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NORTHWEST TERRITORIES  
**POWER  
CORPORATION**

*Empowering Communities*

An NT Hydro Company

## EXECUTIVE SUMMARY

The Northwest Territories Power Corporation (NTPC) has operated the Taltson Twin Gorges Generating Station since 1965. Under Water Licence N1L4-0154, a Water Effects Monitoring Program (WEMP) was developed with the objective of providing efficient and effective identification of short-term, long-term, and cumulative changes throughout the Taltson River aquatic environment. Terms of Reference (TOR) for the WEMP were developed in 1999 (FSC 1999) following consultation with regulators, communities, and a workshop with a Community Advisory Committee.

In June 2011, NTPC submitted an Application for Renewal of Water Licence N1L4-0154 to the Mackenzie Valley Land and Water Board (MVLWB). The Minister approved Water Licence MV2011L4-0002 for a period of 15 years commencing August 31, 2012 and expiring August 30, 2027. As a condition of Part F of Water Licence MV2011L4-0002:

“The Licensee shall submit to the Board for approval within thirty (30) days of the issuance of this Licence the Terms of Reference for an Aquatic Effects Monitoring Plan (AEMP). In addition to the information contained in the Water Effects Monitoring Plan Terms of Reference dated May 2011, this plan shall also contain the information described in Schedule 2, Item 1, attached to the Licence.”

The AEMP TOR presented within this document takes into account the commitments made by NTPC and requirements as outlined in the Water Licence.

The specific monitoring programs that comprise the proposed AEMP include:

1. **Riparian Habitat and Fish Usage Assessment:** A study to monitor the trends and fluctuations of the aquatic environment along the riparian zones within the Taltson River from Nonacho Lake to Twin Gorges facility, including fish species composition and condition, vegetative communities, and habitat characteristics. Completed to 2019 (Thornton *et al.* 2020).
2. **Trudel Creek and Lower Taltson River Fish Stranding Monitoring:** A study to determine the potential for fish to become stranded during the annual maintenance ramp down in Trudel Creek and the lower Taltson River. Completed to 2018 (Faulkner *et al.* 2015, 2016a, 2016b; Buchanan *et al.* 2017; and Parsamanesh *et al.* 2018).
3. **Mercury in Sediment and Fish Flesh Monitoring:** A study to monitor mercury concentrations in sediment and fish flesh within the Taltson River from Nonacho Lake to Twin Gorges facility. Completed to 2019 (Ganshorn *et al.* 2020).
4. **Desktop Fish Mortality Assessment:** Evaluation on the probability of fish entering the penstock inlet in the Twin Gorges Forebay and become entrained through the turbines. Completed in 2016 (Buchanan *et al.* 2016).
5. **Nonacho Lake and Lower Taltson River Flow Analysis:** Use the updated HEC-ResSim model to determine the appropriateness of permitted water level and flows in the Nonacho Lake and Twin Gorges Reservoirs. Analysis completed in 2015 (Imam and Cullen 2015).
6. **Taltson HEC-ResSim Hydrologic Modeling Update:** Continual updates to the existing Taltson River HEC-ResSim Hydrologic Model that incorporates data from recently installed monitoring stations. Complete in 2019 (Akaoka *et al.* 2020).
7. **Sediment and Erosion Monitoring Program:** A stand-alone Nonacho Lake and Trudel Creek Sediment and Erosion Management Plan (SEMP) was developed to address sediment and erosion concerns identified by stakeholders. Completed to 2019 (West *et al.* 2019).

The schedule for completing the AEMP monitoring programs is summarized in Table ES1 below:

**Table ES1: AEMP Monitoring Schedule**

Monitoring Program	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Riparian Habitat and Fish Usage Assessment								X							X	
Trudel Creek and Lower Taltson River Fish Stranding Monitoring		X	X	X	X	X	X									
Mercury in sediment and Fish Flesh Monitoring		X						X							X	
Desktop Fish Mortality Assessment					X											
Nonacho Lake and Lower Taltson River Flow and Water Level Analysis				X												
Taltson HEC-ResSim Hydrologic Model Update		X	X					X								
Sediment and Erosion Monitoring		X	X					X							X	

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## 1. INTRODUCTION

### 1.1. Taltson Twin Gorges Generating Station

The 18 MW Taltson Twin Gorges Generating Station was established to provide power to Pine Point Mine in 1965. The facility is located within the Taltson River watershed (Map 1) and contains the following main features:

1. Main dam and powerhouse;
2. South Valley Spillway into Trudel Creek; and
3. Nonacho Lake Reservoir, Control Structure and Spillway.

