



Project Title: Salmo River Instream Enhancement Program (Phase 2)

FWCP Project No: FWCP: COL-F22-F-3438

Prepared for: Fish and Wildlife Compensation Program

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Prepared with financial support of the Fish and Wildlife Compensation Program on behalf of its program partners BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and Public Stakeholders.

Date: 31-MAY-2024

AS-BUILT REPORT

Salmo River Instream Enhancement Project (SRIEP) (Phase Two) March 1, 2022

SITE A



SITE B



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All photos: Gerry Nellestijn

Drone Photography: Garry Quist





Salmo River Instream Enhancement Project (SRIEP) (Phase Two)

SITE A and SITE B the NELSON NORDIC SKI CLUB (NNSC)

CBT Project #: 16,731 FWCP: COL-F22-F-3438

INTRODUCTION

In the summer and fall of 2022, two sites in the Salmo River named Site A and Site B, the Nelson Nordic Ski Club Site (NNSC) underwent construction. These sites were partner funded by the Columbia Basin Trust (CBT) under their Ecosystem Enhancement Program (EEP) contract #: 16,731 and under the Fish and Wildlife Compensation Program (FWCP) 'Large Grants' portfolio contract COL-F22-F-3438.

The sites carried the dual purpose of providing: 1) restoration and enhancement of critical fish habitat and connectivity for Rainbow Trout and for blue-listed Bull Trout and 2) bank stabilization and water quality enhancing erosion control.

Site A is located approximately 800 meters upstream of the confluence of Erie Creek and the Salmo River (UTM coordinates 4912'04.50"N 11751'48.19"W see Figure 1). **Site B** is located approximately 300 meters downstream of the confluence of Apex Creek and Clearwater Creek on the Euphrates Trail on the Nelson Nordic Ski Club tenure (UTM coordinates 11U 484735 E 5470874 N; see Figure1).

Prior to construction, written consent was obtained from all landowners adjacent to work sites and permits for "Changes in and About a Stream" were approved by the Province of British Columbia. Pre-construction monitoring was carried out at both sites. Day/night snorkel surveys were conducted 'pre construction' in the river adjacent to sites slated for construction of fish habitat enhancement structures. Fish species and lengths were counted and recorded. As a matter of interest the original proposal called for enhancement to occur on "Site B Stockdale" however a landowner withdrew his support and consent for access to the project site. As a result, the NNSC site is Site B.

CONSTRUCTION

Six different fish habitat enhancement/erosion control structures were utilized to meet the objectives of the Site A/Site B in-stream projects.

- 1) Large Woody Debris (LWD) Debris Catchers. 2) LWD "W" Structures. 3) LWD Triangular Structures. 4) LWD Lateral Log Structures and 5) Boulder Clusters. (Appendix 1/2) 6) At Site B ballasted 'trench buried' rootwads were employed.

In addition, instream 'boulder clusters' were placed. The methods and materials used for construction of these structures remained constant within each site, however their placement and configuration used was tailored to each location within the site. A plan design was created by the SWSS for each site and approved by an engineer.



