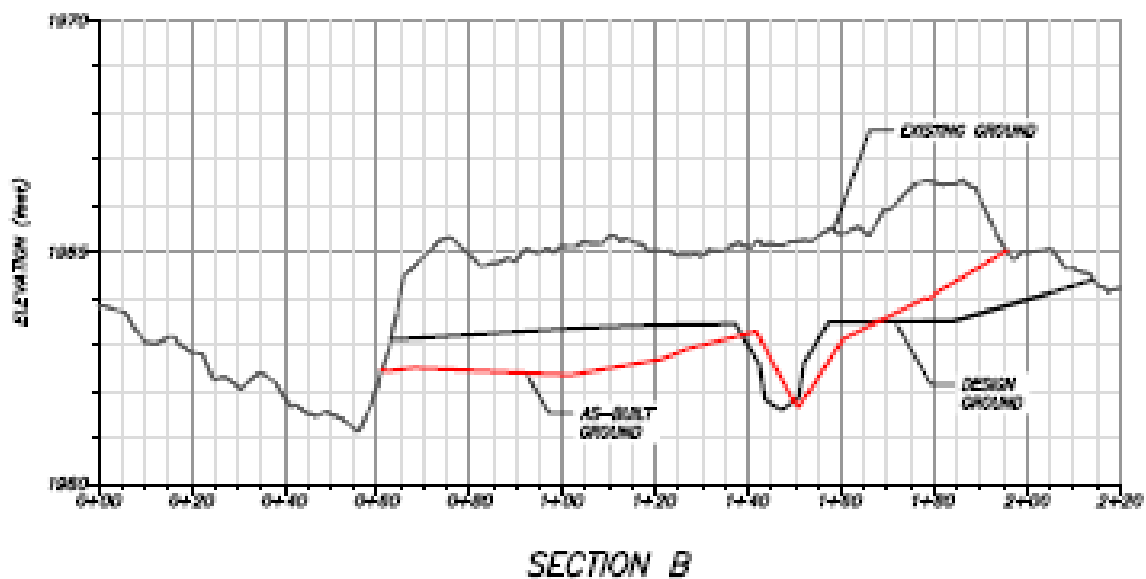




*Goal 2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right.*

The as-built topographic survey of the river right parking lot fill removal area indicates the floodplain was lowered by 2-3 feet due to the project (Figure 16 and 17), giving Nason Creek increased access to its floodplain. The difference in post construction grading as compared to the plan set from Station 1+90 to 2+00 was a field staking change made to avoid removing mature existing forested vegetation.

Figure 16. Cross section of parking lot fill removal area (see Figure 17 for cross section location).



*Goal 3) Increase in-stream structure to provide fish cover in the 2007 oxbow by altering sediment deposition patterns and promoting future vegetation establishment.*

The as-built survey conducted in September, 2014 indicated that the 28 logs were added as shown in the plans. However, high flows in fall 2015 (possibly a 25 year event) caused approximately 10 logs to shift downstream (Figure 18). Surveys will be conducted in 2016 to document the post flood location of all logs which are likely still in the oxbow. Log placement was engineered to remain in place through the 5 year event and the December 2015 flows were likely higher than that. The Nason Creek gauge does not record high flows, however, this event was documented as a 25 year event in the nearby Icicle creek drainage. Logs were only engineered to withstand the 5 year event because they were placed manually without soil disturbance or vegetation removal for equipment access in an area with no recreation use and limited downstream infrastructure constraints. All of the wood likely has remained in the oxbow and initial exposure to high flows has already altered sediment deposition patterns and assisted with vegetation establishment.

Figure 17. Parking lot fill removal area topographic survey. Black lines – final design; Red lines – as-built September, 2014