Closure of Pine Point Mine in 1986 allowed the expansion of power supply to the communities of Hay River, Fort Smith, and Fort Fitzgerald; however, the power production requirements of these communities is considerably less than previously used to operate the mine. As a result, water continually spills over the South Valley Spillway (SVS) and through Trudel Creek before rejoining the Taltson River 33 km downstream.

The reduced power production demands since 1986 have resulted in limited to no flow regulation at the Nonacho Lake Reservoir. Therefore, the current flow regime has been relatively constant for over 30 years.

### 1.2. Main Dam and Powerhouse

The Twin Gorges dam is a 285 m long, maximum 25 m high zoned earth and rock fill dam with a filtered central till core. A reinforced concrete intake structure located on the upstream face of the main dam is equipped with trash racks, sectional bulkheads (stop logs) and a fixed-wheel closure gate. The powerhouse contains a single vertical shaft Francis-type turbine-generator unit with a rated capacity of approximately 18 MW. A 4.9 m diameter, 375 m long buried steel penstock connects the intake to the powerhouse and is fitted with a 12.2 m diameter steel surge tank. The North Valley dam is located approximately 3 km north of the Twin Gorges dam. It is a rock fill freeboard dam with no impervious core, with a rock toe berm constructed on the downstream side equal to the maximum estimated flood level.

The Taltson Twin Gorges Generating Station is located about mid-way between the Tazin-Taltson confluence and Tsu Lake. It was completed in late 1965 following a two-year construction period. The site is characterized by two narrow gorges. The plant is located in the north gorge where a 17 m high earth fill dam permits development of a head of 30 m. The south gorge is closed off by an auxiliary dam. A low perimeter dam closes a gap in the reservoir rim in the North Valley.

The powerhouse is founded on bedrock in the north gorge and is connected by a 335 m long, 5 m diameter welded steel penstock to a conventional concrete intake structure. The intake houses a 4.9 m x 4.9 m head gate, cable hoisting equipment and water level gauges. This gate closes by gravity under the control of a fan break. A set of stop logs are also provided so that the intake may be dewatered to permit inspection and maintenance of the head gate. A mono-rail hoist is provided for handling of the stop logs and trash racks, as required. A 12.2 m diameter steel surge tank about 20 m upstream of the plant serves to protect the pipeline from damage due to the water hammer in the event of a sudden loss of load or from severe load changes. The main plant building has a concrete substructure with a structural steel superstructure. In 1976, an additional steel framed annex building was constructed on the downstream side of the original main plant to house four small horizontal-axis Ossberger turbines. Water supply was provided by means of an auxiliary penstock 2.1 m in diameter branched off the main steel penstock 30 m above the surge tank and routed around the south side of the main plant. The Ossberger units discharged

directly into the tailrace of the main plant. In 1995 the Ossbergers were decommissioned.

### **1.2.1. South Valley Spillway into Trudel Creek**

Any flows in the Taltson River not passing through the plant for power production are spilled over a 200 m long overflow concrete spillway constructed in a natural spill section called "South Valley", some 13 km northeast of the plant. The spill water re-enters the Taltson River via a 33 km long reach of Trudel Creek at a point 2 km below the Twin Gorges plant.