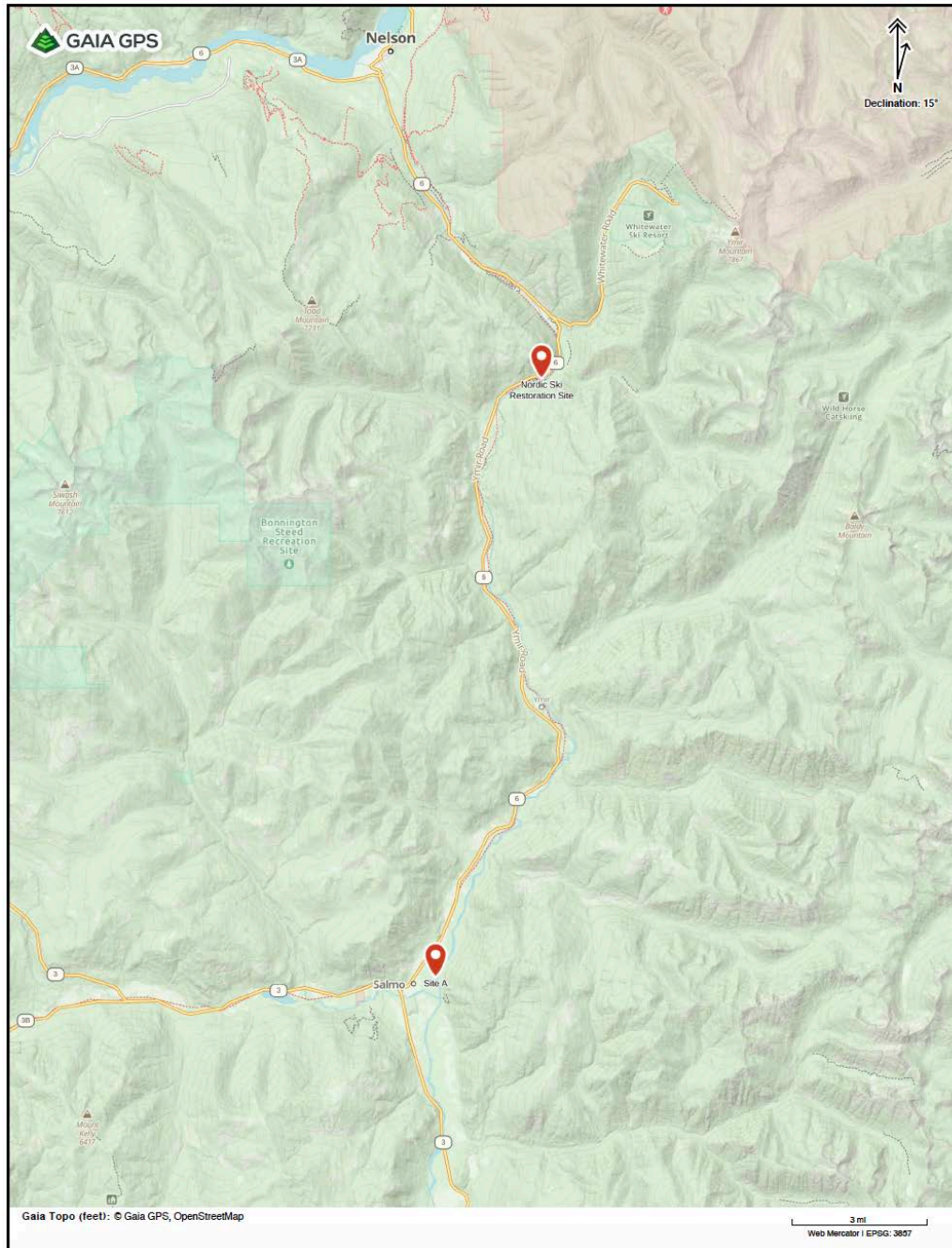


Figure 1: Map Locating 'Site A' and the 'Site B' within the Salmo River Watershed.



Boulder Clusters, Rock and 'Bank Stabilization'

Boulder clusters, groups of three to six large (~ one meter) boulders, were placed in the thalweg in order to maximize their effectiveness in low water. These clusters serve to slow down and direct the flow of water as well as to provide a downstream refuge for fish in high water events. Clusters are placed at least fifteen meters apart from each other. A spider hoe was used in the placement of these structures in order to minimize disturbance to the riverbed. A small divot was dug into the substrate by the spider hoe prior to the placement of each boulder to ensure that it was secured into the natural substrate.

Boulders were also used as riprap; a layer of rock placed on the eroding bank to armor and protect the bank from further erosion. Armouring/boulders reduce the velocity of flow due to their rough surface thus minimizing erosion potential. Rocks of a dimension large enough to withstand flooding events and determined by the engineer were utilized.

Ballasting rocks of an appropriate size and shape, typically angular, one cubic meter+, were carefully selected from the quarry of origin or onsite boulders to cable and anchor Large Woody Debris (LWD) structures (see Appendix 1).