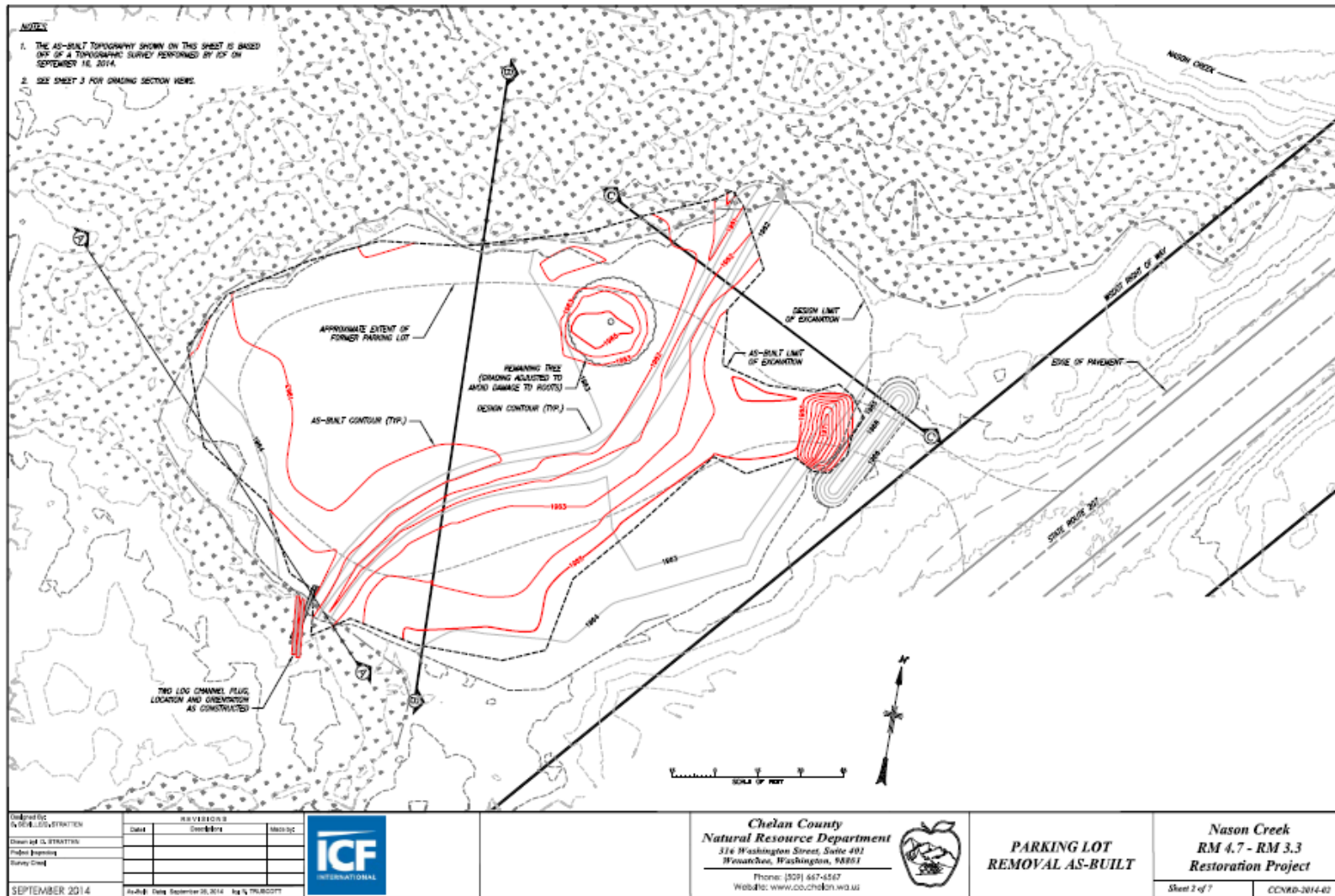
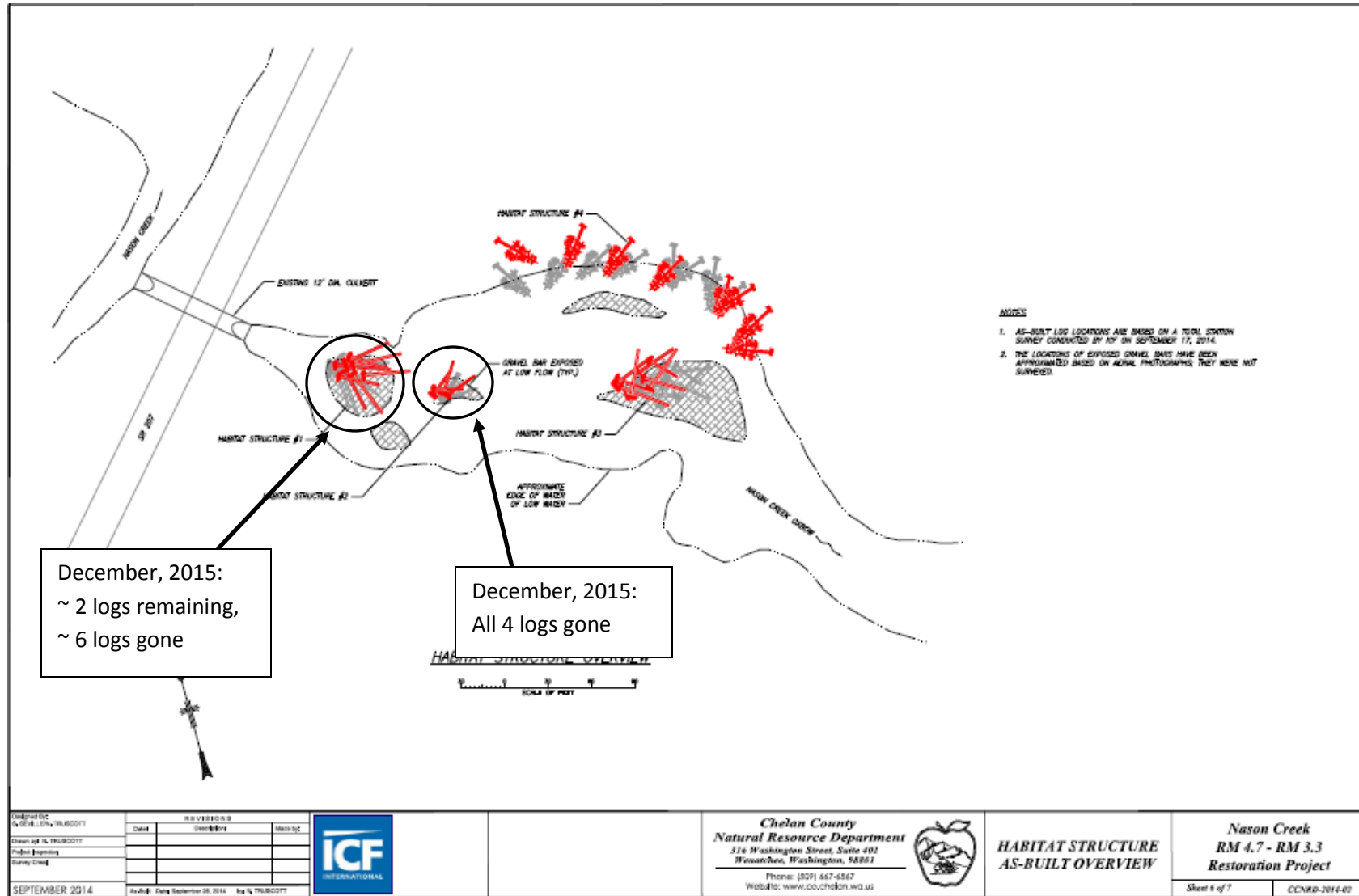