### **1.2.2. Nonacho Lake Reservoir, Control Structure and Spillway**

Early in 1968, a rock fill dam was constructed at the outlet of Nonacho Lake to create upstream storage to supplement natural winter flows in order to meet increased power demands on the system. The dam contains three manually controlled gates (1.8 m x 1.8 m) which are periodically opened and closed as natural flows dictate. A natural rock escarpment adjacent to the dam has been widened to 67 m to form an overflow spill. A fraction of the spill flow exits from Nonacho Lake through a natural gap (referred to as Tronka Chua gap) into Tronka Chua Lake, and eventually re-enters the Taltson River above the Twin Gorges. In addition, approximately 6.5 m<sup>3</sup>/s percolates through the dam. A live storage volume of 1030 million m<sup>2</sup> is provided between a full supply level (FSL) of 320.0 m and a low supply level (LSL) of 318.2 m.

## **1.3. Project Study Area**

The Taltson Twin Gorges Generating Station is located on the Taltson River some 36 km northeast of Fort Smith at approximately 60° 25'N and 111° 24'W. The Nonacho Lake storage dam is located 215 km northeast of Fort Smith at 61° 40'N and 109° 56'W.

The study area associated with the Twin Gorges Generating Station can be divided into two (2) distinct areas: Taltson River (including Nonacho Lake); and Trudel Creek.

### **1.3.1. Taltson River**

The Taltson River flows in an irregular pattern in its upper reaches and then northward in its lower reaches finally emptying into Great Slave Lake about 55 km east of Fort Resolution. It has a drainage area of about 65,000 km<sup>2</sup> bounded by Slave River, Lake Athabasca, and the headwaters of the Dubawnt River. The drainage basin is almost entirely within the Canadian Shield region, with bedrock being mainly Pre-Cambrian. The basin is characterized by thinly spread glacial and post glacial drift. The Taltson River channel is controlled by geological and post glacial features, for the most part, except for the lower 115 km where it is confined to the eastern margin of the Slave River delta.

From its headwaters, the main stem of the Taltson River is about 650 km long and links a series of interconnected lakes. Some of the larger ones being Gray, Hjalmar, Tronka Chua, Nonacho, Taltson, King, Lady Grey, Benna Thy, Tsu and Deskenatlata. The Tazin River meets the Taltson River some 75 km below the outlet of Hill Island Lake. The Thoa River flows into the Tazin River at Hill Island Lake. The other principal tributary of the Taltson is the Tethul River which drains the south-western corner of the basin including the north-eastern corner of Alberta.

### **1.3.2. Trudel Creek**

The current flow conditions in Trudel Creek began with the permanent closure of Pine Point Mine in 1986, after 20 years of operation. Closure of the mine led to a reduction in water use from the Taltson River for power generation, causing increased flows over the South Valley Spillway (SVS) and into Trudel Creek. Since 1986, approximately 85% of the flow from the Taltson River has been diverted into Trudel Creek over the SVS. The other approximately 15% of the Taltson River flow is used for power generation at the

current Taltson Twin Gorges Generating Station.

Trudel Creek in its current state is a large river with fluctuating water levels. It is characterized by low-gradient, straight-channel morphology, and confined banks. The general homogenous, low-gradient system features three lakes held by a series of bedrock controls. Current channel widths range from 70 m to 230 m.

Overall, Trudel Creek has a very low elevation gradient and drops less than 50 m over its 33 km length from the SVS to the confluence with the Taltson River. Excluding the SVS, the elevation drop is only 25 m over approximately 32 km. This equates to an average bed slope of 0.08%. Moreover, most of the elevation drop occurs at the outflow of two lakes: Trudel Lake and Unnamed Lake.

#### **1.4. Regulatory Review Environment**

The Taltson Twin Gorges Generating Station was constructed under the authority of the *Dominion Waters Act* and from 1970 until 2012, operated under water licence (N1L4-0154) issued under the *Northern Inland Waters Act* (since superseded by the *Northwest Territories Water Act*).

Minimal environmental studies to address impacts to the physical, biological, social, economic, and cultural resources to the area were conducted prior to the initial development of the Project. Under Water Licence N1L4-0154, a Water Effects Monitoring Program (WEMP) was developed with Terms of Reference (TOR) for the WEMP developed in 1999 (FSC 1999) following consultation with regulators, communities, and a workshop with a Community Advisory Committee. Studies conducted as a component of Water Licence N1L4-0154 included detailed investigations of fish and aquatics; furbearers; and hydrologic monitoring including hydrology, ice, and sediment and erosion. In addition, the Dezé Energy Corporation collected a considerable amount of environmental data as a component of the Taltson Hydroelectric Expansion Project. As a result, there was a considerable amount of information available from which to assess changes that may occur, or continue to occur, as a result of the project.