Large Woody Debris Structures

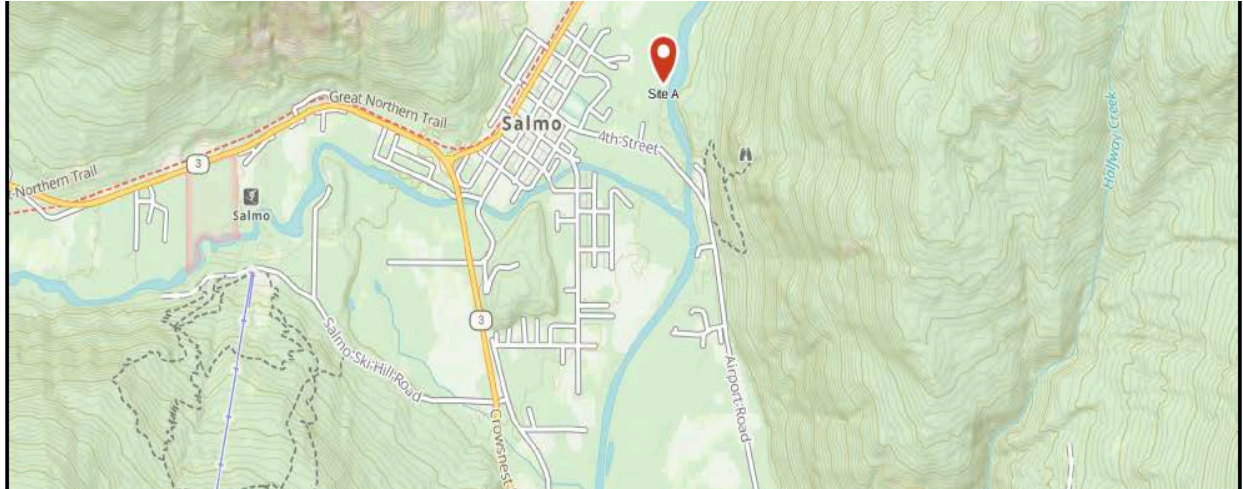
Large wood debris (LWD) structures were also employed at both of the in-stream sites. These included 1) debris catchers, 2) lateral logs, 3) triangular LWD 4) "W"-LWD and 5) 'trench buried' rootwads structures. (Appendix 1).

Cedar logs with a length of ~8 -12m and a circumference of greater than 50 centimeters DBH – diameter at breast height - were fastened to one cubic meter plus ballasting rocks with 9/16 inch galvanized cables. In some cases, rootwads were left intact on these logs and placed in the stream to increase habitat complexity. A 5/8" auger bit was used to "skim" holes through the cedar logs to allow cable to be fed through the holes to secure to ballast rocks. Skim holes were drilled at a depth of one to two inches at an angle that would easily provide comfortable in-line access to ballast rock. Ballast rock was lab verified non-acid bearing granite rock available from SilverKing Contracting Salmo side of Nelson. At times the placement of ballasting rocks precluded the use of the 'skim auger' as there was insufficient space to operate the drill. In these cases grooves were cut into the logs with a vegetable oil equipped chainsaw. Hole placements in the ballasting rocks were lined up with the skim holes or grooves and drilled to a minimum depth of 9" with a Hilti T76 hammer drill using a 9/16 inch bit. Holes were then cleaned with an air compressor to remove any dust and debris and rinsed with water and cleared again with the air compressor. This process was repeated until the holes were free of dust and water. Cable was then measured to ensure minimal slack would be present in the attached cable and the cut to length with an angle grinder. Cables were passed through the skim holes and placed into ballasting holes to confirm a proper fit before the use of adhesive. Hilti Epoxy resin was then injected into each hole with a Hilti epoxy injection 'gun' and the end of the cable was snugly inserted.



SITE SPECIFIC CONSTRUCTION

Site A: (Figure 2)



Some site preparation and materials stockpiling began in the fall of 2021. Access was thru Renee and Lance Esovoloff's place at 201 First St. just outside of Salmo. Actual construction began at Site A on September 22, 2022 and took 11 days to complete. A road and staging points were designed to allow for the delivery of rocks and LWD by dump truck. Care was taken with the access design to minimize impacts to native vegetation, particularly in the riparian zone. Even at the cost of slightly longer hauls SWSS chose areas that were already relatively clear of vegetation and free of large trees. Brush and small trees were cleared, and large trees were minimally limbed from this pathway and staging points.

A dump truck 'fed' the 'John Deere' 280 'bank-based' excavator at the River access staging point. In turn the 'bank-based' excavator 'fed' the instream 'Kaiser' Spider Hoe. All instream activities were carried out by the Spider Hoe at this site. In tandem these two large pieces of equipment were able to efficiently and with remarkable quality, place both 'rip rap' and LWD structures. Previous to any rock or LWD placement Nilex non-woven Geotextile fabric was installed over the entire area of eroding bank from the River's edge up to the top of the bank.



Figure 3: Geofabric/Toe Trench

Geotextile fabric was placed in a manner to cover both the slope and the bottom of a 'toe trench,' creating a "J" shape in the fabric to form fit a 'toe trench' within the River substrate. This provided additional protection against erosion undermining the base of bank stabilization (See Figure 4). At least one meter of overlap with the geofabric was employed when necessary in a fashion that would accommodate relief with the direction of water



flow. The upstream geofabric layer overlapped the downstream geofabric layer by at least one meter. Geofabric coverage was installed along the entire eroding site.

