Appendix V5-6J

Doris North Gold Mine Project: Roberts Outflow and E09 Fish Habitat Enhancement Report

Hope Bay Mining Limited

DORIS NORTH GOLD MINE PROJECT
Roberts Outflow and E09 Fish Habitat Enhancement Report

NEWMONT™
NORTH AMERICA

Rescan™ Engineers & Scientists

Rescan™ Environmental Services Ltd.
Rescan Building, Sixth Floor - 1111 West Hastings Street
Vancouver, BC Canada V6E 2J3
Tel: (604) 689-9460 Fax: (604) 687-4277

December 2012

DORIS NORTH GOLD MINE PROJECT

ROBERTS OUTFLOW AND E09 FISH HABITAT ENHANCEMENT REPORT

December 2012
Project #1009-008-11

Citation:

Rescan. 2012. *Doris North Gold Mine Project: Roberts Outflow and E09 Fish Habitat Enhancement Report*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.

Prepared for:

NEWMONT NORTH AMERICA

Hope Bay Mining Limited

Prepared by:

Rescan™ Engineers and Scientists

Rescan™ Environmental Services Ltd.
Vancouver, British Columbia

Executive Summary

Rescan
Engineers and Scientists

Executive Summary

Habitat enhancement of Roberts Outflow boulder garden and stream E09 was conducted by Rescan Environmental Services Ltd. (Rescan) in 2012, on behalf of Hope Bay Mining Ltd., for the Doris North Project.

The enhancement of the boulder garden was completed between September 3 and 10, 2012. The approved *No Net Loss Plan* (NNLP) proposed the construction of a single channel 12 to 15 m in length through the “stranding zone” of the boulder garden. In place of a single channel, four channels were built, with a total length of 69 m. The additional channels were designed to provide alternative routes for fish in the event that the structural integrity of the single channel design from the NNLP deteriorated over time. The channels were designed be stable, so as to increase their longevity and to minimize maintenance requirements. In addition, they should allow fish to pass through the area more quickly and provide additional routes to avoid predators.

Fish were observed struggling for extended periods in the boulder garden prior to the enhancement work. In contrast, within two days of the completion of the first channel, 61 fish successfully made it through the boulder garden. Many of these fish were observed passing through the area, and they exclusively chose the new channels over the existing options. In addition, these fish made it through the boulder garden with little delay. Although anecdotal, the observations made by crews strongly suggests that the new channels provide excellent fish passage corridors through the boulder garden.

Enhancement at E09 was completed between July 27 and September 8, with the majority of the instream work completed between July 30 and August 5, 2012. Two juvenile Arctic char rearing pools were created with a total area of 11.7 m^2, exceeding the requirements of the approved design by 3.7 m^2. Considering the nature of the substrate at E09, sediment control proved successful. Turbidity within isolated work areas was high, but this did not significantly impact turbidity levels in the stream.

Acknowledgements

Acknowledgements

This report was prepared by Rescan Environmental Services Ltd. (Rescan) for Hope Bay Mining Ltd. Fish habitat construction and monitoring was completed by Bob Askin (M.Sc., P.Geo., P.Eng.) and Fraser Ross (B.Sc., R.P.Bio.). Brad Wilson (M.Sc., FCGmA) completed Micro Blaster™ operations and Paulette Penton (M.Sc.) provided field assistance. Fredd Taptuna and Robert Qaqquq provided bear monitoring assistance. Great Slave Helicopters provided helicopter support.

The report was prepared by Fraser Ross (B.Sc., R.P.Bio.) and reviewed by Deborah Muggli (Ph.D., M.Sc., R.P.Bio.). Report production was co-ordinated by Robert Tarbuck (Word Processing), Francine Alford (Graphics) and Pieter van Leuzen (GIS).

Table of Contents

Rescan
Engineers and Scientists

Table of Contents

List of Figures

List of Tables

List of Plates

List of Appendices

Glossary and Abbreviations

Rescan
Engineers and Scientists

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

DFO	Fisheries and Oceans Canada
HBML	Hope Bay Mining Ltd.
kPa	Kilopascals
MMER	Metal Mining Effluent Regulations
NNLP	No Net Loss Plan
NTU	Nephelometric Turbidity Units
QEP	Qualified Environmental Professional
TIA	Tailings Impoundment Area
XS	Cross Section

1. Introduction

Rescan™
Engineers and Scientists

1. Introduction

The Doris North Project is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the south shore of Melville Sound (Figure 1-1). Construction of the Project has been underway since 2010, but Hope Bay Mining Limited (HBML) announced on January 31st, 2012 that the Project would be placed into care and maintenance. The Doris Camp was closed down in October of 2012 for the winter, and current plans are to open the camp only seasonally in order to conduct water management activities.

As part of the Doris North Project, Tail Lake was approved for use as the Tailings Impoundment Area (TIA). A No Net Loss Plan (NNLP) was developed to compensate for the loss of fish habitat in Tail Lake and Tail Outflow (Golder 2007).

The NNLP was updated with two separate reports in 2010: *Updates to the Doris North No Net Loss Plan for Tail Lake* (Rescan 2010a) and *Updates to the Doris North No Net Loss Plan for Tail Outflow* (Rescan 2010b). Two separate reports were required because compensation for the loss of fish habitat in Tail Lake is governed by Section 27(1) of *Metal Mining Effluent Regulations* (MMER), whereas compensation for loss of fish habitat in Tail Outflow is governed by Section 35(2) of the *Fisheries Act*. These updated reports describe changes in the location, scheduling and cost of some of the compensation projects described in the NNLP.

Part of the compensation for the loss of Tail Lake and Tail Outflow involved enhancing fish habitat in Roberts Outflow and in a tributary flowing in to Roberts Lake (identified as stream E09). Other compensation measures included the creation of shoals in Windy Lake. The habitat compensation monitoring at the Windy Lake shoals is being reported separately. This report presents the habitat compensation work that was conducted at Roberts Outflow and Stream E09 during the summer and fall of 2012.

The habitat enhancement projects were carried out following best management practices to ensure compliance with the Fisheries Authorization and other available guidelines. Both the Land Development Guidelines for the Protection of Aquatic Habitat produced by Fisheries and Oceans Canada (DFO; Chillibeck et al. 1993) and Standards and Best Practices for Instream Works by BC MOE (MOE 2004) were followed. These documents clearly describe the best approaches to mitigate the impacts of work on fish and fish habitat using a range of methods including effective site isolation, sediment and erosion control and site restoration.

Chapter 2 of this report presents the details of the implementation of the fish habitat enhancement projects at both Roberts Outflow and Stream E09. Chapter 3 of this report presents a brief summary of the project.

Figure 1-1

Doris North Project Location

NEWMONT NORTH AMERICA

Rescan Engineers & Scientists

2. Habitat Enhancement Implementation

2. Habitat Enhancement Implementation

The following sections provide details on construction, mitigation, engineering, and biological overview of the fish habitat enhancement at Roberts Outflow and stream E09, along with accompanying photographs. Figure 2-1 presents the geographic location of the enhancement sites.

The initial design for the habitat enhancement projects at Roberts Outflow and stream E09 were based on the final version of the NNLP and the update reports (Golder 2007, Rescan 2010a, Rescan 2010b). Since the production of the NNLP in 2007, baseline data collection in the boulder garden and E09 has continued, providing additional information on these sites.

The on-site fisheries biologist and water resource engineer reviewed the plans and completed site inspections prior to instream work. The final designs and construction methods improved on some aspects of the NNLP based on baseline data, site conditions and the experience of field personnel.

A major emphasis was placed on constructing enhancements that were resistant to erosion and that would not infill from sedimentation, while maintaining flow patterns optimal for fish use. Such durable features will provide enhanced fish habitat for many years and will require little ongoing maintenance.

A daily protocol for habitat enhancement projects was developed and used throughout the work period (Appendix 1). Daily field notes, photographs, and sketches were recorded.

2.1 ROBERTS OUTFLOW ENHANCEMENT

The boulder garden site is located at the outflow of Roberts Lake, approximately 2.3 km upstream from the estuary (Figure 2-1). All freshwater habitats downstream of the boulder garden freeze to the channel substrates annually so fish in the Roberts Lake system must overwinter in the lake to survive. The NNLP proposed that the boulder garden at the outflow of Roberts Lake be modified to increase accessibility for fish migrating upstream, particularly at low flow levels when fish passage is most restricted and mortality is highest. A specific section of the boulder garden was identified in the NNLP and referred to as the “stranding zone”, where enhancement was focused. Plates 2.1-1 and 2.1-2 show adult fish trapped in the boulder garden prior to enhancement work.

By increasing fish passage into Roberts Lake, it was predicted Arctic char (*Salvelinus alpinus*) productivity would rise, thus increasing the overall population (Golder 2007). A key measure of success is the provision of nearly unrestricted passage of anadromous Arctic char into Roberts Lake through the boulder garden in low flow conditions.

The boulder garden originates in the shallow littoral zone at the outflow of Roberts Lake. It is approximately 50 m in length, and the substrate is primarily large boulders. During periods of low discharge, flow becomes shallow and braided and passage becomes restricted for adult Arctic char and lake trout. Figure 2.1-1 shows an aerial overview of the boulder garden prior to enhancement.

The enhancement of Roberts Outflow boulder garden was completed from September 3 to 10, 2012. The work was supervised by a Rescan biologist who was on-site at all times and by a Rescan water resources engineer who provided direction on hydraulic changes and channel structural stability. A Micro Blaster™ operator was on site to selectively blast rocks identified for removal by the engineer and biologist. At the end of construction, True North Geomatics Ltd. surveyed the site with a Leica GPS900 RTK GNSS system to provide accurate as-built drawings. This system had a horizontal accuracy of 10 mm and a vertical accuracy of 20 mm (Figure 2.1-2).