In June 2011, Northwest Territories Power Corporation (NTPC) applied for Renewal of Water License N1L4-0154 to the Mackenzie Valley Land and Water Board (MVLWB). A new Water License (MV2011L4-00002) was approved for the Project for 15 years (August 29, 2012 - August 28, 2027). This Water License entitles NTPC to store and divert water to create hydroelectric power associated with the Twin Gorges facilities on the Taltson River in the Northwest Territories. The water licence was subject to an Aquatics Effects Monitoring Program (AEMP) (NTPC 2013) and a Sedimentation and Erosion Management Plan (SEMP; NTPC 2012) for Nonacho Lake and Trudel Creek. The objective of the AEMP was to provide efficient and effective identification of short-term, long-term, and cumulative changes throughout the Taltson River aquatic environment.

Through the regulatory review process conducted by the MVLWB, the AEMP was approved in May 2013 and includes six specific monitoring plans: Riparian Habitat and Fish Usage Assessment, Trudel Creek and Lower Taltson River Fish Stranding Monitoring, Mercury in Sediment and Fish Flesh Monitoring, Desktop Fish Mortality Assessment, Nonacho Lake and Lower Taltson River Flow Analysis, and a Taltson HEC-ResSim Hydrologic Modeling Update.

In 2014, the results of Trudel Creek and Lower Taltson River Fish Stranding Monitoring designed to investigate the potential for fish to become stranded during the generating station annual maintenance ramp down in Trudel Creek and the lower Taltson River formally identified that the annual maintenance shutdown results in fish stranding mortality downstream of the powerhouse. Fish mortality due to annual shutdowns is in contravention to Section 35(1) of the *Fisheries Act*. Fisheries and Oceans Canada (DFO) became the lead regulator under the *Fisheries Act*. Mitigation measures tested were not able to eliminate all fish mortality and it was determined that an *Fisheries Act* authorization (FAA) under Section 35(2) of

the *Fisheries Act* was required to continue these shutdowns. Consequently, NTPC applied for a FAA in 2018 which was obtained on August 14, 2020.

### 1.5. Development of the Aquatic Effects Monitoring Plan

In support of Water Licence MV2011L4-0002, NTPC developed a TOR for an AEMP that reflects the current operating condition of the Twin Gorges Generating Station and builds on the baseline information collected throughout the Taltson River watershed prior to 2013. The AEMP TOR takes into account the commitments made by NTPC during the regulatory review process and requirements outlined in the Water Licence. Part 1c) in Schedule 2: Conditions Applying to Monitoring of the Water Licence requires:

“A review and a description of the application of Aboriginal Affairs and Northern Development Canada’s (AANDC) *Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the NWT* in the development of the Aquatic Monitoring Plan.”

The AANDC guidelines were developed to provide project proponents guidance in the development of appropriate monitoring programs that incorporate best practices to conduct aquatic effects assessments. The process associated with the guidelines has been tailored towards proposed or new development projects and, in general, follows an 8-step framework as described below:

- **Step 1:** Identification of issues and concerns associated with a development project relative to potential effects on the aquatic ecosystem;
- **Step 2:** Problem formulation for aquatic effects monitoring;
- **Step 3:** Development of data quality objectives and conceptual study design;
- **Step 4:** Development of detailed AEMP design;
- **Step 5:** Documentation and verification of the sampling design;
- **Step 6:** Implementation of the AEMP;
- **Step 7:** Evaluation, compilation, analysis, interpretation, and reporting of AEMP data and information; and
- **Step 8:** Application of AEMP results within a management response framework.

As the Taltson Twin Gorges Generating Station has been in operation for since 1965, the issues and concerns associated with the aquatic environment are well understood and have been discussed with regulatory agencies and stakeholders during the regulatory review process. Where applicable, components of the 8-step framework identified above have been incorporated into each monitoring program, specifically Step 2 and Step 3.