Figure 18. As-built of added wood in 2007 Oxbow (in red). Also indicated is approximate number and location of displaced wood.



## Riparian Monitoring

Table 1. River left (abutment removal) stem count

Species	Plants on flat floodplain	Plants on Slope	Plants on top of slope	TOTAL PLANT COUNT	TOTAL PLANTS INSTALLED	SURVIVAL RATE
<i>AMELANCHIER ALNIFOLIA</i> - serviceberry			91	91	90	1.01
<i>CORNUS SERICEA</i> - red osier dogwood	39			39	60	0.65
<i>HOLODISCUS DISCOLOR</i> - ocean spray		1	62	63	80	0.79
<i>PINUS PONDEROSA</i> - ponderosa pine		2	22	24	25	0.96
<i>POPULUS BALSAMIFERA</i> - black cottonwood	4	20	27	51	70	0.73
<i>ROSA NUTKANA</i> - nootka rose (count for both nootka and woods)	93	3	120	216	130	0.88
<i>ROSA WOODSII</i> - Wood's rose					116	
<i>SALIX LASIANDRA</i> - pacific willow	10	1		11	20	0.55
<i>SAMBUCUS NIGRA</i> spp. <i>cerulea</i> - blue elderberry	2		1	3	12	0.25
<i>SPIRAEA DOUGLASII</i> - Douglas spirea	45			45	55	0.82
<i>SYMPHORICARPOS ALBUS</i> - common snowberry	3	12	153	168	118	1.42
<b>Total Number of Trees/Shrubs</b>	196	39	476	711	776	0.92

