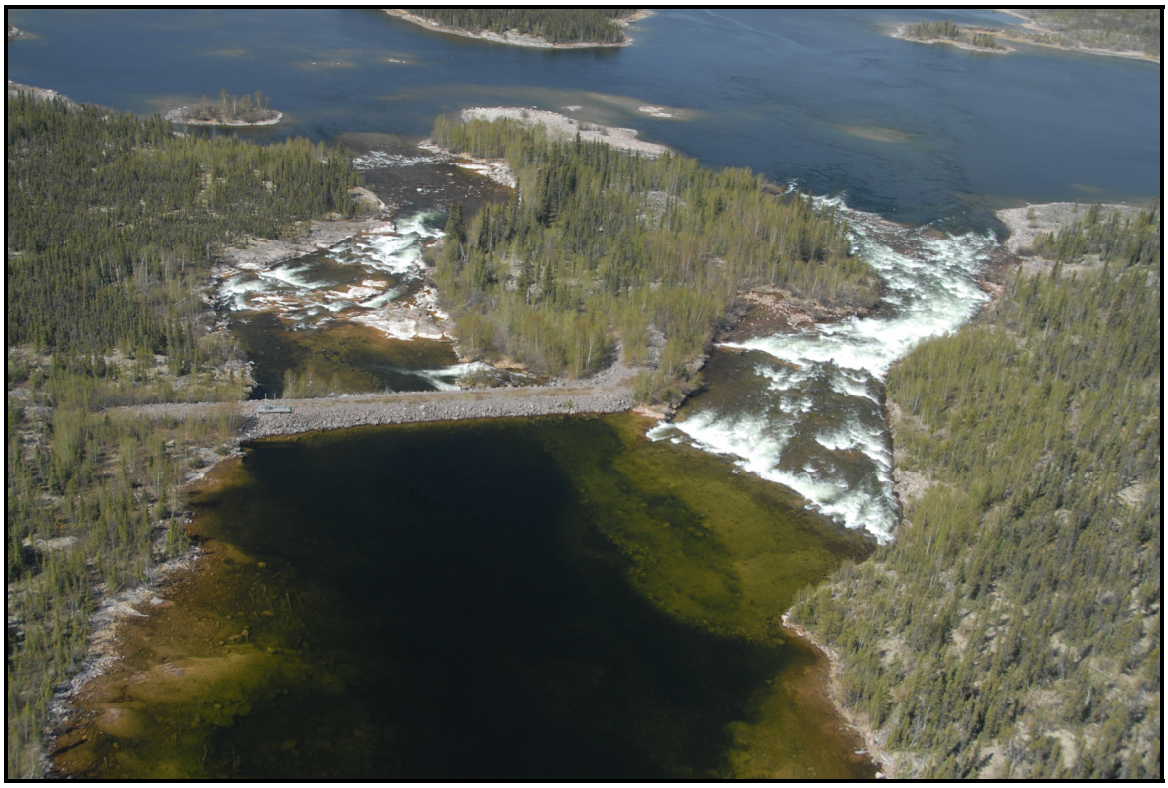
Dezé Energy Corporation Ltd.
Taltson River Hydroelectric Expansion Project



July 2008 Habitat Assessment for Instream Works Locations: Nonacho Lake and North Gorge

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SCIENCE ▪ TECHNICAL ▪ ENVIRONMENTAL MANAGEMENT ▪ GRAPHIC MEDIA

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1. INTRODUCTION

The Taltson Hydroelectric Expansion Project (Project) is a development that proposes to add a new 56 MW power plant to the existing 18 MW Taltson Twin Gorges Plant. The Project would interlink the expanded generation facility through approximately 700 km of new transmission line to supply hydropower to the Ekati, Diavik and Snap Lake mines and the proposed Gahcho Kué diamond mine.

1.1 Background and Rationale

The construction of the proposed power facility will require the following key infrastructure components:

- A new 56 MW hydroelectric station at Twin Gorges, utilizing the existing plant Forebay and the full elevation difference between the Forebay and the Taltson River (40 m) below Elsie Falls via a new 1,250 m intake canal, penstocks and tailrace canal;
- A new gated control structure at the outlet of Nonacho Lake, including a micro-hydro plant for site-generated power and decommissioning of the existing control and spillway;
- Interconnection of the new generating station with the existing 18 MW Twin Gorges generation plant in a new 115/161 kV switchboard at Twin Gorges;
- Approximately 700 km of new transmission line; and
- Four new substations, one at each mine site.