In addition, Schedule 2 of the Water Licence requires a summary of relevant baseline data including: baseline data collected to date; identification of baseline data gaps; and a description of methods to fill in baseline data gaps.

The remainder of this document provides a summary of baseline data collected and a description of the monitoring programs that have been developed for the continued operation of the Taltson Twin Gorges Generating Station.

## 2. BASELINE STUDIES

Several studies and reports have been completed by NTPC based on the 1999 TOR. Rescan Environmental Services (2006a) conducted a review of the studies completed to date, identified existing information gaps, and put forth a recommendation to NTPC to modify the existing TOR and the overall intensity of the WEMP. NTPC presented the proposed modifications to the Mackenzie Valley Land and Water Board (MVLWB) who distributed the proposed request to regulatory agencies and local stakeholders. Responses were received from the Department of Indian and Northern Affairs Canada (INAC), Fisheries and Oceans Canada (DFO) and Environment Canada (EC); however, no conclusions or agreements were finalized.

In 2006, the Dezé Energy Corporation (Dezé) initiated a feasibility study on the potential expansion of the existing Taltson Twin Gorges Generating Station. The Taltson Hydroelectric Expansion Project (Expansion Project) proposes to add a new 56 MW power plant to the existing 18 MW Twin Gorges facility and interlink the expanded generation facility through a new transmission line to supply hydropower to Ekati, Diavik, Snap Lake and the proposed Gacho Kué mines.

Baseline fish and aquatic assessments of the Taltson River watershed were conducted as a component of the Expansion Project feasibility studies. In addition, a robust hydrological software model of the Taltson River basin was created to model flows and water levels along the Taltson River system between Nonacho Lake and Great Slave Lake.

### 2.1. Water Licence N1L4-0154 WEMP Study Program

The Terms of Reference for the WEMP conducted for Water Licence N1L4-0154 included three major areas of study:

- Fish and aquatics;
- Furbearers, primarily beaver and muskrat; and
- Hydrologic monitoring, including hydrology, ice, and sedimentation/erosion.

Fish and aquatics monitoring included sampling of Nonacho Lake, Taltson Lake, a control lake (later identified as Rutledge Lake), and the Taltson River. Specific monitoring programs included assessments on fish abundance, fish condition, population age structure, mercury in fish flesh, mercury in aquatic plants, parasites in fish flesh, internal discolouration and feeding habitats.

Furbearer monitoring specifically focused on beaver and muskrat associated with Nonacho Lake, a control lake (Rutledge Lake), and along the lower Taltson River. The monitoring program included assessment of beaver and muskrat abundance by assessing active house counts and push-up counts, respectively.

The hydrology and ice component associated with the 1999 TOR is extensive with detailed monitoring proposed from upstream of the Nonacho Lake reservoir down to Great Slave Lake. Specific monitoring programs targeted water level changes and ice regime, water level fluctuations, ice related water level fluctuations, and sedimentation/erosion.

Initiation of the WEMP commenced in-part in 2000 and in full in 2003. The following sections summarize the specific monitoring programs completed for each area of study.

#### 2.1.1. Fish and Aquatics

In 2003, Rescan completed the first year of fish and aquatics monitoring to address the variables/indicators outlined in the 1999 TOR. The second year of fish and aquatics monitoring for the WEMP was completed in 2004. Based on the outcomes of the 2003 monitoring programs Rescan made the following modifications to the 2004 WEMP:

- Addition of two more reference lakes (Sparks Lake and Gagnon Lake).
- Addition of the Twin Gorges Forebay as a sampling site; and
- Addition of a second year of monitoring for mercury in fish flesh/aquatic plants, parasites in fish flesh, mercury in sediment, and benthic invertebrates.

According to the 1999 TOR, additional fish and aquatics monitoring was to be conducted in 2007, three years following the 2004 program.

