

# Inner-Zone Project Identification

January 18, 2011

Nason Creek  
Lower White Pine Reach  
Chelan County, Washington

Prepared by:



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**Background and Scope**

A Reach Assessment (RA) of the Lower White Pine Reach (LWP) of Nason Creek, Chelan County, WA was completed in 2009 by the USBR. The RA examines the condition of fluvial geomorphic processes and the effect on salmonid habitat, and identifies priority restoration strategies and areas. The effort presented in this document builds on the work completed in the RA by identifying more specific project opportunities within portions of the reach. These project opportunities conform to the restoration strategies and priority areas presented in the RA. They are also intended to be compatible with potential future reconnection scenarios being considered for currently disconnected areas south of the railroad corridor. However, because the specific configuration of future reconnection has not yet been finalized, some of the project opportunities presented herein may need to be modified to conform appropriately to the final reconnection scenario.

In the RA, the LWP reach was spatially divided into inner zone and outer zone sub-reaches, and restoration priorities were presented for the LWP as a whole and for each sub-reach. The spatial organization and restoration principles of the RA are guiding concepts behind the completion of the inner zone project identification effort presented here.

This document presents conceptual level project identification within inner zone sub-reaches, and areas with potential for inner zone processes within the LWP. Sub-reaches south of the railroad corridor were specifically omitted from the identification process because restoration of these areas is currently being investigated by the USBR. By focusing on inner zone sub-reaches, some of the higher priority activities identified by the USBR, such as reconnection south of the railroad corridor, are not identified. However, high priority actions that might occur in outer zone and disconnected inner zone sub-reaches were taken into consideration when identifying potential projects..

**Objectives**

The primary purpose of this effort is to identify a suite of potential salmon habitat enhancement and restoration actions that contribute to the recovery of ESA-listed species and are conducted within the existing geomorphic and ecological context of the reach. Proposed actions conform to restoration strategies and priority areas previously identified by the USBR and are intended to be coordinated with on-going efforts by the USBR, Yakama Nation, and other entities to perform habitat reconnection in this reach. Due to on-going planning regarding large-scale reconnection south of the railroad corridor, project identification was focused on existing inner zone sub-reaches north of the rail corridor.

**Response to Comments**

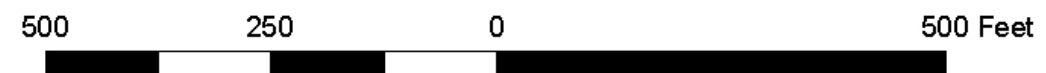
After a review and comment period, a number of comments were submitted in regards to general presentation as well as project specifics. All comments were reviewed and responded to, and changes to the report were made where appropriate.