Of the above noted infrastructure components, the creation of the 1,250 m intake canal (referred to as "the North Gorge") and gated control structure and associated works at the outlet of Nonacho Lake would be the only two components requiring in-stream construction activities. Figure 1 illustrates the locations of the Nonacho dam and Twin Gorges (North Gorge location) within the Project area.

The construction of the transmission line is considered to be a relatively low risk activity with respect to fish and fish habitat due to the proposed construction methods, which will be administered under the existing Department of Fisheries and Oceans Canada Operational Statements for Overhead Line Transmission.

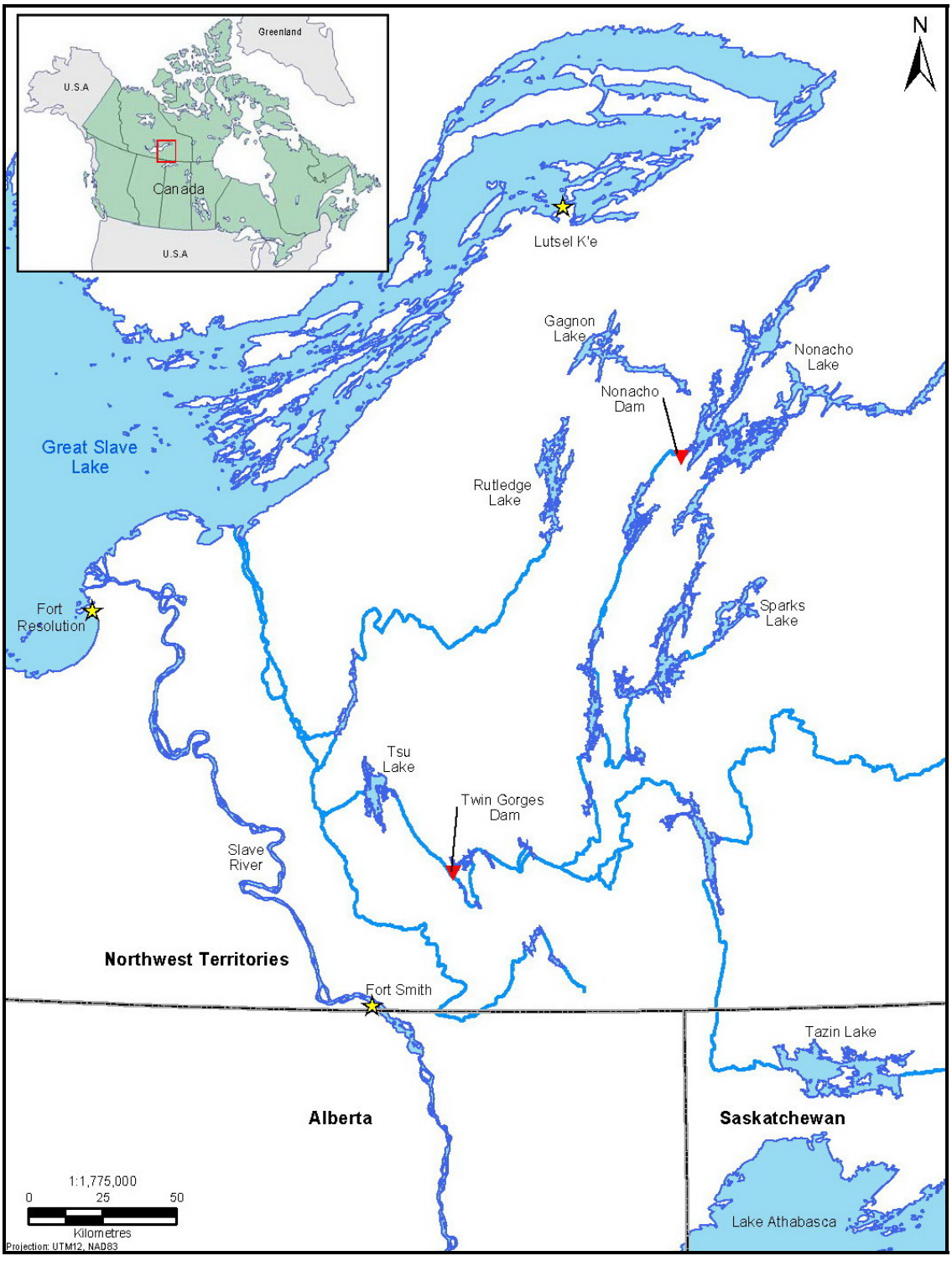

Figure 1. Location of the Nonacho Dam and the Twin Gorges Dam (North Gorge Canal).