Table 2. River right (parking lot removal) stem count

Species	TOTAL PLANT COUNT	RIVER RIGHT INSTALLED	SURVIVAL RATE
<i>AMELANCHIER ALNIFOLIA</i> - serviceberry	17	17	1.00
<i>CORNUS SERICEA</i> - red osier dogwood	133	136	0.98
<i>HOLODISCUS DISCOLOR</i> - ocean spray	25	32	0.78
<i>ALNUS INCANA</i> spp. <i>tenuifolia</i> - mountain alder	26	40	0.65
<i>LONICERA INVOLUCRATA</i> - black twinberry	25	37	0.68
<i>PINUS PONDEROSA</i> - ponderosa pine	17	15	1.13
<i>POPULUS BALSAMIFERA</i> - black cottonwood	30	50	0.60
<i>ROSA</i> - nootka and woods rose	313	310	0.87
<i>SALIX LASIANDRA</i> - pacific willow	77	100	0.77
<i>SAMBUCUS NIGRA</i> spp. <i>cerulea</i> - blue elderberry	4	5	0.80
<i>SPIRAEA DOUGLASII</i> - Douglas spirea	284	300	0.95
<i>SYMPHORICARPOS ALBUS</i> - common snowberry	107	100	1.07
<b>Total Number of Trees/Shrubs</b>	1058	1192	0.89

*Goal 4) Revegetate the fill removal areas (river right and left).*

Results of the stem count on August 20<sup>th</sup>, 2015 indicate plant survival on the planted floodplains is meeting and exceeding permit requirements with 92 percent survival on abutment removal site and 89 percent survival on the parking lot removal site (Tables 1 and 2, Figure 19). Counts suggest 100 percent survival of many species, including serviceberry, ponderosa pine, and snowberry on both sides and red osier dogwood on river right only. The lowest survival rate for one species was the blue elderberry counted in the abutment removal (Tables 1 and 2).

Figure 19. High survival of plants on river right (left photo) and river left (right photo) floodplains.



Cover and vitality of the brush mattress on abutment removal area was excellent, with an estimated cover and survival of 90-95 percent (Figure 20).

Figure 20. Brush mattress site pre and post construction.



PP9 – pre construction, April 29, 2014; 488 cfs      PP 9 – Aug 20, 2015; 29cfs



A breach was observed in the brush mattress, apparently due to the newly formed channel that conveyed fall 2014 and 2015 high flow (Figure 14 and 21).

Figure 21. Breach in brush mattress circled in red.



Summary data from the Ecology mandated Shade Study is below. Average shrub cover in the 5 plots (Table 3) was in cover class 4, which pertains to 10 – 25 % cover (Table 4).

Table 3. Visual shrub cover (cover class) and invasive cover estimates in 10m X 10m plots on river right.

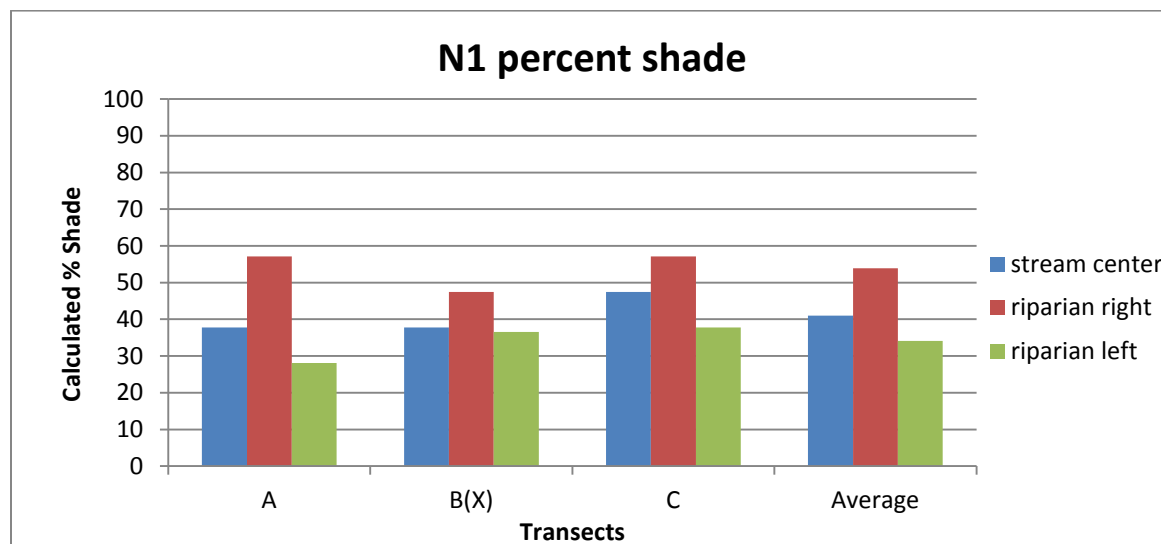
	Plot LBA	Plot RBA	Plot LBX	Plot RBX	Plot LBC
<b>survival</b>	<b>90</b>		<b>80</b>	<b>99</b>	<b>95</b>
<b>total shrub</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>5</b>
serviceberry		4			
rose	4	3	5	3	3
snow		4		3	4
cottonwood		3		3	6
pine		3		3	
ocean spray		2		2	
dogwood	4	2		4	
elderberry		2			
alder	3	2	3	2	2
willow	4		3	4	4
spirea	4		6	4	3
<b>total invasive</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>2</b>
mullen	3		7		4
reed canary grass	7	7		7	6
prickly lettuce		2			