Nason Creek  
Project Group 1  
RM 11.05-11.6



**Legend**



- River Mile
- Potential Project
- Project Group 1
- USBR Inner Zone




## Project Group 1 (RM 11.05-11.6)

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 1	<p><u>LWP IZ-1</u> (USBR 2009; Pg 84-88):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 5)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4)</li> </ul>	RM 11.5C	Instream Habitat Enhancement	LWD and riparian bank margin enhancement	Between RM 11.6 and RM 11.45, river right is lined with riprap to protect the adjacent railroad grade. There are deep scour pools along the riprap, but little to no cover. The right bank could be enhanced by wood placement at multiple locations. Due to the proximity of the railroad grade, a bank could be created by placing logs in the channel and back-filling behind them, therefore allowing for the establishment of a riparian buffer between the railroad prism and the channel. The channel would be shifted slightly northward to accommodate this alteration. Bank jams on the left bank through this area would create bar and pool features. The straightened channel and altered hydraulics may preclude the creation of alternating riffle-pool sequences.	 <p>View looking upstream at the river right bank near RM 11.5. The channel has been straightened and vegetation cleared along the railroad. October 2010.</p>
Group 1	<p><u>LWP OZ-1</u> (USBR 2009; Pg 34-36)</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1,2)</li> </ul> <p><u>LWP IZ-1</u> (USBR 2009; Pg 84-88):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 5)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4)</li> </ul>	RM 11.35L	Reconnect Stream Channel Processes	Side-channel reconnection	Between RM 11.5 and RM 11.25, there is a network of high-flow channels on valley left. These channels are currently connected to inner zone processes as evidenced by sand and gravel deposits and high-flow channel topography. However, successional vegetation and muted channel topography suggests that flood scour is relatively infrequent. Channel straightening and related incision of the mainstem may be contributing to disconnection. Several options exist for restoring connections between the side-channel and main channel habitat, including select excavation and installation of LWD complexes. All option would include riparian revegetation in impacted areas.	 <p>View in the downstream direction at gravel and sand deposits in a high-flow channel on river left near RM 11.4. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 1	<p><u>LWP IZ-1</u> (USBR 2009; Pg 84-88):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 5)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4)</li> </ul> <p><u>LWP IZ-2</u> (USBR 2009; Pg 65-69):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 4, 6)</li> </ul> <p><u>LWP OZ-2</u> (USBR 2009; Pg 32-34):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Option 1, 2)</li> </ul>	RM 11.35R	Instream Habitat Enhancement	LWD enhancement	As the river turns left away from the railroad grade near RM 11.4, the outside of the bend is a high, vertical bank with areas of active slumping. Multiple log jams could be placed along the bank to increase hydraulic roughness, slow velocities, decrease erosion, and provide habitat cover and complexity. Backwater effects could increase floodplain connection near 11.35L, and coordination of these 2 projects would be beneficial. Also, the tortuous sinuosity of the downstream bend is indicative of impending meander cut-off which could occur via avulsion at or near this location. A cut-off would decrease sinuosity in a reach that already suffers from significant channelization and therefore may be undesirable. Addition of floodplain roughness through placement of wood in potential cut-off paths could be used to decrease the potential for avulsion.	 <p>View in the upstream direction at the river right bank near RM 11.35 where incision has left a tall slumping bank. There is a lack of vegetation that provides LWD or cover. October 2010</p>
Group 1	<p><u>LWP IZ-2</u> (USBR 2009; Pg 65-69):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 4, 6)</li> </ul> <p><u>LWP OZ-1</u> (USBR 2009; Pg 34-36)</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1,2)</li> </ul>	RM 11.25L	Off-Channel Habitat Enhancement	Alcove habitat enhancement	A wetland complex outlets near RM 11.25 on river left. Currently, there is no low flow connection to this off-channel habitat. A mound of soil approximately 3.5 ft high and 25 ft wide separates the channel from the mainstem. An alcove could be created by removing this barrier to connect the active channel and provide a backwater for juvenile rearing. Water surface elevations in existing wetlands should be maintained. There is existing vegetation cover on the bank. Redds were observed in a riffle just downstream.	 <p>A small wetland occupies a meander scar on river left near RM 11.25. The wetland could be enhanced to provide alcove habitat. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 1	<p><u>LWP IZ-2</u> (USBR 2009; Pg 65-69):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 4, 6)</li> </ul>	RM 11.2L Alternative 1	Riparian Revegetation	Revegetate cleared floodplain	On river left between RM 11.25 and 11.15, all riparian forest vegetation has been cleared from the floodplain. The bank along this section is actively eroding. Revegetation of this bank and adjacent floodplain area would improve bank stability, provide cover, shade, and a source for future recruitment of LWD. Currently, the bank is well above the water level at low flow. Restoration would include re-establishment of native vegetation communities appropriate to the soil and moisture conditions at the site. Revegetation could be conducted in conjunction with other potential habitat restoration elements at the site.	 <p>View in the upstream direction along river left at riparian clearing along an actively eroding bank near RM 11.2. October 2010</p>
Group 1	<p><u>LWP IZ-2</u> (USBR 2009; Pg 65-69):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 3, 4, 5, 6)</li> </ul>	RM 11.2L Alternative 2	Instream Habitat Enhancement	LWD enhancement and restoration of natural rates of channel erosion	The river left bank between RM 11.25 and 11.15 is a 10 ft high, actively eroding, vertical bank composed of unconsolidated alluvium with no riparian forest to provide natural rates of channel erosion. There are large slumps of material and no woody vegetation. Continued rapid erosion will likely result in a channel avulsion across the large interior point bar, which would reduce meander length in a reach that has already experienced considerable straightening. Several log jams along the bank would increase hydraulic roughness, decrease velocity, and decrease erosion while planted vegetation matures. Log jams would be used to increase near-term stability until planted vegetation matures and is able to provide long-term natural rates of channel erosion and LWD recruitment. LWD would also provide habitat cover and complexity. Even with construction of log jams to slow the rapid erosion of this bank, there will remain a considerable risk of channel avulsion across the interior point bar (neck cutoff). This alternative would include riparian revegetation.	 <p>View in the downstream direction at the actively eroding bank near RM 11.2. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 1	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>• Reconnect Habitat (Short Term) (Options 3, 5)</li> </ul> <p><u>LWP OZ-2</u> (USBR 2009; Pg 32-34):</p> <ul style="list-style-type: none"> <li>• Riparian Rehabilitation (Option 1, 2)</li> </ul>	RM 11.05R	Off-Channel Habitat Enhancement	Alcove habitat enhancement	<p>The river turns left at RM 11.05. There is a high-water channel against the railroad grade that outlets near this location. There is currently no low-flow connection. An alcove could be excavated to provide off-channel habitat connected to the main channel. Water surface elevations in existing wetlands would need to be maintained. The excavated site would need to be protected to deter channel avulsion along the railroad prism. These protection measures may include buried logs and rocks to hold grade through the alcove and hinder a head-cut, and floodplain roughness elements in the alcove and throughout the bar to decrease overbank flow velocities. The potential for sedimentation of the alcove will need to be investigated as part of project design.</p>	 <p>View in the upstream direction at a wetland that runs along the base of the railroad grade on river right near RM 11.05. October 2010</p>