1.2 Objectives

Project components associated with the construction of the proposed generating facility have potential to interact with the aquatic environments at the Nonacho control structure and the North Gorge. The objective of this report is to confirm, expand and quantify fish habitat at these two locations. This report describes the:

- Project components in relation to fish and fish habitat;
- Methodologies used to identify the existing aquatic habitat at the Nonacho control structure and the North Gorge to define spatial boundaries;
- Habitat present at the Nonacho control structure and the North Gorge; and
- Probable fish communities that rely on habitats at the Nonacho control structure and the North Gorge to carry out at least one stage of their life history.

2. ASSESSMENT METHODOLOGY

An overview assessment of the aquatic habitat associated with the Nonacho control structure and the North Gorge was carried out by Arc Environmental Ltd. on August 14, 2007. Follow up assessments at these sites were completed by Cambria Gordon Ltd. (CGL) on July 4 and 7, 2008 to identify what habitat is available and if any fish species present within the area may be using these sites for critical life history stages including spawning or juvenile rearing.

The fish and fish habitat assessment was carried out in 2 phases: a desktop review followed by a field program. As part of the desktop review, the 2003 and 2004 Taltson Hydro Project Water Effects Monitoring Program reports (Rescan, 2004; Rescan, 2005) were used to prepare a complete species composition list of fish that could potentially be present at the sites.

Habitat typing of the areas upstream and downstream from the Nonacho dam and spillway and at the North Gorge intake and outlet locations was completed at the desktop level by analyzing a series of low level aerial photographs (taken June 4, 2008 by Cambria Gordon Ltd.).

Each habitat type was then assessed on the ground to determine if any of the potential fish species, identified at the desktop level, may be using the area for at least one of their critical life history stages.

The field habitat assessment was completed through an evaluation of velocity and depth conditions, as well as substrate, cover and vegetation. As a result of the comprehensive fish sampling efforts that have been completed in the general area during previous field programs, no

additional sampling was required as part of the CGL 2008 assessment to establish species presence; however a combination of electro-fishing and snorkel surveys were used to collect additional information on fish use. The sampling conditions varied widely between each habitat type, and assessment methodologies were tailored to accurately evaluate the aquatic habitat at each location.

At the Nonacho Dam, high velocities within the spillway channel, in the mainstem channel below the rock-fill dam and along the outlet of the new control structure restricted the obtainable information to visually observable characteristics of substrate and vegetation types and estimates of depths. Sampling efforts at the inlet of the intake canal incorporated a half hour snorkel survey completed by 2 people, which extended approximately 50 m both up and downstream, in addition to a series of linear transects to describe the vegetation (submergent and emergent communities), depth and substrate conditions and confirm fish presence in the area.

The field assessments completed at the proposed North Gorge intake canal location in the Forebay and at the proposed canal tailrace outlet location downstream on the Taltson River involved a qualitative analysis along with a half hour snorkel survey around the proposed intake location and existing Twin Gorges Dam.

3. NONACHO CONTROL STRUCTURE

3.1 Project Interactions

The existing Nonacho Lake control structures were constructed in 1968 and consist of a rock-fill dam, three timber lined sluice gates and a rock channel spillway. The dam and the sluice gates are nearing the end of their serviceable life. As the Project would require greater controlled releases from Nonacho Lake than is currently possible through the timber sluice gates, a new control structure has been designed to replace the existing gates. The new structure will be comprised of the following components:

- A short intake canal in rock from Nonacho Lake at a point upstream of the left abutment of the existing dam;
- A concrete structure housing four gated sluice passages; and
- A rock cut canal downstream of the gates to the existing release channel downstream of the dam.

As part of the proposed Project and in addition to the new control facility, instream work activities will also include the repair of the dam to reduce the leakage, the decommissioning of the sluice gates and a small concrete raise placed on the crest of the existing spillway.