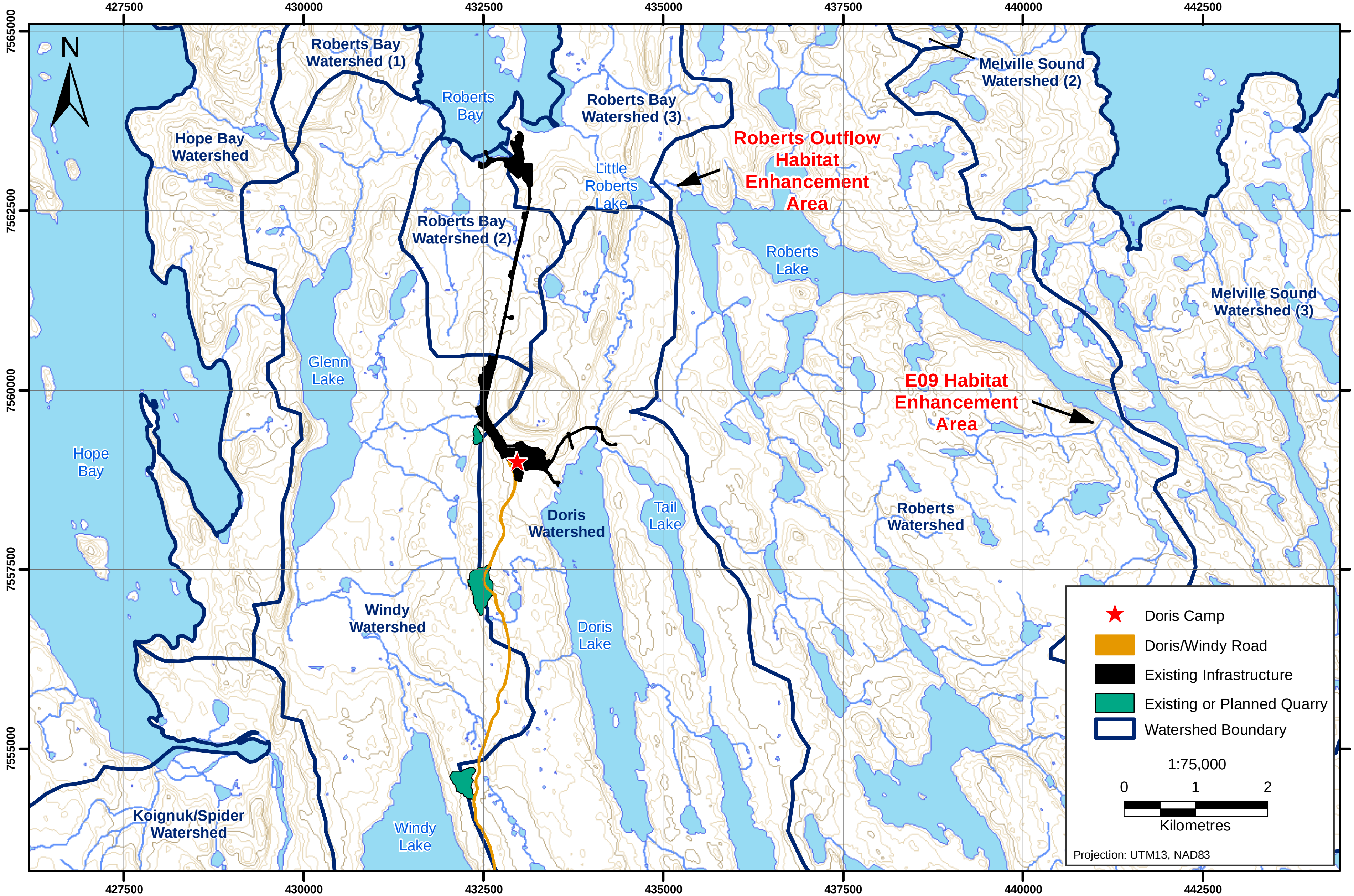


Figure 2-1

NEWMONT NORTH AMERICA

Location of Roberts Outflow and E09 Habitat Enhancement Sites

Figure 2-1

Rescan Engineers & Scientists

Figure 2.1-1

NEWMONT NORTH AMERICA

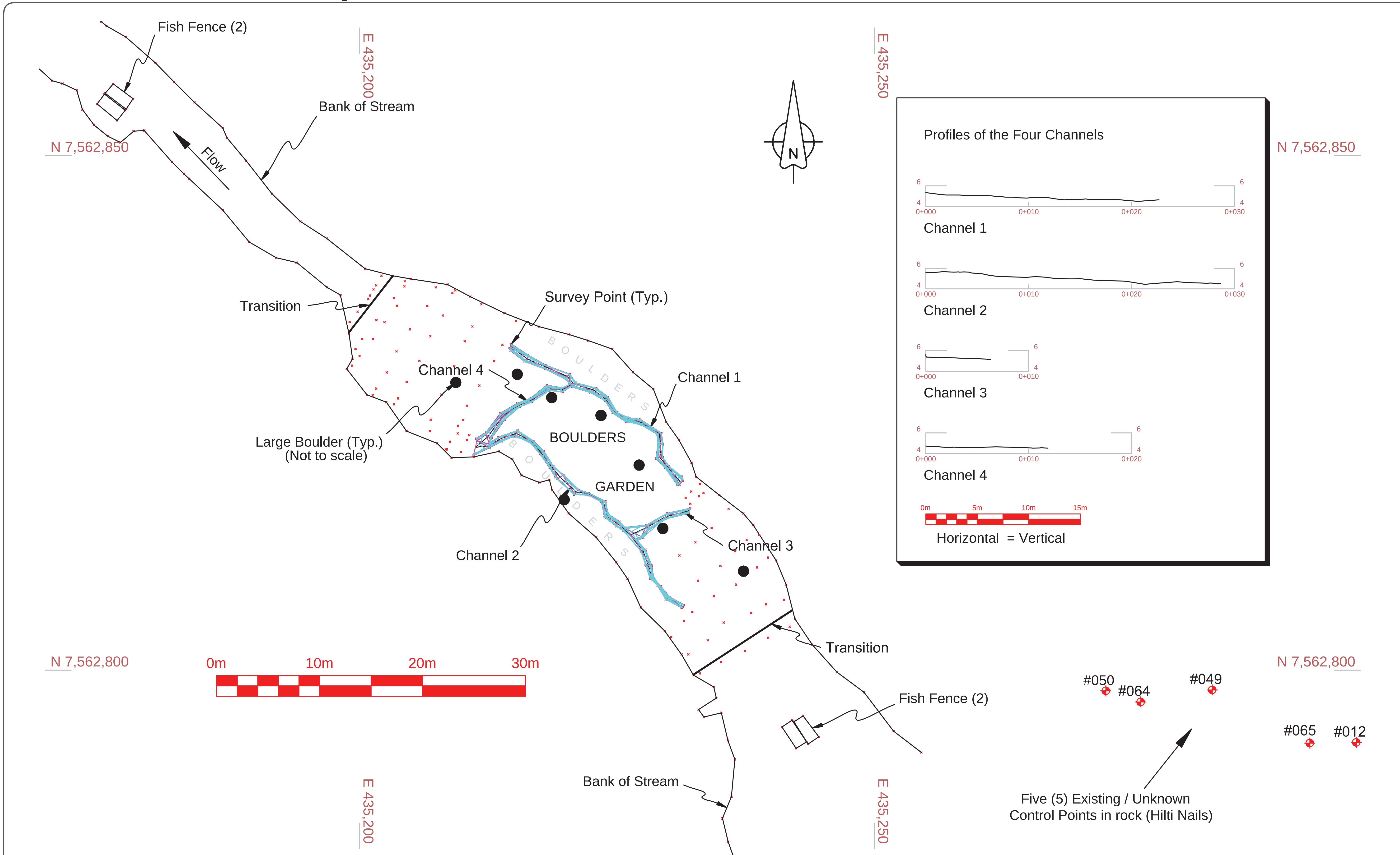
Roberts Outflow Boulder Garden Prior to Enhancement

Rescan Engineers & Scientists

Plate 2.1-1. A large adult lake trout struggling in the stranding zone of the boulder garden.

Plate 2.1-2. An Arctic char that was trapped between boulders upstream of the "stranding zone."

PROJECT # 1009-008-11 ILLUSTRATION # a38450c_T December 17, 2012



NEWMONT NORTH AMERICA Rescan Engineers & Scientists

Figure 2.1-2

Topographic Survey of Channels of Roberts Lake Outflow

Several incidents occurred between dangerous wildlife and field crews monitoring the Roberts Outflow fish fence just prior to the start of the enhancement project. Bears visited the area every few days to feed on Arctic char in the boulder garden. The task hazard analysis determined that there was an elevated risk that a potentially dangerous conflict could occur between humans and bears so additional safety precautions were implemented. Two armed bear monitors were on site at all times whose primary responsibility was to watch the surrounding area for approaching bears. The helicopter stayed at site throughout the day so the crew could be removed with no delay. Emphasis was placed on completing the work as quickly as possible to reduce the likelihood of a conflict, while not compromising the success of the project. The additional safety measures allowed the safe completion of the project.

The following section presents the requirements of the boulder garden enhancement listed in Section 4.1 of the NNLP followed by details on how each requirement was met.

<u>Section 4.1.2. Create a Clear Flow Path in the "Stranding Zone" in the Middle of the Boulder Garden</u>

A channel 12 m in length was constructed through the "stranding zone", following the approach described in the NNLP (channel 3 in Figure 2.1-2). This channel started at the upstream end of staging pools at the downstream end of the boulder garden, and travelled diagonally across the boulder garden to the far bank (Figure 2.1-2). Plates 2.1-3 and 2.1-4 are photographs from before and after construction of the channel through the "stranding zone". Selected boulders are numbered in both plates for reference.