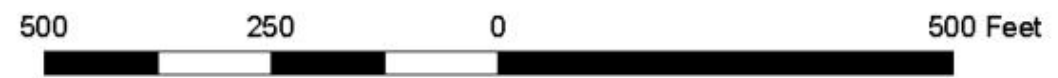






Nason Creek  
Project Group 2  
RM 10.75-11.0



**Legend**

-  River Mile
-  Potential Project
-  Project Group 2
-  USBR Inner Zone



## Project Group 2 (RM 10.75-11.0)

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 2	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 4, 6)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4 5)</li> </ul>	RM 10.9C	Instream Habitat Enhancement	LWD and riparian enhancement	Between RM 11.05 and 10.7, the channel has been straightened along the railway grade. Field evidence suggests that the result has been incision and channel simplification. Several channel margin log jams could be placed on both sides of the river through this area to increase habitat complexity, cover, and pool availability/quality. Due to the proximity of the railroad grade, a bank could be created by placing logs in the channel and back-filling behind them, therefore allowing for the establishment of a riparian buffer between the railroad prism and the channel. The channel would be shifted slightly northward to accommodate this alteration. This work would need to be coordinated with ongoing reconnection efforts for areas south of the railroad being pursued by USBR.	 <p>View in the upstream direction at a straightened channel section near RM 10.9. October 2010</p>
Group 2	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 4, 6)</li> </ul>	RM 10.8L Alternative 1	Riparian Revegetation	Riparian revegetation	The river left stream bank between RM 10.9 and 10.75 is actively eroding. The bank has been cleared of native riparian forest vegetation that is necessary to provide natural stability. There is a cleared powerline corridor that parallels the bank within 50 to 60 ft of the stream. This alternative would revegetate the bank and riparian area with low-growing native shrub vegetation in order to accommodate the power lines yet provide important riparian functions. This work would need to be coordinated with ongoing reconnection efforts for areas south of the railroad being pursued by USBR. This alternative may be favored if existing infrastructure must be maintained in its current configuration. Accessibility to utilities would need to be maintained.	 <p>View in the downstream direction at the eroding bank on river left near RM 10.8. There is very little vegetation supporting the bank. October 2010</p>