An excavator passed boulders and riprap from the staging sites down to the Spider hoe instream. Large and smaller boulders were deposited and tamped down in the trench to 'tight fit' anchor the geotextile fabric in place. Riprap was strategically placed to minimize gaps on top of the fabric to a depth of at least one meter.

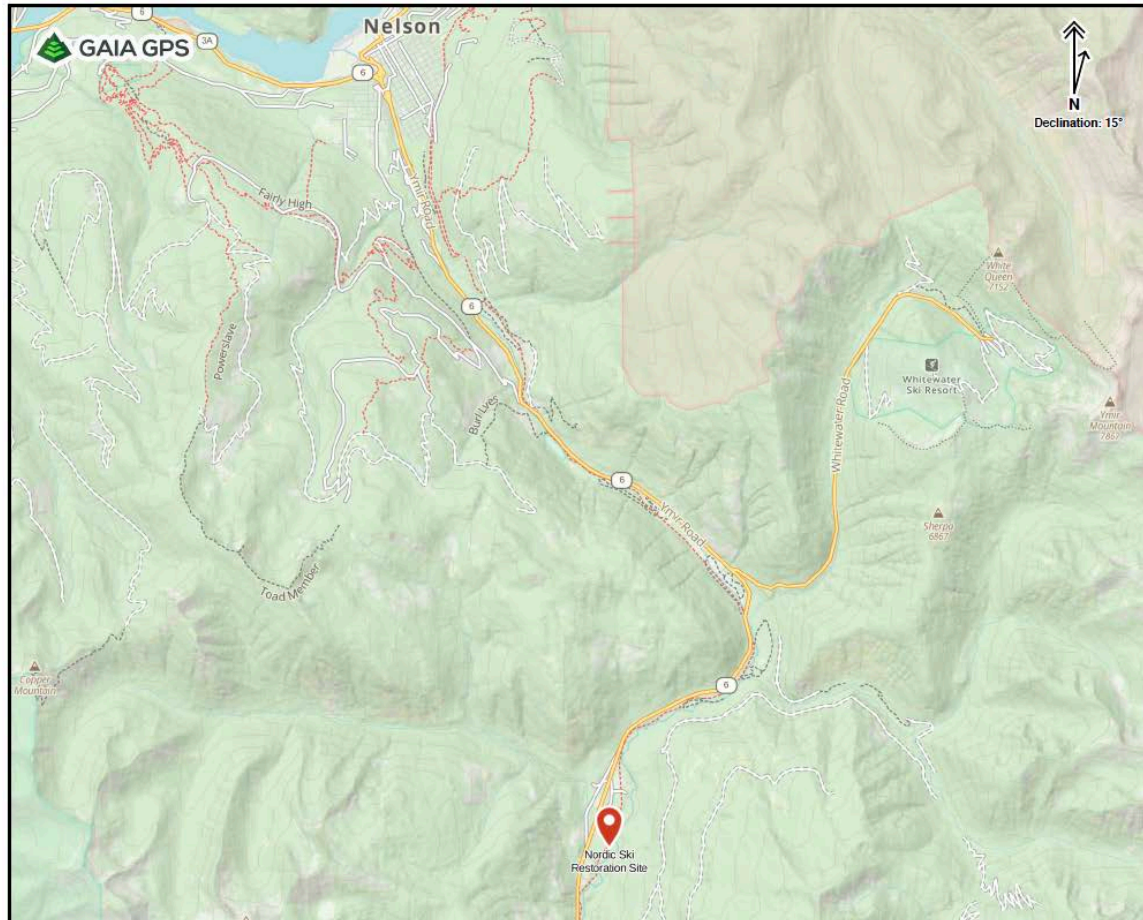
Six boulder clusters were installed at the upstream end of the site. A debris catcher was constructed on a gravel bed just downstream from the boulder clusters (Figure 4). A lateral log was placed on angle downstream from the debris catcher, followed by two triangle structures before the bank stabilization began.