Table 4. Cover class designations used in estimating shrub cover in shrub plots.

Cover class	Range of cover (%)	Class midpoints (%)
1	<1	0.5
2	1–5	3.0
3	5–10	7.5
4	10–25	17.5
5	25–50	37.5
6	50–75	62.5
7	75–100	87.5

Shade values were higher on the right side (southeast) side of the constructed channel, due to existing shade from the surrounding forest. Shade values ranged from 28 – 57 % (Figure )

Figure 22. Transect and transect average percent shade around constructed channel.



## Fish Use

*2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right.*

Tetra tech staff observed 47 juvenile steelhead in the new constructed channel in late April of 2015 (Figure 23, Table 5), indicating the site is meeting the goal of providing ESA-listed juvenile salmonids with off-channel rearing and refuge habitat.

Table 5. Tetra tech fish counts in the N1 constructed channel (Figure 2) in April, 2015.

	<b>Nason discharge (cfs)</b>	<b>Juvenile steelhead</b>	<b>Juvenile Chinook</b>
<b>Old channel June 2014</b>	734	0	62
<b>Old channel April 2015</b>	300	0	0
<b>New channel April 2015</b>	300	47	0

Figure 23. Conditions in constructed channel during April, 2015 snorkel survey.



*Goal 3) Increase instream structure to provide fish cover in the 2007 oxbow by altering sediment deposition patterns and promoting future vegetation establishment.*

Yakama Nation conducted snorkel surveys of the entire 2007 oxbow, including the area where wood was added in 2014, pre construction and post construction in March and August of 2014 and 2015 (Figure 24, Table 6). Results indicate ESA-listed salmonids are using the oxbow – however, how added large wood effects fish-use of the site cannot be inferred from these fish counts. Nason Creek had just half the discharge during the 2015 low flow survey compared to the 2014 low flow survey (table 6) – which likely contributed to the lower numbers of salmonid observations and higher numbers of Shiner and Sucker species observed in 2015.

Figure 24. Nason Oxbow. Red circle indicates the area wood was added in 2014. Blue line is the extent of the YN's snorkel survey.





Table 6. Yakama Nation Juvenile Fish Counts in the 2007 Oxbow before wood was added (2012-2014) and after (2015).

Date	Nason Discharge	Salmonids					Other				
	cfs	Brook	Chinook	Coho	Steelhead	Whitefish	CC Fry	Dace	Sculpin	Shiner	Sucker
8/23/2012	74	0	165	123	1,438	966	10	0	0	14	0
3/20/2013	423	3	131	39	426	111	0	0	8	7	0
9/3/2013	82	3	601	80	1040	392	1439	5	1	143	171
3/20/14	404	2	171	6	301	6	0	0	7	7	0
8/27/14	67	2	421	0	395	401	0	0	1	4	8
3/25/15	733	1	28	36	178	117	0	0	8	49	13
8/6/15	33.7	0	96	29	372	42	0	7	0	1206	3676

### Summary, Conclusions and Recommendations

This 2015 monitoring report documents pre- and post-construction site conditions in the first year since project completion. To date, the project is meeting project goals of restoring natural stream (floodplain) processes on river left and river right near RM 4.6. In addition, there has been documented fish use of the river right constructed channel and 90 percent survival of installed plants. Video documentation and additional surveys are needed to assess progress toward project goals in the oxbow (providing instream structure, altering sediment deposition patterns, and shrubby vegetation establishment).