In 2006, results from the 2003 and 2004 WEMP's were compared with reference water bodies, revealing no significant difference in fish and aquatic variables/indicators (Rescan 2006a). As such, NTPC proposed to the MVLWB that no additional fish and aquatics monitoring programs should be required under the current operating conditions (Memo to Sarah Baines, October 3, 2006). Should operating conditions of the Taltson Twin Gorges Generating Station change, NTPC proposed to implement a WEMP one year after the proposed change and subsequent monitoring to occur in a 5-year cycle.

No additional fish and aquatic monitoring was conducted post-2004 by NTPC.

Specific monitoring programs outlined in the 1999 TOR, the minor modifications made by Rescan in 2004, progress and completion status of the WEMP for fish and aquatics, and the proposed modifications by NTPC are summarized in Appendix B.

### **2.1.2. Furbearers**

Two years of monitoring of both beaver and muskrat were completed. Beaver lodge surveys were conducted in 2000 and 2003 while muskrat ice push surveys were conducted in 2001 and 2004. Monitoring program dates do not correspond to the original schedule outlined in the TOR; however, no modifications of the assessment methodologies were made during the monitoring programs.

According to the 1999 TOR, additional beaver and muskrat surveys were to be conducted in 2008 and 2009, respectively.

In 2006, monitoring results were compared with reference water bodies revealing no significant difference for furbearers (Rescan 2006a). As such, NTPC proposed to the MVLWB that no additional beaver and muskrat monitoring programs should be required under the current operating conditions (Memo to Sarah Baines, October 3, 2006). Should operating conditions of the Twin Gorges facility change, NTPC proposed the following modifications to the TOR:

- Remove Nonacho Lake and Porter Lake from the beaver monitoring program;
- Remove Porter Lake from the muskrat monitoring program;
- Add two control water bodies in the Twin Gorges area; and
- Increase the frequency of monitoring to a 3-year cycle.

No additional monitoring programs of beaver and muskrat were conducted post-2004 by NTPC.

Specific monitoring programs outlined in the 1999 TOR, progress, and completion status of the WEMP for furbearers and the proposed modifications by NTPC are summarized in Appendix B.

### **2.1.3. Hydrologic Monitoring**

In 2001, NTPC compiled and reported the available and relevant meteorology and hydrology data collected, recorded, and purchased throughout the life of the Taltson Hydro Project up to 2001. The purpose of the report was to compile and summarize meteorology/hydrology data and to identify which

components of the Project required further investigation in order to meet the goals of the WEMP (Rescan 2001).

Hydrology and ice monitoring program components of the WEMP were completed in 2003 and 2004. The hydrology and ice work undertaken in 2003/2004 constitutes the initial monitoring of the 1999 TOR items.

According to the 1999 TOR, additional hydrological, ice and sedimentation/erosion surveys were to be conducted.

The data review (Rescan 2006a) proposed that the following information still be collected (Memo to Sarah Baines, October 3, 2006): geomorphology of Trudel Creek, bank erosion, and downstream sedimentation.

No additional programs on hydrology, ice and sedimentation/erosion were conducted following 2004 by NTPC.

Specific monitoring programs outlines in the 1999 TOR, progress, and completion status of the WEMP for hydrology, ice and sedimentation/erosion, and the proposed modifications by NTPC are summarized in Appendix B.

## **2.2. Taltson Hydroelectric Expansion Project Study Programs**

In support of an Environmental Effects Assessment and the preparation of a Developers Assessment Report (DAR), the Expansion Project completed a considerable number of baseline studies on fish and fish habitat, icing, wetlands, and wildlife. In addition, an extensive hydrological model was developed to understand the operating condition effects on water level fluctuations throughout the Taltson River basin.

The Expansion Project baseline studies used for the DAR were supplemented with the information gathered from the previously conducted WEMP studies.

### **2.2.1. Fish and Aquatics**

The focus of the fish and aquatic study programs associated with the Expansion Project were to characterize the fish habitat structure and cover conditions (depth, velocity, cover and substrate) along the littoral stream margins of the Taltson River and associated water bodies. Assessments were conducted in Nonacho Lake, Lady Gray Lake, and Trudel Creek (including the Twin Gorges Forebay). Direct sampling for fish was conducted to determine presence and composition; however, it was not intended to describe fish abundances.