Close observation of Fig. 4 will illustrate that three lateral logs were installed beginning at the upstream end of the bank stabilization and carrying on downstream. These were situated in an area where the riparian vegetation was not present. Continuing downstream, one triangular structure was constructed, then four W-LWD structures were built and finally another triangle structure at the furthest downstream end of the site. In total four lateral logs, four triangle and four W-LWD structures were installed along the streambank. For the installation of Triangle and W-LWD structures, a portion of the upper bank was excavated and a large ballasting rock was situated in the bank. Logs were then embedded in the bank and cabled to the ballasting rocks (Figure 6, also Appendix 1)

Figure 4: Entire 'Site A' overview. Notice Waterstreet Side Channel, bottom of the photo



Site B: Nelson Nordic Ski Club: (Figure 5)



Site B Introduction: Site B is located within the Nelson Nordic Ski Club tenure. Club officials approached the SWSS based on our reputation that we accomplish ecologically sensitive bank stabilization that engages a fish habitat enhancement component.

Site Location and Access

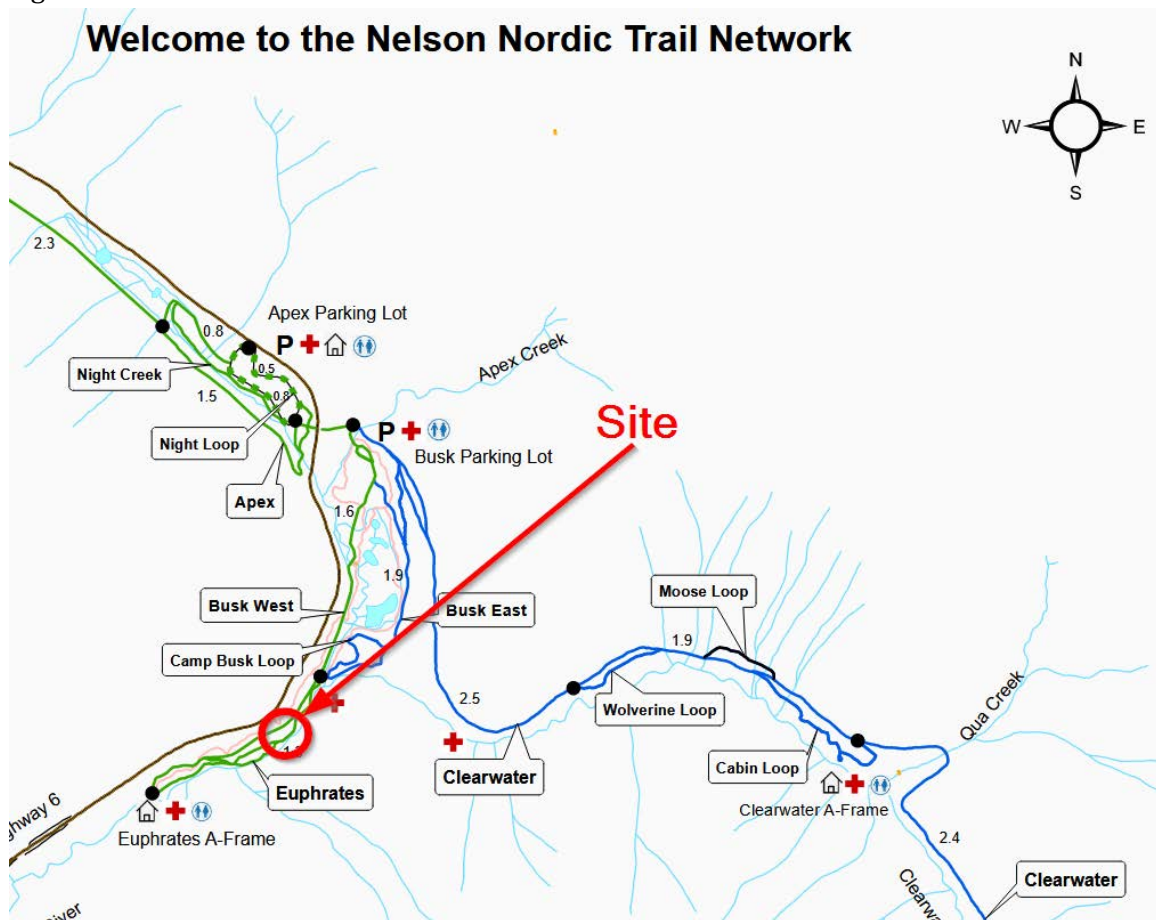
The site is situated in the headwaters of the Salmo River approximately 12 km southeast of the City of Nelson (UTM coordinates 11U 484735 E 5470874 N; see Figure 1 and 5) and within the old rail bed alignment that runs from Troupe near the City of Nelson to Salmo, BC. The abandoned rail trail tenure status has reverted to the Ministry of Transportation and Highways and is presently managed by the Regional District of Central Kootenay (RDCK) as a recreational trail. The Nelson Nordic Ski Club uses the cleared trail adjacent to the site known as Euphrates for its winter program (see Figure 6). The site was easily accessed by machinery – truck and excavator - from Highway 6 down the rail trail and along the Euphrates nordic trail alignment.