Plate 2.1-3. The stranding zone of the boulder garden before enhancement.

Additional channels were constructed to improve access to Roberts Lake. In addition, because fish struggled to get beyond the top of the original channel built through the "stranding zone", this channel was extended (channel 1; Plate 2.1-5 and 2.1-6).

Plate 2.1-4. The stranding zone of the boulder garden following enhancement. Two channels traverse the stranding zone.

Plate 2.1-5. The constructed diagonal channel through the stranding zone of the boulder garden.

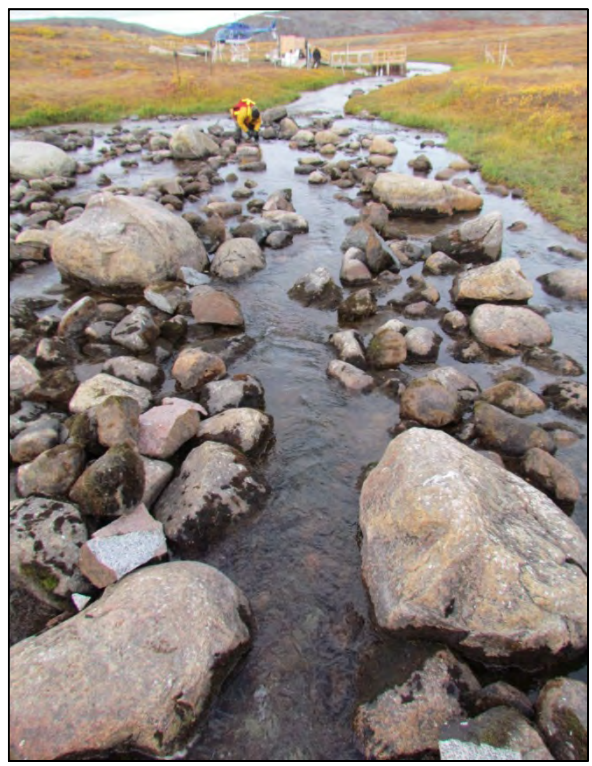


Plate 2.1-6. Channel 1 was constructed to provide access from the end of the channel through the stranding zone upstream to the lake.

Modifications to the NNLP were made to improve the long term durability of the enhancement. The original channel was roughly perpendicular to the direction of flow, which will expose it to greater erosive forces at high discharge rates. The extension to the channel through the “stranding zone” (channel 1) was built parallel to the direction of flow (Plate 2.1-7 and 2.1-8). In addition, another channel 28.5 m long was built parallel to flow along the left bank (channel 2 in Figure 2.1-2). These channels will provide additional movement corridors in the event that the original channel becomes structurally unstable.

Plate 2.1-7. An aerial view of the middle section of the boulder garden.

The post-construction survey found that 69 m of new channel was created with an average maximum depth of 302 mm (min. 156 mm, max. 572 mm, n = 46). This far exceeded the 15 m of channel required from the NNLP.

The enhancement channels were constructed so to have sufficient depth for fish passage, even during periods of low discharge. Thompson (1972) assessed the minimum water depths that enable upstream migration of various adult salmon and trout. Most salmonids require around 180 mm water depth except the larger Chinook, who required 240 mm. It is expected that adult Chinook would require greater water depths than Arctic char as they generally grow far larger.

In a study on adult Alaskan chum salmon, fish could successfully pass through sections of creek with water depths greater than 0.12 m if there was course substrate and 0.08 m in sections with finer substrate (Sautner et al. 1984).

Although there is limited information on water depth requirements for successful passage for anadromous Canadian Arctic char, existing data for other salmonids with similar body size and shape suggests that the new channels are sufficiently deep.

Field crews observed an immediate improvement in the ability of fish to pass through the boulder garden following the completion of the first channel. The fish fence program found that prior to enhancement only 57% of Arctic char successfully made it through the boulder garden in August 2012 (Rescan 2012). Fish almost exclusively used the new channels and they could easily navigate through the boulder garden in less than ten minutes. Within two days of opening the channel, 61 fish had been caught at the upstream fence. Plate 2.1-9 shows an adult fish swimming through the new channel in the "stranding zone".

Plate 2.1-8. The middle section of the boulder garden with a new channel. Fish were observed freely swimming through the new channel.

Plate 2.1-9. A fish swimming in the new channel through the stranding zone.

Section 4.1.2 and Appendix D, Figure D2. Construction Will Be Completed without the Use of Heavy Ground Equipment. Rocks Will Be Removed from the Fish Passage by Either Helicopter or Manual Means

The NNLP was designed so that the boulder garden enhancement could be completed without the use of heavy machinery, therefore limiting the impacts to the area. The tundra is easily damaged as heavy machinery alters the physical structure and mineral content of the soil, it causes soil erosion, it increases thaw depth of ice and degrades the vegetation cover (Ayers 1994; Kevan et al. 1995).

All construction activities were completed without the use of heavy equipment. Boulders were lifted and relocated by field crew members by hand and by using mechanical advantage. Pry bars and other hand tools were used to dislodge and move boulders which could not be moved by hand. Large boulders too heavy to lift were broken into pieces that could be managed by hand using a Micro Blaster™ (see below for details).

Section 4.1.2. Large Boulders Will Be Broken Into Sizes That Can Be Moved by Manual Labour, Using a Magnum Buster™ or Equivalent; and, Setback Distances When Breaking Rocks Will Follow the "Guidelines for the Use of Explosives in or near Canadian Fisheries Waters"

Many boulders identified in the NNLP for removal were too heavy to relocate by hand, so additional methods were explored prior to fieldwork. The NNLP proposed the use of the Magnum Buster™, a non-explosive technology that uses cartridges with 15 g of nitrocellulose propellant (gunpowder) that produces a rapidly expanding gas when fired. Holes are drilled into boulders then cartridges are placed into the holes and detonated. The energy is converted into a hydrostatic pulse by directing the gas into the water filled hole within the rock that causes the rock to split. This would ideally break the boulder into pieces that were manageable by hand and could be removed or relocated as required, eliminating the need for heavy machinery.

The setback distances were recalculated prior to fieldwork as the less powerful Micro Blaster™ was purchased for the project which uses a cartridge with 1 g of propellant. The formulae in the "*Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters*" were used to recalculate setback distances based on the smaller cartridge size (Wright and Hopky 1998). The recalculation found that the setback distance, using conservative numbers for the type of substrate for an overpressure of 50 kPa was 24.5 cm from the point of detonation.

The Micro Blaster™ was used on boulders that had a diameter greater than 50 cm, so most of the area with an overpressure greater than 50 kPa would be within the boulder. Consequently, the area of instream habitat exposed to each blast was minimal. However, each rock was isolated with blasting pads to further limit impacts to fish and to eliminate risks of fly rock to field crews.

Blasting rock with the Micro Blaster meant that rounded boulders were split into segments that had sharp edges and abrasive sides. Angular fragments were removed from the channel to reduce the likelihood of causing damage to passing fish.

Section 4.1.2 and Appendix D, Figure D2. Boulders Will Be Moved into Channel Areas downstream of the Boulder Garden to Provide Additional Fish Habitat Value

The NNLP stated that boulders would be relocated into the channel downstream of the boulder garden to provide additional fish habitat. However, manually moving every boulder 20 to 50 m would have greatly increased the likelihood of injury to a crew member and it would have increased damage to the tundra through repetitive foot damage. Moving boulders by helicopter would have taken a lot of time and would have been a large expense. The decision was made to relocate boulders within the boulder garden, and create local habitat features where possible.

Boulders were strategically relocated so they would improve both stability and habitat value of the boulder garden. Boulders were placed downstream of each new channel so they would not be moved back into the channels during future high water events. Boulders were used to provide additional habitat value by creating boulder clusters and by focusing flow into the new fish channels. In addition, boulders were used to block access to channels where fish were regularly observed stranded, and to direct fish into channels where they could pass.

Appendix D, Figure D2. Rocks outside of the Fish Passage Shall Be Left in Place

Rocks outside the fish corridor were left in place. The engineer reviewed the modifications and confirmed that the work did not compromise the structural integrity of the boulder garden.

Appendix D, Figure D2. Voids in the Streambed Created by the Removal of Rocks Shall Be Filled in, with Smaller Rocks, to Maintain a Level Streambed

The streambed was modified during enhancement as the new channels were designed so that they were lower than the surrounding streambed. The channels needed to be lower to provide optimal passage for fish in low flow conditions, so filling the voids would have reduced their efficiency.

The channels were constructed so that they were structurally stable as the substrate beneath the boulders consisted of more boulders. This means it is unlikely that vertical erosion will occur within the new channels as they are naturally armoured.

Appendix D, Figure D2. Rocks Upstream of XS 0+25 Shall Not Be Disturbed

Some select boulders were removed from upstream of XS 0+25. Channel 3 and the upstream section of channel 2 were located above this cross section, so that fish channels could link the downstream section of the boulder garden to Roberts Lake even at the lowest flow conditions. These sections were designed by the water resources engineer in such a way that there would be no impacts to the water level in Roberts Lake.

Appendix D, Figure D2. The Low Water Fish Passage Path Shall Be Laid Out in the Field and the Construction Supervised by a Qualified Person

A Qualified Environmental Professional (QEP) was on site throughout work. A Rescan biologist was present at all times to direct activities and to oversee work. A Rescan water resources engineer was on site for three days at project commencement to provide direction on hydraulic changes and channel structural stability. The fish passage path was laid out in the field by the water resources engineer with assistance from a fish biologist. The construction was supervised primarily by a fish biologist with experience in construction monitoring and sediment and erosion control.