In order to provide a more generalized overview of the information gathered in support of the Expansion Project, specific information gathered has been summarized by aquatic components. The following aquatic components were studied in various locations throughout the Taltson River watershed and are further discussed below:

- Littoral habitat mapping including fish species diversity and usage of the littoral zones in Nonacho Lake, Lady Gray Lake and Trudel Creek;
- Development of a mercury model to predict fish tissue concentrations resulting from the proposed project upgrades in Nonacho Lake and Trudel Creek. In addition, testing fish tissue mercury concentrations in Nonacho Lake;
- Assessment of wetland diversity and function including wetland mapping, identifying wetland properties and classification, and modeling ecological assembly in Nonacho Lake, Lady Gray Lake and Trudel Creek;
- Fish habitat structure and cover condition assessments within Trudel Creek;

- Assessment of Nonacho Lake trout spawning habitat and analysis of water fluctuations on incubating lake trout eggs; and
- Water quality testing in Trudel Creek, including water temperature.

#### **2.2.1.1. Littoral Habitat Mapping**

The Expansion Project required an alteration of the existing hydrograph in the Taltson River, potentially affecting fish and fish habitat in Nonacho Lake, the Taltson River downstream of Nonacho Lake and Trudel Creek. Of specific concern are areas where the hydrograph would shift temporally as well as spatially, thereby changing the months in which high and low flows occur. The greatest effect to habitat would occur in shallow and littoral areas around the lakes and in the river. For this reason, an assessment of the shallow and shoreline habitat in two representative lakes (Nonacho Lake and Lady Gray Lake) and Trudel Creek, was conducted to collect baseline information and determine the likely effect of the proposed new hydrograph.

Specific information was collected at sites throughout Lady Gray and Nonacho Lakes as a reconnaissance to determine if there are any similarities in shallow water habitat characteristics within each lake. Visual observations were made at other sites throughout the Project area to confirm that the two lakes could be used as typical examples to represent vegetated littoral habitat within the system between Nonacho Lake and Twin Gorges. Specific outcomes and assessments conducted during the field program on Lady Gray and Nonacho Lake and Trudel Creek were:

- Identification and classification of the type of shallow water habitat present in the lakes and Trudel Creek;
- Assessment of the shallow habitat areas to determine the elevation range at which submergent/emergent vegetation communities grow; and
- Assessment of the overall quality of the littoral zones for fish productivity and fish species usage of such habitats.

#### **2.2.1.2. Mercury Modeling and Fish Tissue Testing**

The Expansion Project would result in changes to the hydrograph within the Nonacho Lake reservoir and Trudel Creek, which would increase the fluctuation in water levels. In turn, this could potentially disturb sediment layers which would increase methylmercury in the aquatic environment. Elevated levels of methylmercury in piscivorous fish can cause adverse health effects to wildlife and people who consume the fish.

A mercury model was used to predict fish tissue concentrations resulting from the proposed Expansion Project. The model was based on the relationship between fish mercury concentration, the percentage of disturbed lake area and the disturbed area-to-lake volume ratio. Predicted mercury concentrations for lake trout and lake whitefish were calculated based on the proposed 56 MW scenario in Nonacho Lake, and the Taltson River and Trudel Creek lake systems.

Predicted effects from the Expansion Project are anticipated to be negligible or within the natural variation of mercury concentrations. No monitoring of fish mercury levels was recommended.

Although no fish tissue testing was recommended as an outcome of the mercury model, 20 lake trout from Nonacho Lake were tested during August 2010.

#### **2.2.1.3. Wetland Diversity and Function**

Wetlands are transition ecosystems that connect aquatic and terrestrial environments. Wetlands perform

a variety of functions that contribute to the maintenance of biodiversity and healthy ecosystems. For instance, wetlands provide habitat for shallow littoral zone fish (i.e., northern pike) and also regulate hydrology, water quality and climate of a given area.

Fluctuating water levels could affect existing wetland integrity, structure, and function. As such, a monitoring program was conducted, and the following results were obtained:

- Wetland mapping in Nonacho Lake, the Taltson River and Trudel Creek;
- Identification of wetland properties and classification; and
- Modeling ecological assembly of each mapped wetland.