The construction activities have the potential to interact with the aquatic environment at three specific locations:

1. The in-stream habitats immediately up and downstream of the inlet and outlet of the new control structure canal;
2. The in-stream and shoreline habitats immediately above the existing rock fill dam extending approximately 50 m to the outlet of the new control structure; and
3. The instream habitat immediately upstream and downstream of the spillway.
4. In addition, the raised spillway has potential to increase the frequency of zero flows overtopping the spillway. Therefore the instream habitat throughout the spillway channel may also be affected by the Project.

3.1.1 Control Structure Intake and Outlet

The intake canal is situated on river left, with the inlet located approximately 50 m upstream of the existing rock fill dam. The outlet of the control structure extends approximately 100 m downstream, which is approximately 50 m downstream of the existing rock fill dam.

The canal would be constructed behind a rock plug, which would be removed when the facilities are ready to be watered-up. The intake canal will be extended into the lake; therefore, a rock extension would be required at the inlet to achieve acceptable entrance conditions for the new release facility. The material will be excavated by the following procedure:

- Rock previously excavated from the terrestrial section of the canal is placed into the lake in the area that is to be removed, building up a temporary pad on which equipment can work in the dry;
- Blast holes are drilled from the surface through the rock berm into the sound rock below the pad, and the canal plug is drilled;
- The holes are charged and blasted; and
- All rock is removed by special long arm excavator machines working from the pad limit, removing it as the work proceeds back to shore.

A concrete pad will then be placed into the aquatic environment and can be anticipated to extend approximately 15 m out into Nonacho Lake, with a width commensurate with the canal. Similarly, blasting of bedrock materials will be required at the outlet of the new control structure

into the existing channel below the rock-fill dam. It is not anticipated that a concrete pad will be required to facilitate the release of water at this location.

The above noted construction activities will result in a permanent change to the existing aquatic habitat conditions at the inlet and outlet of the new control structure. Blasting and other activities have the potential to disturb fish that may exist in the area.

3.1.2 Upstream and Downstream of the Rock-fill Dam

The proposed construction or rehabilitation activities to the rock fill dam will reduce the quantity of leakage through the dam and raise the dam height by 1.0 m. Rehabilitation of the dam will require the placement of a series of coarse and finer rock layers into the aquatic environment on the upstream face. The existing sluice gates and upstream water passages would be decommissioned by closing the gates, placing rock fill into the passages, and possibly injecting concrete into the water passages to permanently seal the zone between the existing face of the dam and the gate.

By minimizing the accidental leakage that is currently experienced at the rock-fill dam and decommissioning of the sluice gates, the aquatic habitat between the rock-fill dam and the outlet of the new control structure will experience significantly less flow than under existing conditions. In addition, the placement of coarse substrates on the upstream face of the dam has the potential to interact with the aquatic habitat values at that location.

3.1.3 Spillway Channel

A concrete sill is proposed to be placed across the existing rock spillway to raise the storage capacity of Nonacho Lake by 0.5 m. Construction of the concrete sill would be undertaken in the dry by drawing down water levels within Nonacho Lake through the new control structure to a level below the invert of the spillway.

Raising the existing spillway 0.5 m will result in periods of reduced flows within the spillway channel and a higher frequency of zero flows, thereby altering the existing aquatic habitat values at this location.

3.2 Results

Based on the review of previous fish sampling data, Project reports and general literature, the following list of species were identified to potentially utilize habitats associated with the Nonacho control structure: lake trout, northern pike, lake whitefish, lake chub, longnose sucker, white sucker, burbot and lake cisco.

3.2.1 Habitat Typing

Habitat typing was conducted at the Nonacho control structure and adjacent area, as part of the desktop review. The initial step of this review was to identify habitat polygons where the physical habitat conditions within each polygon were anticipated to be homogenous. In total, nine distinct habitat polygons were identified at or adjacent to the Nonacho control structures (Figure 2).

0 100 200

Scale (m)

CAMBRIA GORDON LTD.