Section 4.1.2. A Fish Salvage Will Be Conducted by Electrofishing to Remove Any Fish Trapped inside the Exclusion Area

The NNLP stated that fish would be removed by electrofishing prior to the start of work. However, electrofishing in the boulder garden proved to be challenging as much of the wetted area around boulders was too narrow to get the anode and cathode into the water at the same time, and often proved impossible to dip net fish once they were stunned. Low conductivity of the water also contributed to ineffective electrofishing.

Most of the work involved lifting and relocating heavy boulders by hand. Little threat was posed to fish during this work, as boulders were lifted from within or from the edge of the channel and were placed elsewhere. Boulders were not thrown into other parts of the channel, to minimize the likelihood of injuring fish. All rocks that were blasted with the Micro Blaster™ were isolated to minimize the risk to fish.

Section 4.1.2. Fish Exclusion Barriers Will Be Placed Upstream and Downstream to Prevent Fish Entering the Construction Area

The NNLP proposed using upstream and downstream fish exclusion barriers to isolate the work area. Each channel was constructed with a barrier at the upstream and downstream end made of boulders that effectively prevented access to the channel until it was complete.

Field crews observed that fish moved up the creek in schools. No fish would pass through the area for extended periods then several fish would arrive together. Fish were easily observed and heard as they swam through shallow riffles just downstream of the boulder garden. Plate 2.1-10 shows an adult Arctic char swimming through a riffle below the boulder garden. The activity would alert crews of the presence of fish in the area, so they could easily be avoided.

Plate 2.1-10. An Arctic char swimming through a riffle just downstream of the boulder garden. Crews could easily see and hear these fish before they arrived at the work site.

Fish were also easily observed when they were in the boulder garden. Plate 2.1-11 shows an Arctic char trapped in the boulder garden prior to the enhancement work and Plate 2.1-12 shows an adult Arctic char struggling upstream of the staging area. Crews completed an extensive search for fish prior to working in any area. If fish were found in an area, crews would relocate to another area.

Section 4.1.2 and Appendix D, Figure D2. Construction Will Take Place after Snow Melt, and prior to Late Season Rains and the Arctic Char Upstream Migration Begins in Early August

The NNLP proposed that habitat enhancement be completed after snowmelt and before the Arctic char runs begin in early August. However, the work was scheduled for early September of 2012 for several reasons as discussed below.

The sampling program was amended in spring of 2012 when smolt outmigration monitoring was removed from the sampling program and was replaced with assessing adult survival (C. Hanks, pers. comm.; G. Williston, pers. comm.). Delaying the enhancement work to fall meant an additional year of baseline data focused on adult survival could be collected over the summer of 2012.

Plate 2.1-11. Arctic char trapped in the boulder garden were easily observed by crew members.

Plate 2.1-12. An Arctic char struggling upstream of the staging area.

The purpose of the enhancement was to improve fish passage through the boulder garden in low flow conditions. The NNLP scheduled the work for spring when water levels are high from snowmelt. Working in high flow conditions would have reduced the abilities of on-site biologists and engineers to assess the effectiveness of changes to boulder configuration and flow patterns. Working at low flow conditions meant that modifications could be assessed immediately, and improvements could be made where required.

The main concern with working instream in September was the presence of adult Arctic char and lake trout migrating through the boulder garden. However, previous studies show that they move through the boulder garden throughout the summer period; there is no ice-free time of year when the boulder garden is not used on a daily basis by adult fish (Rescan 2010c; Rescan 2011). The 2004 and 2005 fish fence programs are the only other years where sampling continued into September. In both 2004 and 2005, the peak of the run of both Arctic char and lake trout was in August, and fish numbers in September were similar to those in spring. In addition, juvenile fish rearing in the boulder garden move back into the lake in late August and September (Golder 2008), so these fish may have been less numerous in the boulder garden during the work period. Consequently, working instream in September was not anticipated to cause a disturbance to more fish than an earlier work window and resulted in more effective modifications to the boulder garden.

2.2 E09 ENHANCEMENT

Juvenile Arctic char hatch in Roberts Lake in the spring of each year and spend three to eight years rearing in fresh water before they begin annual migrations to the ocean (Swanson et al. 2010). At the time of first ocean migration Arctic char smolts are 152 to 300 mm fork length, so they are vulnerable to predation throughout their early years of life (Scott and Crossman 1973; Golder 2008). Some juvenile fish utilize small tributaries where they can rear and are exposed to lower rates of predation than in lake environments (Hunter 1976).

Baseline studies found that there are limited tributaries that provide juvenile Arctic char rearing habitat within the Roberts Lake system (Golder 2007, 2008). Many tributaries dry completely in the summer and have barriers that restrict fish movement. Increasing the amount of rearing habitat for juvenile Arctic char in certain tributaries could increase the overall production of smolts from the system.

There are several naturally existing pools along streams E09 and E10 and the new enhancement pools were designed to mimic these pools. This section of E09 is a non-alluvial channel and the presence of natural pools in the same reach suggests that the enhancement pools should not be subject to infilling (Golder 2007). The key measure of success is to demonstrate that the created rearing habitat supports greater densities of rearing fish than adjacent natural sections of the stream.

Section 4.1.6 of the NNLP presents the design of the enhancement for Roberts Lake tributary E09. To increase the rearing capacity of E09, two additional pools were designed just upstream of the confluence with E10. Figures A4-1 and A4-2 (Appendix 2) show the design and provide notes on the specifications for construction.

The work at E09 was completed between July 27 and September 8, with the majority of the instream work completed between July 30 and August 5, 2012. A Rescan biologist was present at all times to complete and monitor the work. True North Geomatics Ltd. surveyed the site with a Leica GPS900 RTK GNSS system to provide as-built drawings. Figure 2.2-1 presents a survey of the site following construction of the habitat enhancement.

The following section presents the requirements of stream E09 enhancement listed in Section 4.1 of the NNLP followed by details on how each requirement was met.

Section 4.1.6. Construction Will Take Place in Summer after Mid-August

The instream work was completed primarily between July 30 and August 5, 2012. The work was originally scheduled for after mid-August so that the ground would be defrosted. The work commenced earlier than scheduled, but the ground had thawed and no problems were encountered.

Section 4.1.6 and Appendix D, Figure D9. Construction Will Be Completed without the Use of Heavy Ground Equipment

No heavy ground equipment was used at any time. Digging was completed using hand tools and manual labour. Consequently, damage to the tundra was limited to the impacts of foot traffic.

The ground in the work area was primarily made up of dense root masses of grasses, sedges and willows. Plate 2.2-1 shows an example of a root wad. These dense root wads were cut using a hand saw, pried out with shovels, loaded into mega bags, and removed from site by helicopter.

Plate 2.2-1. Dense root masses needed to be cut using hand saws, were loaded into mega bags, and removed from sites.

Section 4.1.6 and Appendix D, Figure D9. Construction Areas Shall Be Isolated from Stream Flow by Silt Barriers to Control Suspended Sediments within the Work Area

Silt fences were used to isolate the work areas and to minimize the release of turbidity into the creek. Each pool was constructed in sections and flow was maintained around the site. Plate 2.2-2 shows active work area on the right hand side, isolated from the creek by silt fences. This silt fence was left in place for four weeks after the completion of work so that most of the sediment would fall out of suspension before it was reconnected with the main channel.