The site is approximately 115 meters long requiring intensive construction with another approximate 40 meters requiring simple grooming. The SWSS is very familiar with the site. Situated ~300 meters downstream of the confluence of the Apex Creek and the Clearwater Creek (recognized as the *beginning* of the Salmo River) it is approximately 90 meters downstream of a bedrock associated deep pool and 100 meters upstream of a similar but larger deep bedrock pool. It is known that both these pools provide safe haven locations (refugia) for adult blue-listed Bull Trout that previously spawned in the site area and annually migrate into the Clearwater Creek to spawn. Until about 10 years ago the site was commonly used by Bull Trout to build 1 - 2 redds. Spawning substrate was eliminated when erosion moved dramatically 'River Left' (the west side of the River bed). At the same time the Euphrates Trail was threatened. This section of the Nordic Ski Club tenure is universally known by the club members as one of the most scenic stretches of trail in their tenure.

SWSS saw an opportunity to preserve the trail and with the support of their partners, the Columbia Basin Trust and the Fish and Wildlife Compensation Program, to build habitat that could reintroduce appropriate Bull Trout spawning substrate to stable locations as well as reduce water quality concerns associated with mass erosion sites.

Figure 6





The SWSS was in constant contact with both the Ministry of Transportation and Highways Infrastructure (MOTHI) and the Nelson Nordic Ski Club (NNSC) executive/management. The SWSS worked with Mountain Station Consultants Ltd. to design the site prescription.

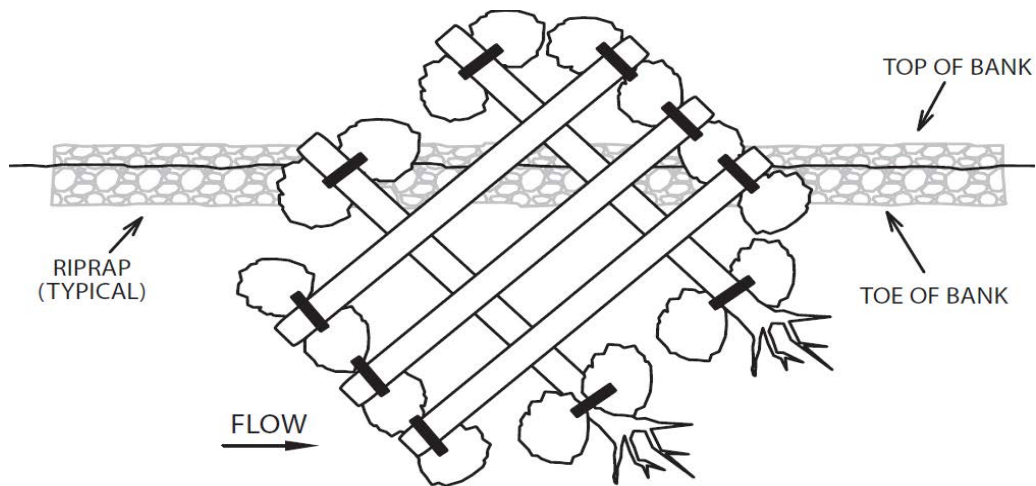
SITE SPECIFIC CONSTRUCTION

Construction of the site habitat enhancement began on August 28 and ended six days later (see APPENDIX 4: Photo Library 'Site B'). A Catapillar 325 C excavator was used for the entire project. Two dump trucks were used to supply the Cat. Six rootwads that were harvested near the site provided the 'in trench' ballasted Large Woody Debris (see APPENDIX 4: Photo Library 'Site B').