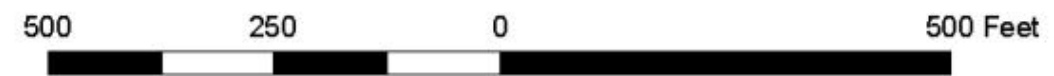
Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 2	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 4, 6)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4 5)</li> </ul> <p><u>LWP IZ-4</u> (USBR 2009; Pg 69-73):</p> <ul style="list-style-type: none"> <li>Reconnect Processes (Options 1, 2, 4)</li> <li>Riparian Rehabilitation (Options 1, 3, 5)</li> </ul> <p><u>LWP OZ-4</u> (USBR 2009; Pg 31-32):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2)</li> </ul>	RM 10.8L Alternative 2	Re-Establish Stream Channel Processes	Restore channel topography	This alternative would increase sinuosity between RM 10.9 and 10.7 by excavating portions of new channel north of the current alignment. The new planform would include riffle-pool sequences and placement of LWD. The goal would be to increase channel/floodplain connections and re-establish channel processes to the extent possible through an artificially confined and straightened reach. Consideration would have to be given to protection of the railroad, powerline, and private structures. Potential re-location of the powerlines should be pursued. This work would need to be coordinated with ongoing reconnection efforts for areas south of the railroad being pursued by USBR.	 <p>View in the downstream direction near river mile 10.8 where channel complexity could be enhanced by excavating toward river left, and building the bar on river right. October 2010</p>
Group 2	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 4, 6)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4 5)</li> </ul> <p><u>LWP OZ-4</u> (USBR 2009; Pg 31-32):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2)</li> </ul>	RM 10.8L Alternative 3	Instream Habitat Enhancement	LWD enhancement	If revegetation or channel re-alignment are not viable due to existing infrastructure or geomorphic constraints, then a third alternative would be to add multiple channel margin log jams between RM 10.9 and 10.7. Wood placements would increase hydraulic roughness, decrease water velocity, and restore natural bank stability in the long-term. Habitat quality would also be increased. This work would need to be coordinated with ongoing reconnection efforts for areas south of the railroad being pursued by USBR.	 <p>View in the downstream direction at the river left bank between RM 10.9 and 10.7 that is actively eroding. Multiple log jams could be placed along the bank to decrease velocity. October 2010</p>