PROJECT # 1009-008-11 ILLUSTRATION # a38451c_T December 17, 2012

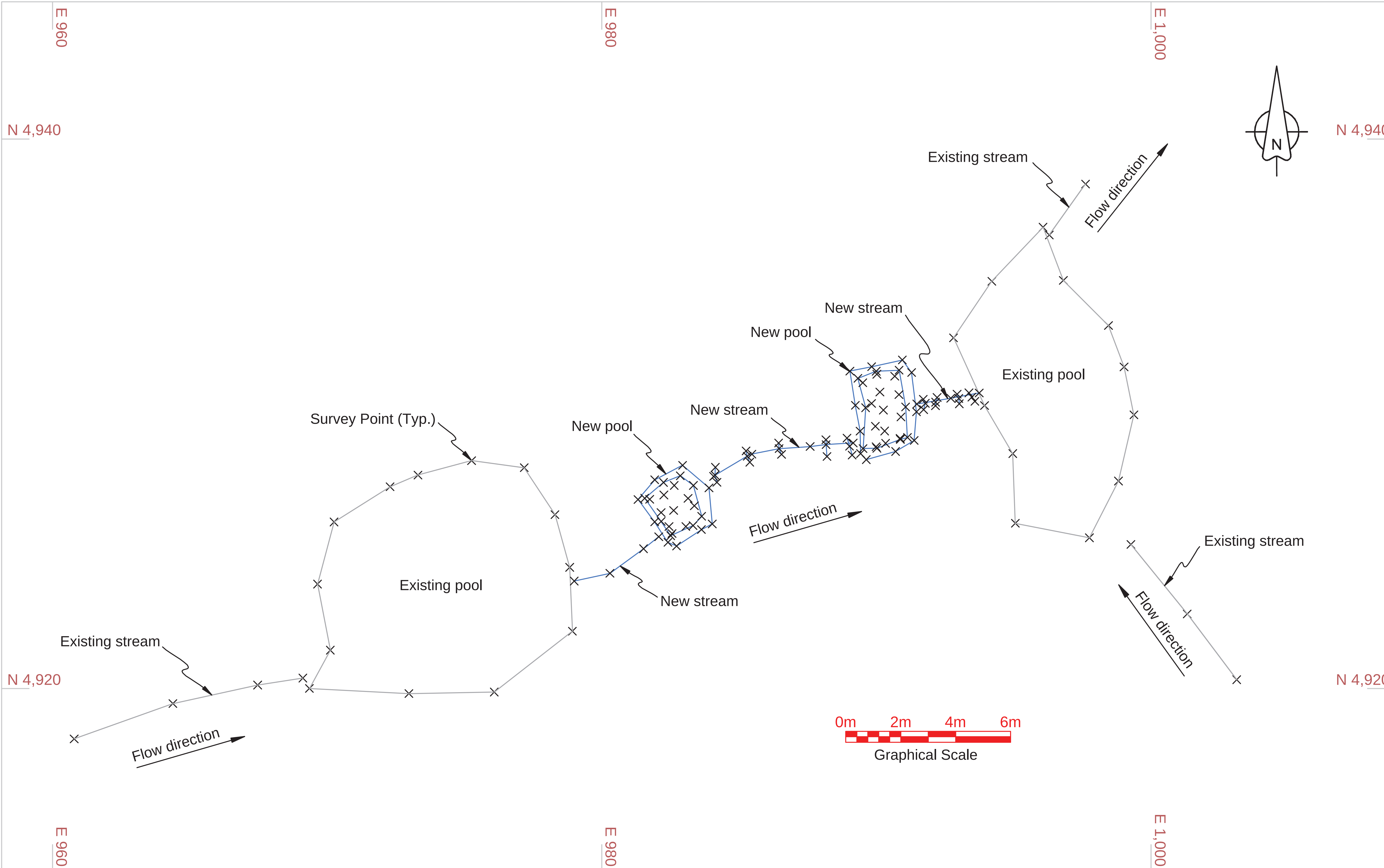


Figure 2.2-1

Topographic Survey of Fish Habitat at Stream E09

Plate 2.2-2. The work area (right) was effectively isolated from the flowing channel (left) using silt fences. This kept downstream turbidity within acceptable levels.

Turbidity was sampled using a LaMotte 2020e portable turbidity meter. The turbidity meter was calibrated using a blank and a 1 NTU and 10 NTU turbidity standard before each use. Once a sample was taken, the sample tube was cleaned to remove liquid and fingerprints from the outside of the tube. The sample tubes were rinsed thoroughly between samples. The sampling protocol followed the *Ambient Freshwater and Effluent Sampling: Water and Wastewater Sampling* (Clark 2003).

Turbidity monitoring stations were established before work began to monitor the impacts of the work downstream and so that impacts could be proactively managed during the work if mitigation proved ineffective. A sample site was located in the main channel at a naturally occurring pool upstream of the work site (TS1). This site acted as a control as it would not be impacted by the work. Sample sites were located within both newly constructed pools, inside the sediment control structures (TS2 and TS3). These sites were sampled to monitor the turbidity levels inside the work area. A sample site was located in the main channel in an existing natural pool just downstream of the work site (TS4). The final sample site was located in the main channel approximately 150 m downstream of the work area.

Appendix 3 presents the turbidity data collected over the work period. Turbidity increased to very high levels within the work areas. However, site isolation meant that turbidity release into the creek was limited. Table 2.2-1 summarizes the turbidity readings over the work period.

Table 2.2-1 presents turbidity data recorded at monitoring stations upstream, in and downstream of the work site. Turbidity was extremely high at the sites inside the sediment barriers (TS2 and TS3). Turbidity did slightly increase at sites downstream of the work area (TS4 and TS5) when compared to the upstream site (TS1). However, the increases were minimal and the isolation proved very effective. The dense nature of the substrate in the work area (Plate 2.2-1) meant that silt fences could be used to create a tight seal with very little loss of turbid water. In addition, the volume of flow in the stream was low and it was easily directed around the work area.

Table 2.2-1. Turbidity Monitoring Site Results at E09 during Instream Work, July 30 to August 5

Site Location	Site Code	Zone	Easting	Northing	n	Mean (NTU)	SD	SE	CI
U/S existing pool	TS1	13 W	440901	7559410	19	2.9	1.32	0.30	0.63
U/S new pool	TS2	13 W	440906	7559411	12	1000.7	940.71	271.56	597.70
D/S new pool	TS3	13 W	440915	7559415	15	553.4	599.93	154.90	332.23
D/S existing pool	TS4	13 W	440919	7559414	19	9.6	5.45	1.25	2.63
150 m D/S of work site	TS5	13 W	441033	7559475	19	3.0	0.94	0.22	0.45

U/S = upstream, D/S = downstream, n = number of turbidity samples, NTU = nephelometric turbidity units, SD = standard deviation, SE = standard error of the mean, CI = confidence interval (95%)

Turbidity was recorded again on September 5. These samples showed that turbidity had returned to background levels at all sampling sites.

<u>Appendix D, Figure D9. Habitat Compensation Shall Be Laid Out at Site by a Qualified Person</u>

A fish biologist with construction monitoring and habitat enhancement experience laid out the site and was on-site throughout the work. The site layout closely followed the design in the NNLP, as there were no major deviations from the plan.

<u>Appendix D, Figure D9. Two Pools Shall Be Excavated in a Suitable Portion of the Lower Reach of the Stream. Pools Shall Typically Be 2 m in Length and > 2 m in Width (4 m² Required Area per Pool); Pools Shall Be Excavated to 1 m on Either Side of the Existing Channel Banks; and Pools Shall Be Excavated to Approximately 0.1 to 0.2 m below the Natural Streambed.</u>

The NNLP required that each pool be at least 4 m^2. Figure 2.2-1 is a survey of the site following the construction of the two new pools and shows that both pools are larger than this size; the upstream pool is 5 m^2 and the downstream pool is 6.7 m^2, providing 3.7 m^2 of habitat above the requirements of the NNLP.

The channel through this area was poorly defined prior to the enhancement. Plate 2.2-3 shows the enhancement area before work started. Water was seeping through vegetation over an area several metres wide. Flow was widely dispersed and very shallow and would have restricted fish movement under most flow conditions. The lack of a defined channel meant there were no existing channel banks to define where the ponds should be located so they were positioned in the centre of the lowest point in the channel. As previously described, the pools were dug in sections and flow was diverted around the work area to reduce the release of sediment into the creek.

A small channel was created upstream and downstream of the ponds to connect them to the nearest naturally occurring ponds in the area. As previously described, dense vegetation and dispersed flow reduced connectivity through the area. The new channel will permit the movement of fish through the area even in low flow conditions. Plate 2.2-4 shows the newly constructed channel flowing between the two new pools.

The average depth of the new upstream pool is 0.19 m below the natural streambed and the average depth of the downstream pool is 0.18 m below the natural streambed.

Plate 2.2-3. There was not a defined channel through the area prior to enhancement.

Plate 2.2-4. The new channel will allow fish to move through the area in low flow conditions.

Appendix D, Figure D9. Pools Shall Be Excavated around Boulders Which are too Large to Move (Typically > 0.40 m). Boulders Shall Be Excluded from the Total Required Area of the Pools

No boulders were encountered when digging the new pools. The substrate consisted of a mixture of root mass and fine sediments.

Appendix D, Figure D9. Excavated Material Shall Be Disposed of by Stockpiling in an Area above the High Water Level of the Stream

The root masses and soils dug from the new ponds were loaded into mega bags and slung from site by helicopter. Eight mega bags were removed with an approximate total weight of 2000 kg. The material was used in reclamation at other locations.

Appendix D, Figure D9. Constructed Pools Are to Mimic Natural Pools as Best Possible. Natural Features Such as Bank Overhangs, Vegetation and Boulders Shall Be Present in the Constructed Pools; Suitable, Naturally Occurring Rock Shall Be Placed in the Pools to Provide Bed and Bank Stabilization, and Cover for Fish; and Prior to Excavation of the Pools, Aquatic and Waters Edge Vegetation Will Be Harvested for Transplanting to the Excavated Pools.

The pools were constructed so that they mimicked other naturally formed pools in the area. Two mega bags of local, naturally occurring cobbles and boulders were slung to the site by helicopter and were used to enhance the site. The newly constructed channel that connected the pools was partly lined with rock and some small weirs were installed. These weirs were designed to provide additional habitat for fish. In addition, the focused flow and rock will prevent the channel becoming overgrown with vegetation. Plate 2.2-5 shows a rock weir constructed in the new channel.

Plate 2.2-5. A small rock weir installed in the new channel will provide additional fish habitat.

Vegetation was harvested from the site prior to the excavation of the pools. Some of this vegetation was transplanted along the banks and into the new pools to improve bank stability and to improve the habitat quality of the pools.

3. Summary

3. Summary

The enhancement at Roberts Outflow boulder garden was completed between September 3 and 10, 2012. Enhancement at stream E09 was completed between July 27 and September 8, with the majority of the instream work completed between July 30 and August 5, 2012.

All work was completed without any environmental incidents. The sites were laid out and monitored throughout each project by QEPs. Each requirement listed in the NNLP was met or exceeded, and modifications made to the plan were done under consultation with a water resources engineer and biologist.

The NNLP required the construction of a channel through a section of the boulder garden identified as a “stranding zone”. The original plan proposed the construction of a single channel 12 to 15 m in length. However, four channels were built, with a total length of 69 m, to provide alternative routes for fish in the event that the structural integrity of the channel designed in the NNLP deteriorated over time. The channels were installed so that they will be resistant to erosion and will require little ongoing maintenance. In addition, they should allow fish to pass through the area more quickly and provide additional routes to avoid predators.

Field crews working at the fish fences at Roberts Outflow observed fish struggling for extended periods in the boulder garden prior to the enhancement work. Within two days of the completion of the first channel, 61 fish successfully made it through the boulder garden. Many of these fish were observed passing through the area, and they exclusively chose the new channels over the existing options. In addition, these fish made it through the boulder garden with little delay. Although anecdotal, the observations made by crews strongly suggests that the new channels provide excellent fish passage corridors through the boulder garden.

The enhancement work at E09 created two pools with a total area of 11.7 m^2, exceeding the requirements of the NNLP by 3.7 m^2. Considering the nature of the substrate at E09, sediment control proved successful. Turbidity within the isolated work areas was high, but this did not significantly impact the turbidity levels in the stream.