NONACHO CONTROL STRUCTURE - HABITAT POLYGONS

FIGURE 2

3.2.1.1 Polygon A

Polygon A is located immediately upstream of the rock-fill dam and within Nonacho Lake. This polygon is defined by a shoreline lacustrine habitat and is characterized by a small bedrock bench along the lake margin ranging in depths from 0 to 0.5 m. The bedrock bench drops off steeply to depths of 4 m and greater at approximately 10 to15 m from the wetted edge. Along the lake margin, water velocities were slow; however, an undercurrent was observed 10 m from the shoreline. The observed undercurrent is likely associated with the three timber sluice gates located downstream at the rock-fill dam.

The substrate was primarily composed of gravel and cobbles near the lake margin with finer substrates infilling much of the interstitial spaces. Further offshore, substrate conditions shifted primarily to bedrock with boulders frequently interspersed throughout. Along the shallow bench and where the substrates were suitable, sparse submergent and emergent vegetation was present. Immediately adjacent to the inlet location of the intake canal, a sparse 200 m^2 submergent and emergent vegetation community had established. In addition to the vegetation communities, small woody debris (SWD) was observed to be evenly and frequently distributed throughout the polygon and could provide ample cover for juvenile fish. Figure 3 illustrates the habitat associated with Polygon A.

Figure 3. Polygon A, Habitat above the Nonacho Dam.

On the day of observation, a single northern pike was observed to be utilizing the emergent vegetation and SWD directly adjacent to the shoreline; however, no fish species were observed during the snorkel assessment. Based on the physical habitat conditions observed in the field and the review of the compiled fish species list, the following fish could potentially utilize Polygon A for at least one of their critical life stages: northern pike, lake trout, lake chub and lake cisco. Adult and juvenile northern pike may utilize the shallow vegetated habitat in this polygon for spawning and rearing. Juvenile lake chub and cisco may be utilizing the shallow habitat and abundance of cover for rearing, while lake trout may be utilizing the deeper water and rocky substrate offshore.

3.2.1.2 Polygon B

Polygon B is located immediately upstream of the rock-fill dam in Nonacho Lake. This polygon is defined by a pool lacustrine habitat and is characterized by steeply sloped stream margins that extend to depths greater than 3 m. Fish habitat along the upstream side of the rock-fill dam is characterized by a coarse boulder substrate. No in-stream vegetation has established along the dam structure since it was built, and

there is negligible cover for fish. On the upstream side of the dam, a velocity is present near the area where water flows through the timber lined sluice gates.

Within polygon B, cover is predominately old snags, large woody debris and boulders, which were scattered throughout. There was sparse submergent and emergent vegetation present at the time of assessment. Substrate conditions were not visible due to the depths associated with this polygon. Even though Polygon B is located within Nonacho Lake, velocity conditions were present, due to water being passed through the timer lined sluice gates and into the spillway channel.

No fish were observed during the snorkel survey assessment. Based on the physical habitat conditions observed in the field and in review of the compiled fish species list, the following fish potentially utilize Polygon B to carry out a critical stage of their life history: lake trout, lake chub, white sucker, longnose sucker and lake cisco. These species could potentially rear within this polygon; however, they are lake species and may not prefer this area due to the velocity conditions.

3.2.1.3 Polygon C

Polygon C is located immediately upstream of the spillway in Nonacho Lake. This polygon is defined by a shoreline lacustrine habitat and is characterized by a shallow bedrock bench along the stream margin ranging from 0 to 0.5 m in depth. The bedrock bench in this polygon extends out 15 to 20 m before dropping of to depths greater than 3 m. Water velocity along the shoreline is present due to the flow discharging from Nonacho Lake over the spillway.

Substrate conditions were primarily bedrock with an occasional large boulder; most substrates adjacent to the spillway inlet have been washed downstream due to the water velocity conditions, which have likely prevented aquatic vegetation communities from establishing.

No fish species were observed at the time of assessment and based on the physical habitat conditions, it is not anticipated that any of the identified fish species would be utilizing this habitat to carry out a critical stage of their life history due to the bedrock substrates and velocity conditions.

3.2.1.4 Polygon D

Polygon D includes in-stream habitats downstream from existing spillway. This polygon is defined by cascade pool morphology and is characterized by fast flowing waters. The spillway channel is approximately 350 m in length and ranged in width from 60 m at the inlet to 115 m at the outlet. Water velocity conditions within the channel were very fast, which likely limits the presence of boulders and aquatic vegetation cover. Depth measurements within the channel could not be collected due to safety concerns; however, the channel is estimated to be greater than 2 m in depth in most sections. This is likely due to the amount of scour experienced within this channel. At the time of assessment flow conditions were

at the seasonal high and were likely acting as a velocity barrier to fish. Figure 4 illustrates the habitat associated with Polygon D.