APPENDIX 1: Large Woody Debris Structures Employed in 'SITE A' Construction

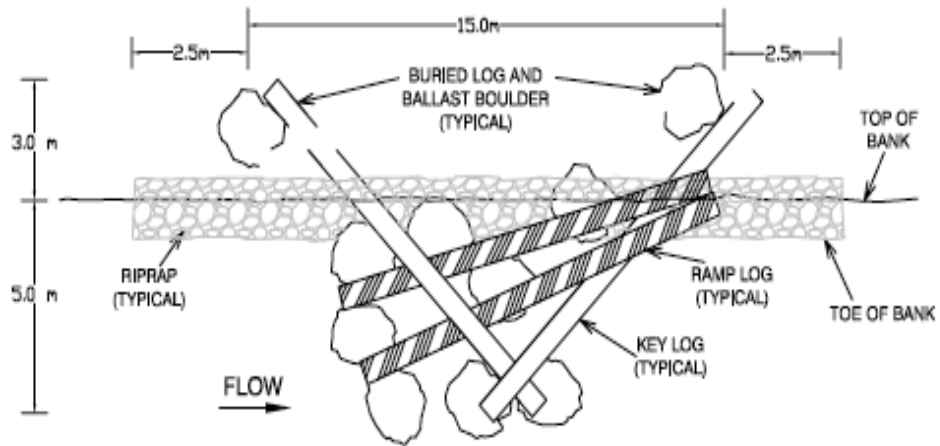
1) Schematic Drawing of a Debris Catcher:



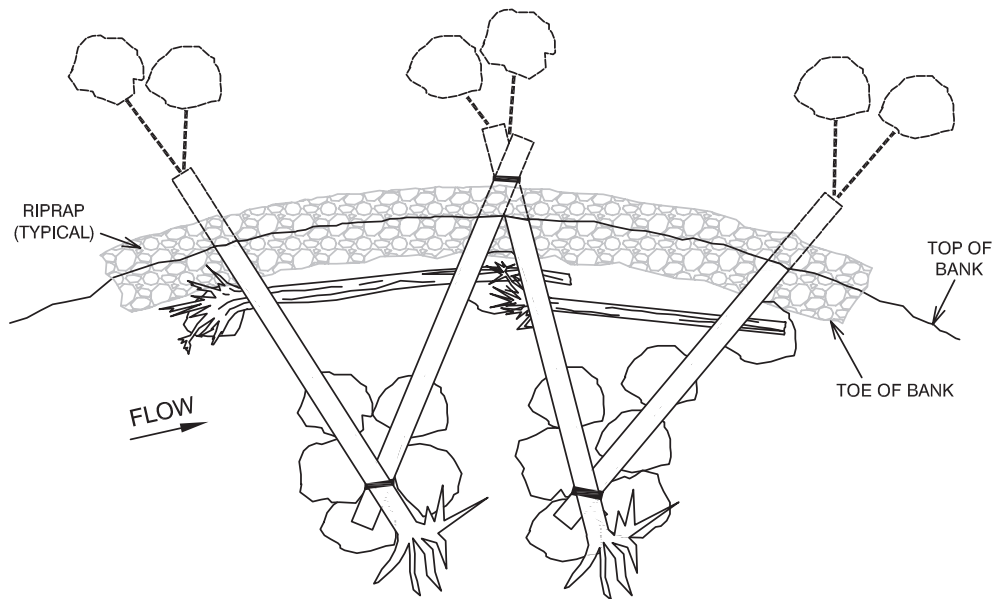
2) Photo of a Lateral Log Structure: This Lateral Log is Complete With a Rootwad.



3) Schematic Drawing of a Triangular Structure:



4) Schematic Drawing of a W-LWD Structure: Illustrates buried/cabled ballast rock



APPENDIX 2: Photo Library 'Site A'



Site A Complete: Looking Upstream (above) Looking Downstream (below)



From River Right Boulder Bar



Downstream end of Site A: shows Triangular Structure C/W 2 Ramp logs and a 'W' structure



Upper end of Stabilization: Shows a Lateral Log C/W rootwad and 2 Triangular structures.



Shows upper Triangle above left, a Lateral Log structure and end view of the Debris Catcher.

DRONE PHOTO LIBRARY: pg 1 of 4

Upper Photo, Downstream end of Site A: Captures Lower Triangle with 2 Ramp Logs and 2 'W' Structures.

Lower Photo, Moving Upstream: Captures 4 'W' Structures.



DRONE PHOTO LIBRARY: pg 2 of 4

Upper Photo, shows repeat of upstream 'W' 1 Triangle, c/w 1 ramp log and 3 Lateral Log Structures.

Lower Photo, shows repeat of upper Lateral Log, 2 Triangles c/w 2 ramp Logs, a Lateral Log and the Debris Catcher.