References

References

Ayers, P. D. 1994. Environmental damage from tracked vehicle operation. *Journal of Terramechanics* 31 (3):173-183.

Clark, M. J. R., ed. 2003. Ambient Freshwater and Effluent Sampling. In *British Columbia Field Sampling Manual: For Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples*. Part E: Water and Wastewater Sampling. Water, Air and Climate Change Branch, British Columbia Ministry of Water, Land and Air Protection: Victoria, BC. http://www.env.gov.bc.ca/wsd/data_searches/field_sampling_manual/field_man_pdfs/amb_fresh_eff.pdf (accessed October 2012).

Hunter, J. G. 1976. Arctic char and hydroelectric power in the Sylvia Grinnell River. Fisheries Research Board of Canada, Manuscript Report No. 1376.

Golder. 2007. *Doris North Project "No Net Loss" Plan*. Prepared for Miramar Hope Bay Ltd. by Golder Associates Ltd.

Golder. 2008. *Doris North Project aquatic studies, 2007*. Prepared for Miramar Hope Bay Ltd. by Golder Associates Ltd.

Kevan, P.G., B. C. Forbes, S. M. Kevan and V. Behan-Pelletier. 1995. Vehicle tracks on high Arctic tundra: their effects on the soil, vegetation, and soil arthropods. *Journal of Applied Ecology* 32:655-667.

Rescan. 2010a. *Hope Bay Belt Project: Updates to the Doris North No Net Loss Plan for Tail Lake*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.

Rescan. 2010b. *Hope Bay Belt Project: Updates to the Doris North No Net Loss Plan for Tail Outflow*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.

Rescan. 2010c. *2009 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.

Rescan. 2011. *Doris North Gold Mine Project: Roberts Outflow and E09 Fish Habitat Enhancement Report*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.

Rescan. 2012. *Doris North Gold Mine Project: Roberts Outflow and E09 Fish Habitat Enhancement Report*. Prepared for Hope Bay Mining Limitedtd. by Rescan Environmental Services Ltd.

Sautner, J., L. J. Vining, and L. A. Rundquist. 1984. An evaluation of the passage conditions for adult salmon in sloughs and side channels of the middle Susitna River. In *Aquatic Habitat and Instream Flow Investigations*. Ed. C. C. Estes and D. S. Vincent-Lang. Anchorage.

Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. *Fisheries Research Board of Canada* 61 (1): 201-207.

Swanson, H. K., K. A. Kidd, J. A. Babaluk, R. J. Wastle, P. P. Yang, N. M. Halden, and J. D. Reist. 2010. Anadromy in Arctic populations of lake trout (*Salvelinus namaycush*): otolith microchemistry, stable isotopes, and comparisons to Arctic char (*S. alpinus*). *Can J Fish Aquat Sci* 67: 842-853.

Thompson, K. 1972. Determining stream flows for fish life. In *Proc. Instream Flow Requirement Workshop*. 31-50. Pacific Northwest River Basins Commission. Vancouver, WA.

Wright, D. G. and G. E. Hopky. 1998. *Guidelines for the use of explosives in or near Canadian fisheries waters*. Canadian Technical Report of Fisheries and Aquatic Sciences No. 2107: iv + 34p. Minister of Public Works and Government Services Canada: n.p.

Personal Communication

Hanks, C. 2012. Vice President Environmental Affairs, Hope Bay Mining Ltd., North Vancouver, BC. Personal Communication: June 2, 2012.

Williston, G. 2012. Habitat Management Biologist, Fisheries and Oceans Canada, Prescott, ON. Personal Communication: August 27, 2012.

Appendix 1

Daily Protocols for Fish Habitat Enhancement Projects

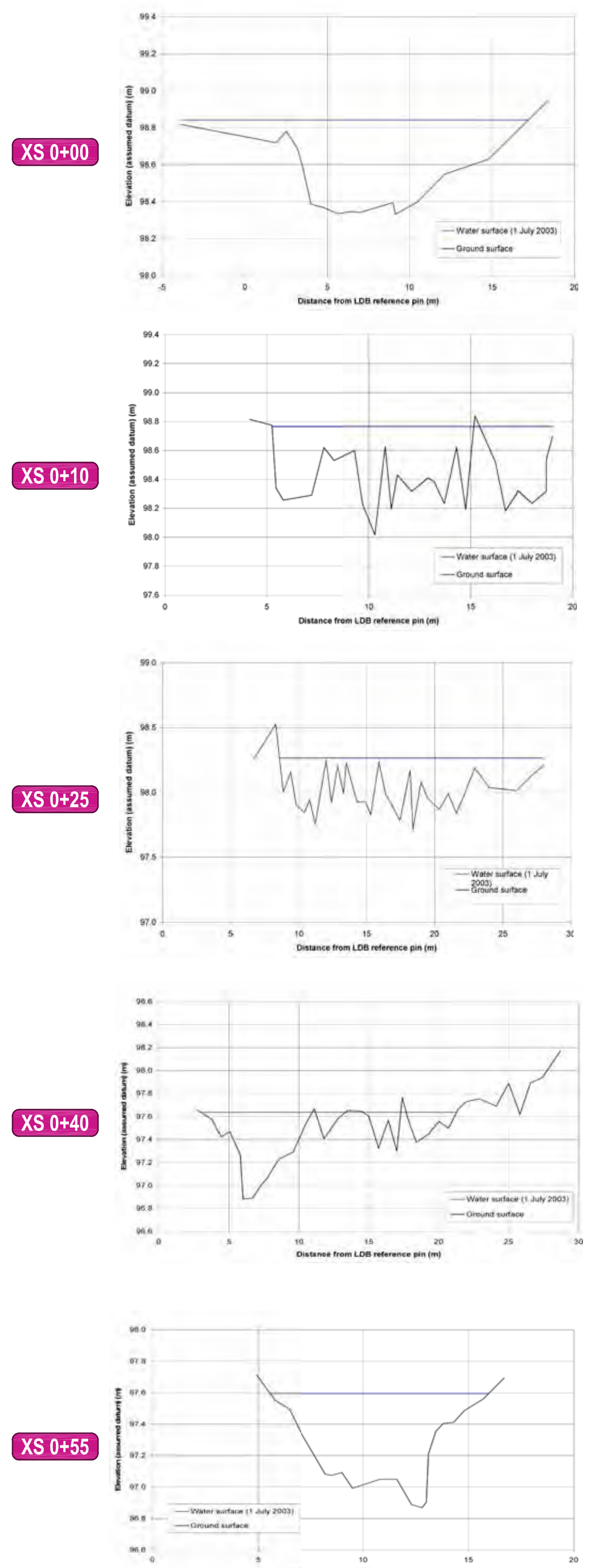
Appendix 1. Daily Protocols for Fish Habitat Enhancement Projects

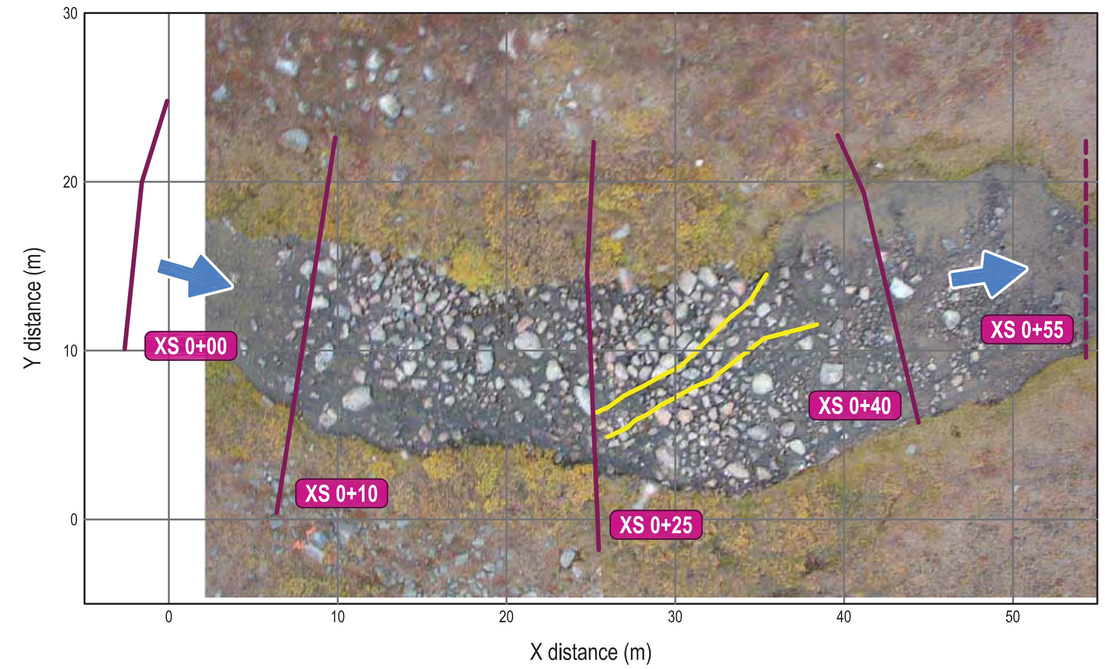
Task	Details
Daily safety, environmental and planning meeting with ESR	• Review the work plan, confirm environmental risks, and discuss processes pertaining to instream works • Review safety issues relevant to the site • Ensure field personnel are aware of sensitivities in the area where they are working • Ensure field personnel know who to call and/or where to find them in case of questions or incidents • Discuss the Halted Works Process if works are carried out instream or within aquatic setbacks
Identify environmentally sensitive areas	• Complete a thorough search for fish in and around boulder garden prior to the start of work in any area
Inspect erosion and sediment control measures	• Complete turbidity assessments • Ensure that erosion and sediment control measures are adequate and properly installed to perform expected function • Discuss the contingency plan in the event of a failure • Record locations of erosion and sediment control materials and ensure that they are in the appropriate places
Wildlife management	• Follow the task hazard analysis for wildlife encounters at all times • Ensure no garbage or waste is left behind at the end of every day • Document and report all dangerous wildlife observations • Test all safety and communication equipment before going to the field each day
Write a daily monitoring summary and send to appropriate supervisors	Include: • Any halted work reports • Any environmental incident reports • Work progress • Sampling reports