Figure 4. Habitat present in polygon D.

No fish species were observed at the time of assessment and based on the physical habitat conditions, it is not anticipated that any of the identified fish species would utilize this habitat to carry out a critical stage of their life history.

3.2.1.5 Polygon E

Polygon E is a side channel located on river left of the spillway. This polygon is defined by riffle pool morphology. The inlet to the side channel is approximately 105 m downstream from the spillway rock sill. The side channel is 6 m wide on average and 150 m in length. The substrate within the channel is dominated by gravel with frequent large boulders found throughout.

The entire reach of the side channel was sampled with an electro-shocker; however, no fish were captured or visually observed. The side channel did not contain any observable fish barriers and access to the downstream end of the channel was not impeded. The spillway drops approximately 2 m immediately upstream from the side channel. At the time of observation, the high velocities flowing over this drop would likely prevent fish migration further upstream within the spillway channel. Based on the physical habitat conditions of the side channel in Polygon E, white suckers could potentially utilize the side channel for their rearing or spawning critical life stage.

3.2.1.6 Polygon F

Polygon F is located at the downstream from the Nonacho dam and proposed control structure and discharges flow back into the Taltson River. This polygon is defined by riffle pool morphology. Channel depths within this polygon range between 0.5 m to 3 m. Substrate conditions are primarily bedrock with the occasional boulder. No in-stream submergent or emergent vegetation communities have established within the Polygon, again likely due to the water velocities and bedrock substrate. Figure 5 illustrates the habitat found within Polygon F.

Figure 5. Habitat present in polygon F.

No fish were observed on the day of the assessment; however, based on the physical habitat conditions it is possible that white suckers could potentially utilize this area for their spawning critical life stage.

3.2.1.7 Polygon G

The outlet of the canal and the proposed control structure would be located approximately 50 m downstream of the rock-fill dam and in the Taltson River on river left, which is at the upstream end of polygon G. At this location, the mainstem channel is characterized by cascade-pool morphology with fast flowing water conditions. Depths at this location could not be determined with typical sampling techniques due to the swift water velocities and could not be approximated, as the channel bottom was not visible. No vegetation was present at or adjacent to the proposed outlet location and substrates consisted mainly of bedrock with

boulders scattered along the stream margin. Figure 6 illustrates the habitat at the outlet of the proposed control structure.

Figure 6. Habitat present in Polygon G.

No fish were observed in this polygon on the date of the assessment, and due to the water velocities and bedrock substrate and this location, it is not likely that the fish species present within the area are utilizing this habitat for any critical life stages. However, lake trout may pass through this channel to reach the pool in polygon H, where they were observed downstream from the sluice gates.

3.2.1.8 Polygon H

The rehabilitation of the rock-fill dam and the permanent closure of the sluice gates have the potential to interact with the aquatic habitat from the downstream side of the dam extending to the outlet of the proposed control structure. Water within this small stretch of habitat is sourced from the sluice gates and the dam leakage. Figure 7 illustrates the habitat present within polygon H.

Figure 7. Habitat present within polygon H.

Habitat within this section of the channel is characterized by pool habitat and is dominated by bedrock and sporadic boulders. Water velocity within these pools was moderate and no submergent or emergent vegetation or woody debris was found within this section of river. On the day of observation approximately six adult lake trout were observed holding in a large pool approximately 3-4 m in depth, immediately downstream from the sluice gates. It is not anticipated that lake trout can migrate through the sluice gates, as velocity conditions likely exceed the swimming capabilities of the fish. Although lake trout were present in the deep pool, it is not likely that lake trout or any of the other fish species present within the area are utilizing this habitat for spawning or juvenile rearing critical life stages.

3.2.1.9 Polygon I

Habitat within this small area is characterized by boulders and moderate velocities. The water in polygon I is sourced solely from leakage through the rock fill dam. No submergent or emergent vegetation is present in this polygon, likely due to the water velocities. Some clumps of grasses and shrubs were present in the water along the margins of this area. This is likely because the flow was at the seasonal high at the time of assessment, and vegetation that was typically terrestrial had been inundated. This was not noted in any other polygons. Figure 8 illustrates the habitat present in this area.