DRONE PHOTO LIBRARY: pg 3 of 4

Upper Photo, shows repeat of Debris Catcher and the beginning of the upstream of site 'Boulder Clusters'. (3 Clusters)

Lower Photo, shows 2 additional Boulder Clusters.



DRONE PHOTO LIBRARY: pg 4 of 4

Upper Photo, moving upstream (left to right) shows 2 Boulder Clusters

Lower Photo, shows repeat of lower Boulder Cluster. And an additional Boulder Cluster and upper end of site.

Notice toward upper right of the lower photo the 'intake' for Waterstreet side Channel.



APPENDIX 3: Photo Library 'Site B'

SITE B: Before Stabilization/Enhancement



After Stabilization/Enhancement



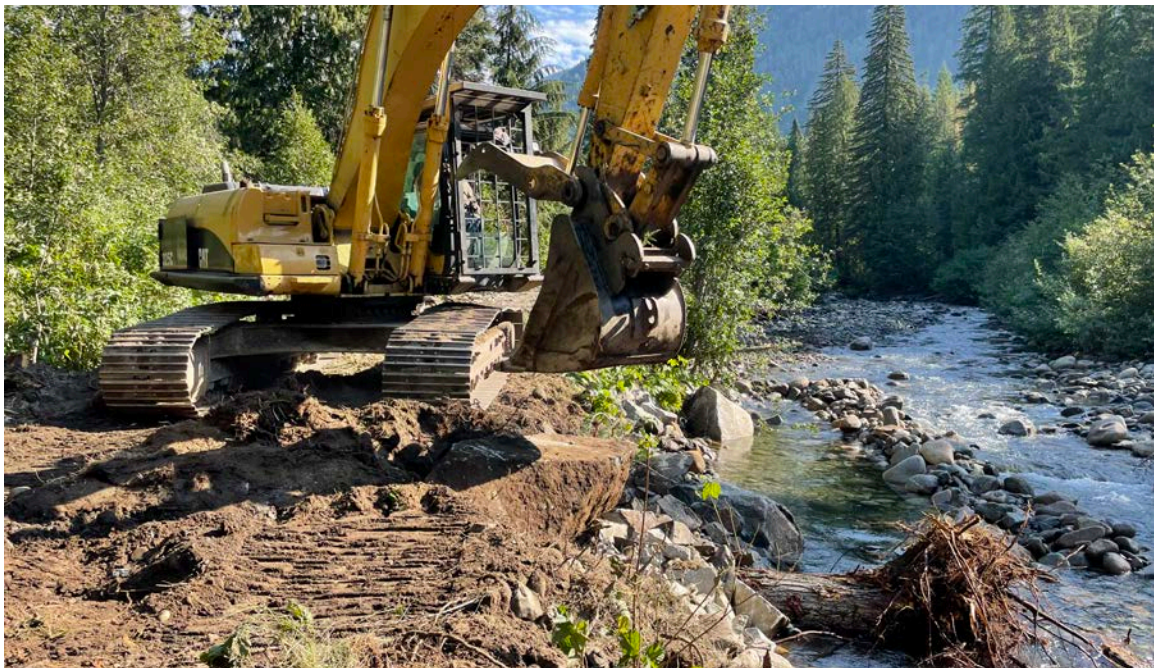
SITE B: Site Preparation:



Site B: Rootwad Trenching/Ballasting: One Meter Extension into the River.



Site B: Rootwad 'Tamped' Into Place.





APPENDIX 4

NUMBER of PARTNERS – CBT/FWCP 'SITE A', 'SITE B'

CBT Project #: 16,731 FWCP: COL-F22-F-3438

1. CBT
2. FWCP
3. SWSS
4. Rodman Hydrological Engineering
5. Masse Environmental
6. Custom Dozing
7. SilverKing Contracting Ltd
8. BC Hydro
9. Monticola Forestry/Selkirk Forestry
10. SDS Trucking
11. Rob Lee Trucking
12. Huser and Son's Equipment
13. VSA
14. Regional District of Central Kootenay
15. Ministry of Transportation, Highways and Infrastructure.
16. Janice and Al Waterstreet
17. Over the Edge Contracting
18. Nelson Nordic Ski Club (NNSC)
19. Mountain Station Consultants
20. The Hutton Family
21. The Casey Dalen Family
22. Lance and Renee Esovoloff

METERS of RESTORATION. CBT/FWCP Projects

SITE A - 440 X 3 M's = 1320 sq. M's instream Habitat

SITE B - 84 +40 X 1.5 M's = 374 sq. . M's instream Habitat