Appendix 2

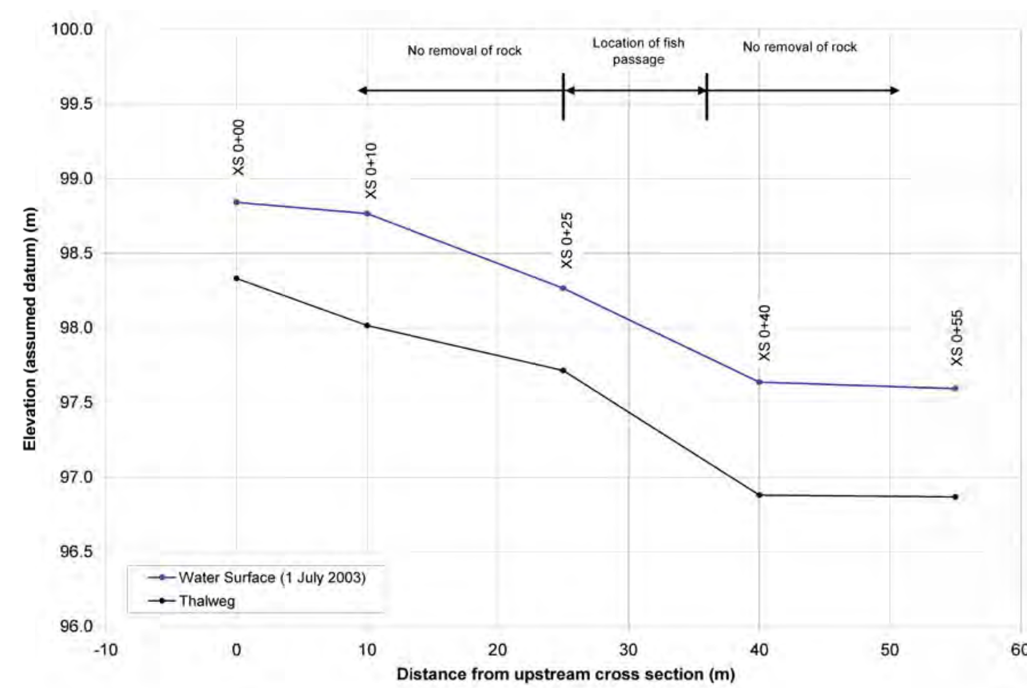
Design Drawings for Roberts Outflow Enhancement from the No Net Loss Plan

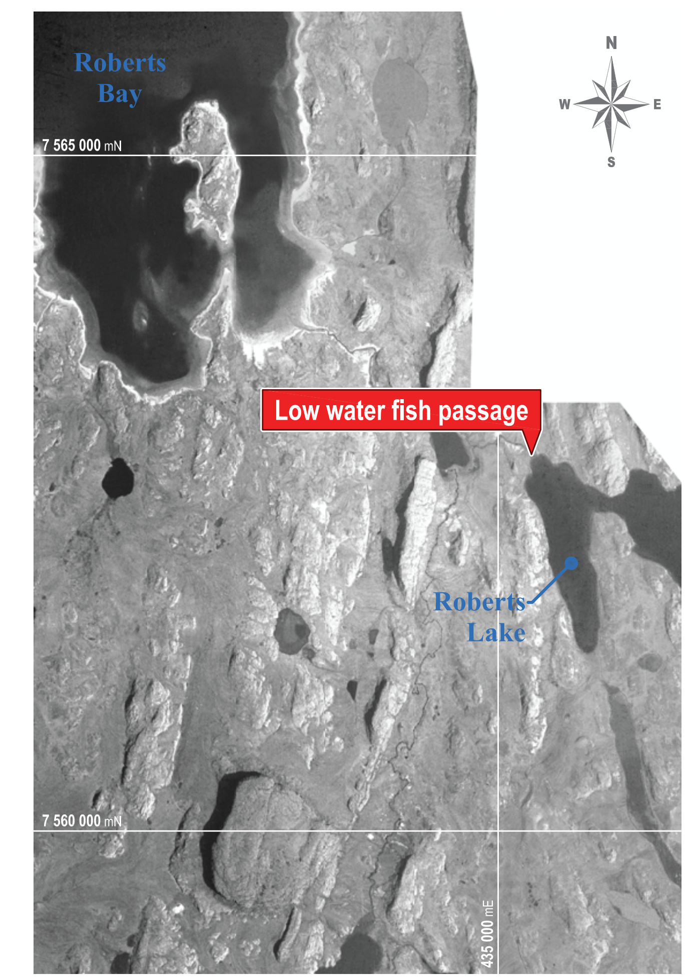
Rescan™
Engineers and Scientists





Low Water Fish Passage





Overview Plan

Scale 1 0 1 KM

LEGEND

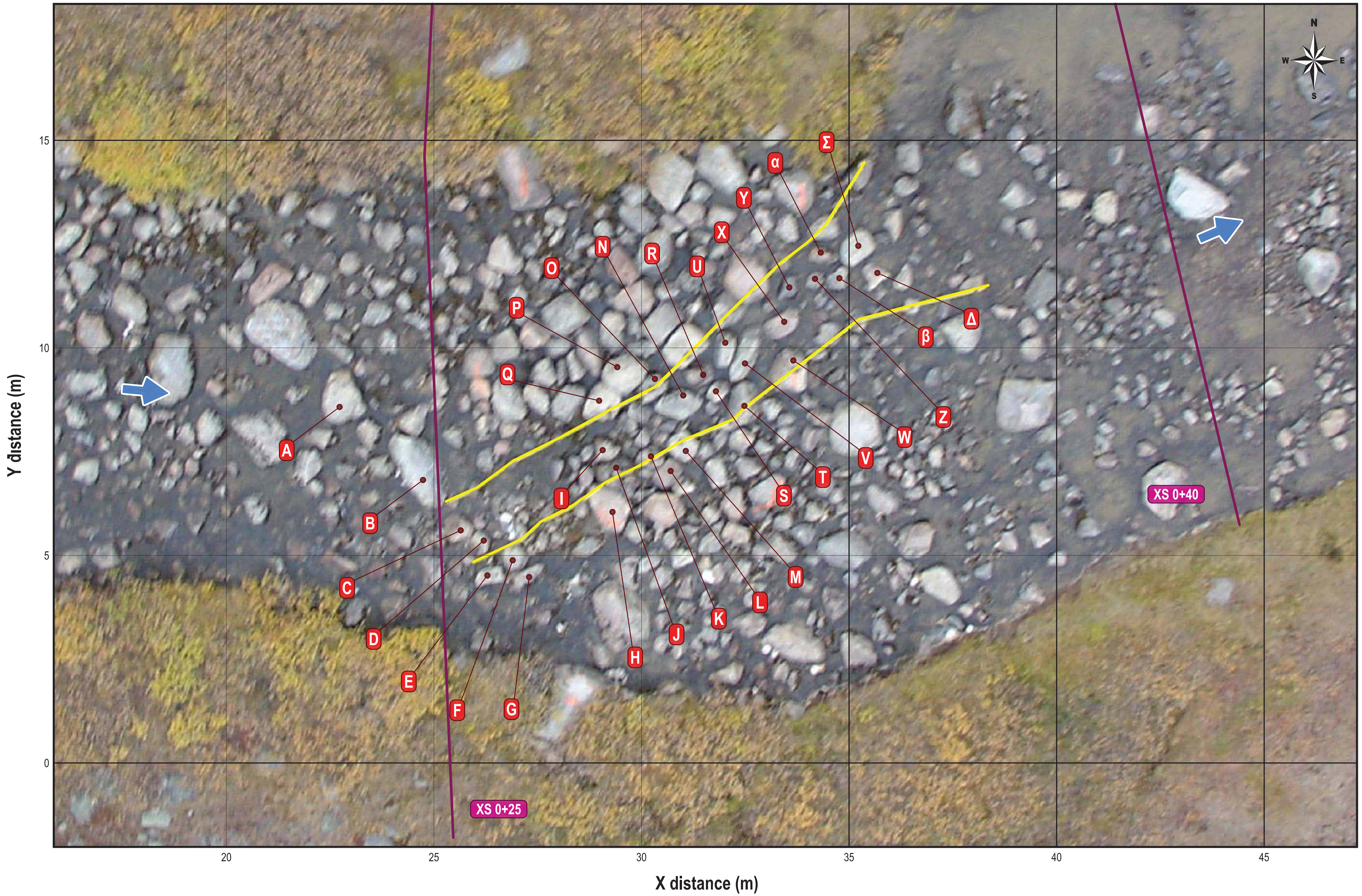
- Low water fish passage
- Cross section location
- Estimated cross section location
- Direction of flow

NEWMONT NORTH AMERICA Rescan Engineers & Scientists

Source: Golder Associates, 2007.

Figure A2-1

Overview of Roberts Lake Outflow Low Water Fish Passage Design



Low Water Fish Passage

LEGEND

- Low water fish passage
- Cross section location
- Estimated cross section location
- Direction of flow

Schedule of rocks to be removed from proposed fish passage.