Nason Creek  
Project Group 3  
RM 10.25-10.75



**Legend**



- River Mile
- Potential Project
- Project Group 3
- USBR Inner Zone





## Project Group 3 (RM 10.25-10.75)

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 3	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>Reconnect Habitat (short term) (Options 3, 5)</li> </ul>	RM 10.65R	Instream Habitat Enhancement	LWD enhancement	At this location, the river turns left and pulls away from the railroad grade. The riprap, however, persists downstream along the right bank. A high-tension transmission tower is located back from the bank, and is being protected by the riprap. Large wood jams could be placed along the bend in order to increase habitat quality and pool scour while maintaining protection of infrastructure.	 <p>View in the upstream direction at the river right bank near RM 10.6 where older riprap could be enhanced by LWD. October 2010</p>
Group 3	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 4, 6)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4 5)</li> </ul> <p><u>LWP IZ-4</u> (USBR 2009; Pg 69-73):</p> <ul style="list-style-type: none"> <li>Reconnect Processes (Options 1, 2, 4)</li> <li>Riparian Rehabilitation (Options 1, 3, 5)</li> </ul> <p><u>LWP OZ-4</u> (USBR 2009; Pg 31-32):</p> <p>Riparian Rehabilitation (Options 1, 2)</p>	RM 10.6L Alternative 1	Re-Establish Stream Channel Processes	Channel re-alignment	There is an abandoned high flow channel and wetlands between RM 10.75 and 10.55 along river left. There is a high bank at the upstream end of the high flow channel. Upstream straightening and incision appears to have reduced the frequency of activation of the high flow channel. This alternative would excavate the high-flow channel to re-meander the channel where it has lost sinuosity following placement of the railroad. New channel topography, LWD, and riparian revegetation would be included in this alternative. Appropriate channel and floodplain configuration given existing geomorphic and social constraints would be considered during the design process. Powerlines in this area provide a potential constraint.	 <p>View in the downstream direction from RM 10.8 toward river left at the upstream end of a potential channel re-meander project. The new channel would trend toward the power lines, which represent a major constraint. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 3	<p><u>LWP IZ-3</u> (USBR 2009; Pg 89-94):</p> <ul style="list-style-type: none"> <li>Riparian Rehabilitation (Options 1, 2, 4, 6)</li> <li>Reconnect Habitat (short term) (Options 1, 3, 4 5)</li> </ul> <p><u>LWP IZ-4</u> (USBR 2009; Pg 69-73):</p> <ul style="list-style-type: none"> <li>Reconnect Processes (Options 1, 2, 4)</li> <li>Riparian Rehabilitation (Options 1, 3, 5)</li> </ul> <p><u>LWP OZ-4</u> (USBR 2009; Pg 31-32): Riparian Rehabilitation (Options 1, 2)</p>	RM 10.6L Alternative 2	Re-Establish Channel and Floodplain Processes	Enhance side- channel and floodplain connections	This alternative would use select excavation and LWD jams at the upstream and downstream ends of the abandoned high flow channel to create a perennial side-channel or a seasonal high-flow channel. Riparian revegetation is included in this alternative. Powerlines in this area provide a potential constraint.	 <p>View in the upstream direction at the river left bank near RM 10.7. This is a potential location to enhance LWD and lower the bank to increase high-flow inundation of the adjacent floodplain. October 2010</p>
Group 3	<p><u>LWP IZ-4</u> (USBR 2009; Pg 69-73):</p> <ul style="list-style-type: none"> <li>Reconnect Processes (Options 1, 2, 4)</li> <li>Riparian Rehabilitation (Options 1, 3, 5)</li> </ul> <p><u>LWP OZ-4</u> (USBR 2009; Pg 31-32)</p>	RM 10.55L	Off-Channel Habitat Enhancement	Alcove habitat enhancement	Near RM 10.55, there is an outlet to an abandoned high-flow channel. There is currently open water but no surface connection. This alternative would create alcove habitat by excavating through the bank. This action would be an addition or alternative to potential side-channel work in project RM 10.6L Alternative 2. There is potential for accumulation of fine sediment at this location. Sediment transport continuity, and potential maintenance issues will need to be considered as part of project design.	 <p>View in the upstream direction at the river left bank near RM 10.55 where a potential backwater alcove could be excavated into an existing floodplain depression. This would also be a potential location for the downstream end of RM 10.6L Alternatives 1 and 2. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 3	<u>LWP IZ-4</u> (USBR 2009; Pg 69-73): <ul style="list-style-type: none"> <li>• Reconnect Processes (Options 1, 2, 4)</li> <li>• Riparian Rehabilitation (Options 1, 3, 5)</li> </ul>	RM 10.45L	Instream Habitat Enhancement	LWD enhancement	On river left between RM 10.5 and 10.4, there is an actively eroding 5 ft high bank composed of unconsolidated alluvium. Several meander bend LWD jams could be placed along this bank to decrease water velocity, slow bank erosion while riparian vegetation recovers, and provide habitat cover and complexity. There are riffle-pool sequences in the channel that could be enhanced by this action, including adding cover to an existing deep pool near RM 10.4. At the downstream end of this bank, erosion is threatening the Highway 2 embankment. This action could also protect the roadway while avoiding the impending use of rip-rap.	 <p>View in the upstream direction toward river left at an actively eroding bank along the toe of the road embankment of Highway 2 near RM 10.4. October 2010</p>
Group 3	<u>LWP IZ-4</u> (USBR 2009; Pg 69-73): <ul style="list-style-type: none"> <li>• Reconnect Processes (Options 1, 2, 4)</li> <li>• Riparian Rehabilitation (Options 1, 3, 5)</li> </ul>	RM 10.4L	Instream Habitat Enhancement	LWD enhancement	There is a 10 ft high eroding bank on river left on the outside of a tight meander. There is considerable depth in the pool on the outside of the bend, but very little cover. Adding a LWD jam could provide cover and increased habitat quality, while slowing rapid bank erosion that is related to an absence of mature forest vegetation and LWD. Wood jams here would also provide a good alternative to the potential future use of rip-rap if the roadway becomes threatened.	 <p>View of the river left bank near RM 10.38, which is actively slumping. The bank is on the outside of a bend where there is a deep pool that would benefit from increased cover. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 3	<p><u>LWP IZ-4</u> (USBR 2009; Pg 69-73):</p> <ul style="list-style-type: none"> <li>• Reconnect Processes (Options 1, 2, 4)</li> <li>• Riparian Rehabilitation (Options 1, 3, 5)</li> </ul> <p><u>LWP OZ-5</u> (USBR 2009; Pg 77-79)</p> <p><u>LWP OZ-6</u> (USBR 2009; Pg 79-81)</p>	RM 10.3C	Reconnect Stream Channel Processes	LWD to re-establish channel dynamics	Between RM 10.35 and 10.25 channel complexity increases with riffle-pool sequences, bar formation, and increased sinuosity. This area is downstream of a tight meander and just upstream of a hard left turn in the stream. The area is depositional, resulting in active bar formation. However, LWD densities are low in comparison to natural conditions. LWD complexes could be constructed at bar apexes, at locations where there are currently rock groins protecting the left bank, and on the outside of meanders. The jams would be designed to encourage channel movement, pool scour, and sinuosity. Consideration of incoming LWD load would also be considered in the design process, with the potential for designing structures to capture fluvial wood. Consideration would need to be given to the proximity of private residences on the river left floodplain.	 <p>View in the upstream direction near RM 10.3 at a large, deep pool that could accommodate a substantial LWD complex. On river left (right side of the photo) is a rock groin that is eroding, and could be replaced or enhanced with wood. Downstream of this location are several gravel bars and pool-riffle sequences where the addition of in-channel LWD would benefit process and habitat. October 2010</p>
Group 3	<p><u>LWP IZ-4</u> (USBR 2009; Pg 69-73):</p> <ul style="list-style-type: none"> <li>• Reconnect Processes (Options 1, 2, 4)</li> <li>• Riparian Rehabilitation (Options 1, 3, 5)</li> </ul> <p><u>LWP OZ-5</u> (USBR 2009; Pg 77-79)</p>	RM 10.25R	Off-Channel Habitat Enhancement	Alcove habitat enhancement	At RM 10.25 on river right, there is an outlet to a floodplain wetland and high-flow channel complex. There is open water along the base of the railroad grade, but no surface connection. Excavation of a 2 ft high bank over a length of about 50 ft would be required to create an alcove at this location. There is potential for accumulation of fine sediment at this location. Sediment transport continuity and potential maintenance issues would need to be considered as part of project design.	 <p>View of a backwater channel extends into the river right floodplain with an outlet near RM 10.25. Moderate excavation would be necessary in order to create an alcove at this location. October 2010</p>