Figure 8 . Habitat present in Polygon I.

It is not anticipated that any of the fish species present in the area will utilize this polygon for their critical life stages due to the limited habitat present.

4. NORTH GORGE

4.1 Project Interaction

The water conveyance canal to the proposed new powerhouse would be located near the Twin Gorges Forebay close to the right abutment of the existing dam and immediately upstream of an historic river channel, known as the North Gorge. The water conveyance canal would run from a gated concrete intake structure a total distance of 1,250 m, where it would flow into buried twin steel penstocks. The penstocks would deliver flow to the turbines through a steel manifold located in the powerhouse. Once through the turbines, the water would rejoin the Taltson River, downstream from Elsie Falls, through a rock tailrace canal.

In-stream works required for construction of the new canal, penstock, powerhouse and tailrace facilities is limited to the connection of the intake canal to the Forebay and the connection of the tailrace to the Taltson River.

4.1.1 Intake Canal

The proposed intake canal location is on the west side of the current Taltson Dam, in the Twin Gorges Forebay. The majority of the excavation of the canal would occur behind a rock plug that would be left in place until the new plant is ready to operate. In addition to the rock plug, rock material would be required to be removed from the Forebay to attain the required entrance depth for the canal. All rock would be removed by a special long arm excavator machine working from a pad. It is expected that the working pad will extend out into the Forebay approximately 10 m with a width that will commensurate with the canal width. Refer to section 3.1.1 for further details on the construction procedures of the intake canal, as it will follow similar procedures to that of the intake canal at the Nonacho dam.

4.1.2 Tailrace

The proposed tailrace will be located approximately 400 m downstream from Elsie Falls and the confluence of Trudel Creek, on river right of the Taltson River. Rock material will be removed from the shoreline and riverbed at the location where the tailrace meets the river, to reduce the exit velocities into the Taltson River. At this time it is expected that a working pad will extend out approximately 10 m into the river channel with a width that will commensurate with the canal widths.

4.2 Results

Based on the review of previous fish sampling data, Project reports and general literature, the following list of species were identified to potentially utilize habitats associated with the Forebay and the North Gorge intake canal: lake whitefish, white sucker, lake cisco, northern pike, lake trout and longnose sucker.

Habitats associated with the tailrace into the Taltson River, downstream from the confluence of Trudel Creek and Elsie Falls may be utilized by the following species: lake whitefish, white sucker, northern pike, lake trout, trout perch, and walleye.

4.2.1 Habitat Typing

4.2.1.1 Intake Canal

Habitat around the proposed intake canal location is very similar to the surrounding areas and supports small shrubs and trees. The habitat is characterized by a fairly steep rocky shoreline. It was not possible to estimate the lake depth past the drop off, as the bottom was not visible. Due to the past flooding of the Forebay, the shoreline is littered with large and small woody debris and standing dead trees. Sparse aquatic vegetation was observed at the time of the assessment.

One juvenile lake trout was seen during a snorkel survey near the proposed intake location. This indicates that lake trout may be using the deeper water near the rocky drop off around the shoreline. It is possible that

northern pike and sticklebacks may utilize the woody debris areas for spawning; however, there is likely low juvenile fish usage around the intake location due to a lack of shoreline vegetation and cover.

4.2.1.2 Tailrace

The tailrace at the downstream end of the proposed North Gorge canal would enter the Taltson River approximately 400 m downstream from the confluence of Trudel Creek and Elsie Falls in the Taltson River. The shoreline habitat in this area is dominated by steep bedrock banks, intermixed with patches of emergent vegetation. The substrate along the shoreline is generally bedrock and boulders with a layer of fine sediment on top. Sparse terrestrial vegetation or woody debris was present along the shore to provide cover. The river is shallow in this area and was no deeper than 2.5 m in the thalweg. Figure 9 and Figure 10 illustrate the habitat present at the proposed tailrace location.

Figure 9. Shoreline habitat at the proposed canal outlet location.

Figure 10. The view across the Taltson River, looking towards the proposed outlet location.

Of the species potentially found within this area, only juvenile white suckers were seen rearing along the rocky shoreline where clumps of emergent vegetation were present. It is not likely that deep water species such as lake trout would be present as preferred habitat conditions are not available.