Rock ID	Length (m)	Width (m)	Thickness (m)	Estimated weight (kg)
C	0.70	0.70	0.50	650
D	0.60	0.50	0.40	320
I	0.70	0.80	0.40	590
J	0.70	0.40	0.60	440
N	0.70	1.10	0.50	1020
R	0.70	0.70	0.60	780
S	0.60	0.50	0.60	480
T	1.00	0.70	0.70	1290
U	0.80	0.40	0.90	760
V	1.40	0.50	0.80	1480
X	0.90	0.50	0.50	590
Y	0.70	0.60	0.50	550
Z	0.50	0.50	0.40	260
α	0.60	0.70	0.40	440
β	0.60	0.70	0.40	440
Σ	0.80	0.70	0.60	890
Δ	0.60	0.60	0.40	380

Schedule of rocks not to be removed.

Rock ID	Length (m)	Width (m)	Thickness (m)	Estimated weight (kg)
A	1.3	1	0.6	2060
B	2.2	1.1	0.9	5750
E	0.5	0.9	0.35	420
F	0.7	0.6	0.5	550
G	1.1	0.6	0.4	700
H	1.4	1	0.6	2220
K	0.6	0.5	0.4	320
L	0.75	0.6	0.6	710
M	0.7	0.7	0.5	650
O	0.8	0.6	0.7	890
P	1	1	0.9	2380
Q	0.9	0.9	0.7	1500
W	1.2	0.8	0.9	2290

Instructions for removal

1. The low water fish passage shall be laid out in the field and the construction supervised by a qualified person.
2. Rocks can be removed from the fish passage by either helicopter or manual means.
3. Rocks outside of the fish passage shall be left in place.
4. Rocks removed from the fish passage shall be relocated downstream to suitable areas identified by a qualified person.
5. Voids in the streambed created by the removal of rocks shall be filled in, with smaller rocks, to maintain a level streambed.
6. Rocks upstream of XS 0+25 shall not be disturbed.
7. Construction shall be done in July 2008.

NEWMONT NORTH AMERICA

Rescan Engineers & Scientists

Source: Golder Associates, 2007.

Figure A2-2

Detailed Design for Roberts Lake Outflow Low Water Fish Channel

Appendix 3

Turbidity Data Collected at Stream E09

Rescan™
Engineers and Scientists

Appendix 3. Turbidity Data Collected at Stream E09

Site	Date	Time	Zone	Easting	Northing	Turbidity (NTU)
150 m downstream of work site	30-Jul-12	13:55	13 W	441033	7559475	1.8
150 m downstream of work site	31-Jul-12	11:20	13 W	441033	7559475	1.5
150 m downstream of work site	31-Jul-12	14:10	13 W	441033	7559475	1.8
150 m downstream of work site	1-Aug-12	8:45	13 W	441033	7559475	2.6
150 m downstream of work site	1-Aug-12	11:40	13 W	441033	7559475	2.4
150 m downstream of work site	1-Aug-12	14:10	13 W	441033	7559475	4.4
150 m downstream of work site	1-Aug-12	15:30	13 W	441033	7559475	4.2
150 m downstream of work site	2-Aug-12	8:50	13 W	441033	7559475	3.8
150 m downstream of work site	2-Aug-12	12:40	13 W	441033	7559475	4.1
150 m downstream of work site	2-Aug-12	15:20	13 W	441033	7559475	3.5
150 m downstream of work site	4-Aug-12	8:20	13 W	441033	7559475	4.0
150 m downstream of work site	4-Aug-12	9:50	13 W	441033	7559475	3.6
150 m downstream of work site	4-Aug-12	12:00	13 W	441033	7559475	3.0
150 m downstream of work site	4-Aug-12	14:55	13 W	441033	7559475	2.8
150 m downstream of work site	5-Aug-12	8:55	13 W	441033	7559475	2.4
150 m downstream of work site	5-Aug-12	11:15	13 W	441033	7559475	2.2
150 m downstream of work site	5-Aug-12	14:40	13 W	441033	7559475	4.1
150 m downstream of work site	8-Sep-12	9:20	13 W	441033	7559475	3.0
150 m downstream of work site	8-Sep-12	11:10	13 W	441033	7559475	2.0
Downstream existing pool	30-Jul-12	13:40	13 W	440919	7559414	2.0
Downstream existing pool	31-Jul-12	11:05	13 W	440919	7559414	4.4
Downstream existing pool	31-Jul-12	14:05	13 W	440919	7559414	5.1
Downstream existing pool	1-Aug-12	8:35	13 W	440919	7559414	3.8
Downstream existing pool	1-Aug-12	11:30	13 W	440919	7559414	10.2
Downstream existing pool	1-Aug-12	13:55	13 W	440919	7559414	18.2
Downstream existing pool	1-Aug-12	15:20	13 W	440919	7559414	14.2
Downstream existing pool	2-Aug-12	8:40	13 W	440919	7559414	8.8
Downstream existing pool	2-Aug-12	12:15	13 W	440919	7559414	14.2
Downstream existing pool	2-Aug-12	15:10	13 W	440919	7559414	11.4
Downstream existing pool	4-Aug-12	8:10	13 W	440919	7559414	8.8
Downstream existing pool	4-Aug-12	9:45	13 W	440919	7559414	10.4
Downstream existing pool	4-Aug-12	11:55	13 W	440919	7559414	14.4
Downstream existing pool	4-Aug-12	14:40	13 W	440919	7559414	12.2
Downstream existing pool	5-Aug-12	8:50	13 W	440919	7559414	7.1
Downstream existing pool	5-Aug-12	11:05	13 W	440919	7559414	6.8
Downstream existing pool	5-Aug-12	14:30	13 W	440919	7559414	22.4
Downstream existing pool	8-Sep-12	9:10	13 W	440919	7559414	3.6
Downstream existing pool	8-Sep-12	11:00	13 W	440919	7559414	4.1
Downstream new pool	1-Aug-12	11:30	13 W	440915	7559415	645.2
Downstream new pool	1-Aug-12	13:55	13 W	440915	7559415	1244.5
Downstream new pool	1-Aug-12	15:20	13 W	440915	7559415	1330.4
Downstream new pool	2-Aug-12	8:40	13 W	440915	7559415	62.8

Appendix 3. Turbidity Data Collected at Stream E09

Site	Date	Time	Zone	Easting	Northing	Turbidity (NTU)
Downstream new pool	2-Aug-12	12:15	13 W	440915	7559415	1829.4
Downstream new pool	2-Aug-12	15:00	13 W	440915	7559415	1224.0
Downstream new pool	4-Aug-12	8:10	13 W	440915	7559415	121.8
Downstream new pool	4-Aug-12	9:45	13 W	440915	7559415	166.2
Downstream new pool	4-Aug-12	11:55	13 W	440915	7559415	204.4
Downstream new pool	4-Aug-12	14:40	13 W	440915	7559415	448.8
Downstream new pool	5-Aug-12	8:50	13 W	440915	7559415	64.4
Downstream new pool	5-Aug-12	11:05	13 W	440915	7559415	55.1
Downstream new pool	5-Aug-12	14:30	13 W	440915	7559415	869.2
Downstream new pool	8-Sep-12	9:10	13 W	440915	7559415	1.9
Downstream new pool	8-Sep-12	10:55	13 W	440915	7559415	33.5
Upstream existing pool	30-Jul-12	13:30	13 W	440901	7559410	2.4
Upstream existing pool	31-Jul-12	11:00	13 W	440901	7559410	3.5
Upstream existing pool	31-Jul-12	14:00	13 W	440901	7559410	1.8
Upstream existing pool	1-Aug-12	8:30	13 W	440901	7559410	2.2
Upstream existing pool	1-Aug-12	11:30	13 W	440901	7559410	3.1
Upstream existing pool	1-Aug-12	13:55	13 W	440901	7559410	3.3
Upstream existing pool	1-Aug-12	15:20	13 W	440901	7559410	2.3
Upstream existing pool	2-Aug-12	8:40	13 W	440901	7559410	4.2
Upstream existing pool	2-Aug-12	12:10	13 W	440901	7559410	2.1
Upstream existing pool	2-Aug-12	15:00	13 W	440901	7559410	2.9
Upstream existing pool	4-Aug-12	8:00	13 W	440901	7559410	1.9
Upstream existing pool	4-Aug-12	9:45	13 W	440901	7559410	2.4
Upstream existing pool	4-Aug-12	11:45	13 W	440901	7559410	5.2
Upstream existing pool	4-Aug-12	14:40	13 W	440901	7559410	2.3
Upstream existing pool	5-Aug-12	8:45	13 W	440901	7559410	1.7
Upstream existing pool	5-Aug-12	11:00	13 W	440901	7559410	3.9
Upstream existing pool	5-Aug-12	14:10	13 W	440901	7559410	1.9
Upstream existing pool	8-Sep-12	9:00	13 W	440901	7559410	6.8
Upstream existing pool	8-Sep-12	10:45	13 W	440901	7559410	2.2
Upstream new pool	2-Aug-12	8:40	13 W	440906	7559411	144.2
Upstream new pool	2-Aug-12	12:15	13 W	440906	7559411	345.8
Upstream new pool	2-Aug-12	15:00	13 W	440906	7559411	1294.7
Upstream new pool	4-Aug-12	8:00	13 W	440906	7559411	244.9
Upstream new pool	4-Aug-12	9:45	13 W	440906	7559411	1863.3
Upstream new pool	4-Aug-12	11:45	13 W	440906	7559411	2204.4
Upstream new pool	4-Aug-12	14:40	13 W	440906	7559411	2339.9
Upstream new pool	5-Aug-12	8:45	13 W	440906	7559411	88.2
Upstream new pool	5-Aug-12	11:00	13 W	440906	7559411	1808.8
Upstream new pool	5-Aug-12	14:25	13 W	440906	7559411	1669.9
Upstream new pool	8-Sep-12	9:00	13 W	440906	7559411	2.4
Upstream new pool	8-Sep-12	10:45	13 W	440906	7559411	1.9