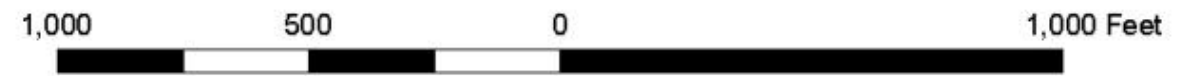






Nason Creek  
Project Group 4  
RM 9.4-10.25



**Legend**



- River Mile
- Potential Project
- Project Group 4
- USBR Inner Zone



## Group 4 (RM 9.4-10.25)

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 4	<p><u>LWP IZ-5</u> (USBR 2009; Pg 94-101):</p> <ul style="list-style-type: none"> <li>• Reconnect Habitat (Short Term) (Options 1, 3, 4, 5)</li> <li>• Riparian rehabilitation (Options 1, 2, 4, 6)</li> </ul> <p><u>LWP OZ-6</u> (USBR 2009; Pg 79-81)</p>	RM 10.15C	Reconnect Stream Channel Processes	LWD to re-establish channel dynamics	Just downstream of RM 10.1 the hillslope on valley left and the railroad on valley right form a channel constriction that has resulted in bar deposition near RM 10.15. This project would include an LWD jam at the apex of the bar to encourage pool scour and increase channel complexity. Excavation of a river left split flow channel may be necessary in order to maintain channel conveyance and not increase hazard to the adjacent railroad grade. There are houses on the hillslope on valley left that would also need consideration as part of engineering design.	 <p>View in the downstream direction at the river left bank near RM 10.15 where there is potential to place an apex jam at the upstream end of the gravel bar and excavate a secondary channel to the left. October 2010</p>
Group 4	<p><u>LWP IZ-5</u> (USBR 2009; Pg 94-101):</p> <ul style="list-style-type: none"> <li>• Reconnect Habitat (Short Term) (Options 1, 3, 4, 5)</li> <li>• Riparian rehabilitation (Options 1, 2, 4, 6)</li> </ul>	RM 10.05L	Instream Habitat Enhancement	LWD enhancement	This project would entail placing several small log jams along the river left bank between RM 10.05 and 10.0 in order to increase cover, local pool scour, and habitat complexity. The railroad grade on river right places a constraint on the degree of hydraulic alteration that would be possible in this area.	 <p>View in the downstream direction near RM 10.05 where multiple log jams could be placed along river left to provide increased habitat quality. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 4	<p><u>LWP IZ-5</u> (USBR 2009; Pg 94-101):</p> <ul style="list-style-type: none"> <li>• Reconnect Habitat (Short Term) (Options 1, 3, 4, 5)</li> <li>• Riparian rehabilitation (Options 1, 2, 4, 6)</li> </ul>	RM 9.85C	Instream Habitat Enhancement	LWD enhancement	Between RM 10.0 and 9.6, the channel has been straightened to accommodate the railroad grade. A small amount of sinuosity exists within the confines of the current channel alignment where low-gradient riffles and shallow pools have formed. Several channel margin jams could be placed on both sides of the channel to enhance the existing bed topography, increase pool scour, and provide bank cover. The need to protect the railroad grade would limit the amount of hydraulic alteration that could occur. On river right along the railroad, an acceptable option may be to place jams in the existing channel, excavate along river left and place fill behind the logs in order to build the bank away from the railroad and to increase sinuosity to the extent possible. Alternative sources of fill may be investigated in order to preserve riparian habitat along river left.	 <p>View in the downstream direction on a straightened channel section near RM 9.85 where gravel deposition has resulted in riffle-pool development. Small margin log jams on both sides of the river could be used to enhance the existing channel. October 2010</p>
Group 4	<p><u>LWP IZ-6</u> (USBR 2009; Pg 73-77):</p> <ul style="list-style-type: none"> <li>• Reconnect Processes (Options 1, 2, 4)</li> <li>• Riparian rehabilitation (Options 1, 3, 5)</li> </ul>	RM 9.55C	Instream Habitat Enhancement	LWD enhancement	Near RM 9.55, riprap/boulders have been eroded and exposed in the channel, effectively creating a weir across the channel. A deep scour pool has formed downstream of the weir, but the pool quality is limited by lack of cover and complexity. The riprap could be replaced by a large log jam spanning most of the channel, or the existing rock could be enhanced with wood. The jam would maintain pool scour while increasing habitat quality.	 <p>View in the downstream direction near RM 9.55 where a boulder weir extends across the channel. A deep scour pool has formed immediately downstream, but lacks cover. The rock could be replaced or enhanced with LWD to maintain pool depth and provide cover. Adequate ballasting of materials would be necessary to protect the bridge downstream. October 2010</p>

Project Group	USBR Reach Assessment Priority Habitat Action Category	Project Number	Strategy Category	Project Name	Description	Photo
Group 4	<p><u>LWP IZ-6</u> (USBR 2009; Pg 73-77):</p> <ul style="list-style-type: none"> <li>• Reconnect Processes (Options 1, 2, 4)</li> <li>• Riparian rehabilitation (Options 1, 3, 5)</li> </ul> <p><u>LWP OZ-7</u> (USBR 2009; Pg 27-29)</p>	RM 9.5L	Off-Channel Habitat Enhancement	Alcove habitat enhancement	On river left near RM 9.5 a culvert drains a wetland that occupies a meander scar. The wetland complex is bisected by Highway 2. On the south side of the highway, the bank could be excavated to create an open surface-water connection to an off-channel backwater. North of the highway, the wetland appears to be functioning well, and should be protected.	 <p>View of a wetland that occupies a meander scar on valley left. The wetland is drained by a culvert along river left near RM 9.5. The bank could be excavated to create a connected backwater alcove at this location. October 2010.</p>
Group 4	<p><u>LWP IZ-6</u> (USBR 2009; Pg 73-77):</p> <ul style="list-style-type: none"> <li>• Reconnect Processes (Options 1, 2, 4)</li> <li>• Riparian rehabilitation (Options 1, 3, 5)</li> </ul>	RM 9.4C	Instream Habitat Enhancement	LWD enhancement and abandoned bridge abutment removal	There are old bridge abutments on both sides of the river near RM 9.4. Log jams could be placed along the channel margin on both sides of the river near these abandoned bridge abutments in order to increase cover and complexity. The abandoned bridge abutments are providing some pool scour, however, they may be limiting riparian function and could be removed and replaced with LWD jams and riparian plantings. The value of removing the abutments needs to be evaluated further.	 <p>View in the downstream direction near the location of abandoned bridge abutments on both sides of the channel near RM 9.4. LWD could be used to enhance habitat quality in this area, and the bridge abutments could be removed. October 2010</p>