#### *1) Restore channel migration potential and natural stream processes on river left, including enhancing activation of the relic side channel (Figure 2).*

Photo points indicate that floodplain connectivity and associated natural processes have been restored by floodplain fill removal. The abutment fill removal area was inundated on April 6<sup>th</sup> at a mainstem flow of 325 cfs and on December 9<sup>th</sup> at a mainstem flow of 2,730 cfs, the downstream relic side channel on river left was also activated following abutment fill removal. The 2015 topographic survey and photo point monitoring document that at moderately high flows, inundation has formed a shallow channel through the project area. Adaptive management actions were implemented in 2015 to facilitate relic side channel activation; see discussion below.

#### *2) Provide high-flow refuge habitat in the excavated channel and increase floodplain inundation on river right.*

High flow photo monitoring documented flows in the excavated channel (April 6, 2015) and throughout the floodplain (December 9, 2015). Fish-use data indicates the constructed channel on river right provides off-channel habitat to ESA-listed species – in April, 2015 Tetra tech snorkel crews observed 47 juvenile steelhead in the channel.

#### *3) Provide fish cover in the 2007 oxbow and potentially alter sediment deposition patterns and promote vegetation establishment.*

Yakama Nation crews observed 206 ESA-listed salmonids on March 25<sup>th</sup> and 468 on August 6<sup>th</sup> during their 2015 snorkel surveys of the 2007 Oxbow. This documents fish use of the oxbow but additional monitoring data will be needed to document whether or not wood placement has increased fish use and/or provided additional cover by increased vegetation establishment.

Approximately 10 of the 28 pieces of the large wood added to the oxbow, all in the two upstream most structures, were displaced by high 2015 fall flows. Staff will survey the site in 2016 to locate the wood that has likely shifted downstream but remained in the oxbow.

#### *4) Revegetate the fill removal areas (river right and left).*

Stem counts in both fill removal areas indicate re-vegetation efforts are exceeding permit requirements in year one of the project which was a drought year. Staff calculated a 92 percent survival rate on the abutment removal area site and 89 percent survival rate on the parking lot removal floodplain. The brush mattress had an estimated survival of 90-95 percent. Formation of the new channel across the abutment removal floodplain caused a small breach in the mattress.

#### *Adaptive Management*

As designed, the fill removed from the abutment remained on site and it was placed in the road bed cut beyond the break in slope and some material was used to re-contour the slope. A small amount of fill extended beyond a large cottonwood tree at the base of the slope. That protrusion plus the ice and snow that extended from it may have partially blocked flows across the site from entering the relic side channel at moderate flow levels forcing flow to form the shallow channel through the site. In fall 2015, WCC crews manually removed some material from this high spot at the base of the slope to facilitate high flow activation of the downstream relic side channel.

The project plans also specified installation of willow cuttings in the oxbow once sediment accumulation had raised base elevations downstream of the wood such that the site would support shrub establishment. Those willow cuttings will be installed in fall 2016.

Approximately 15 willow cuttings were installed in the river right floodplain fill removal area near RM 4.6 in fall 2015. These were marked with orange flagging to evaluate survival in 2016.

#### *Monitoring in 2016*

##### Oxbow

In 2016, staff will continue to monitor the site during high and low flow. Attempts will be made to visit the site at ordinary high water (OHW) flow levels (~700-1000 cfs) to document the flow that wood in the oxbow becomes inundated. Wood locations in the oxbow will also be surveyed to document any wood that has shifted. The video produced will also document wood placement at a variety of water levels and establishment of shrub cover around the wood. Shrub cover will be estimated using plots placed just downstream of the wood placements. The Yakama Nation will snorkel the entire oxbow in winter (early March) and summer (August or September). CCNRD staff will also snorkel around the added wood at OHW to document fish use during high flow.

#### Floodplain fill removal areas

In spring 2016, CCNRD staff will snorkel the constructed channel in lieu of Tetra tech crews who will only snorkel the site every other year. Due to high plant survival in the first year, a stem count may not be necessary in subsequent years. Vegetation monitoring will shift to plots that document cover establishment throughout the site. If the orange flagging remains, staff will assess survival rate of the 15 willow cuttings installed in fall 2015. High flow photo monitoring will continue to document the flow level that activates the floodplain areas. Low flow photo monitoring will continue to document vegetation establishment.