#### **2.2.1.4. Trudel Creek Fish Habitat Structure and Cover Assessment**

A number of monitoring programs were completed in support of the Expansion Project to establish baseline fish and fish habitat conditions in Trudel Creek including:

- A fish and fish habitat assessment (Rescan 2006b) to characterize fish community composition and relative abundance in Trudel Creek, characterize existing fish habitat quality, collect water quality, and map the bathymetry of the Trudel Creek system. Sampling efforts were not specific to certain species and/or life stages. The results of the study were used to compile a fish inventory for the entire Trudel system with comparisons to the lower Taltson River.
- A Spring Low Flow Fisheries Assessment (Rescan 2007) focused specifically on the identification of spawning and rearing areas of northern pike and lake whitefish, determination of the usage of those areas for spawning and rearing activities and collection of water quality data.
- A Fish and Fish Habitat Data Report (Cambria Gordon 2007) was a follow-up program to the May 2007 assessment. The main objective was to identify spawning and rearing habitats of northern pike and lake whitefish, quantify the usage of those habitats during the summer season and collect water quality data.
- The Final Report on Northern Pike Spawning and Rearing Habitat (Rescan 2008) involved a statistical analysis to determine if northern pike are currently using the identified spawning and rearing areas and to quantify early spring habitat in Trudel Creek.
- A littoral habitat assessment was completed to establish fish use of stream margins and shoreline habitats, determine the growth zones of submergent/emergent vegetation communities, identify the in-stream aquatic vegetation species present and to characterize the substrate conditions.
- Aerial oblique photographs were taken along the main channel of Trudel Creek and the entire shoreline of each of the three lake systems. These photos provide an excellent overview of the Trudel system and allow for habitat typing and identification, locating fish obstacles and barriers, qualifying habitat modeling results, marking active erosion sites.

All the field programs described above were utilized to develop a fish habitat structure and cover model for Trudel Creek. The model was developed to predict the change in the availability of preferred habitat conditions for fish. Indicator species and life-stages selected for the model included northern pike juvenile rearing, northern pike spawning, walleye spawning, lake whitefish spawning and lake whitefish juvenile rearing. The model relied heavily on the HEC-ResSim hydrological model created for Trudel Creek and the habitat data collected throughout the system.

#### **2.2.1.5. Water Quality and Water Temperature Analysis of Trudel Creek**

Water samples for turbidity and total suspended solids were collected at eight locations within Trudel Creek in 2007. Visual observations of turbidity and total suspended solids were also made along Trudel Creek during the high peak freshet flow of 2003. No water samples were collected in 2003, but observers noted a substantial difference in turbidity at the confluence of Trudel Creek and the Twin Gorges tailrace.

Samples for physical and organic parameters, dissolved anions, nutrients, and total base metals were collected in August 2007 and 2008 at 10 sites in Trudel Creek.

Temperature profiles were monitored at three locations between July 2007 and June 2008. The temperature was recorded every two hours. Temperature depth profiles were also collected in July 2008 from representative shallow and deep riverine sections of Trudel Creek. Temperatures were measured every 0.5 m until the bottom was reached. Dissolved oxygen depth profiles were collected in Trudel Creek and Trudel Lake simultaneously with the July 2008 temperature profiles. The results were used to generate a dissolved oxygen model for winter months when the lakes are completely covered with ice.

#### **2.2.1.6. Lake Trout Spawning Habitat Assessment**

Nonacho Lake has a self-sustaining lake trout population which supports an active recreational fishery. Lake trout are known to spawn at a number of locations throughout the lake, but the actual spawning depths and spawning habitat type used at these locations has never been quantified. A proposed winter drawdown (September to April) associated with the Expansion Project of 0.50 m to 0.86 m largely occurring after spawning and during the period of egg incubation, represents a potential threat to the lake trout population of Nonacho Lake. Estimates of the actual threat posed by the drawdown and the need for mitigation are dependent on the proportion of lake trout eggs deposited within the proposed drawdown zone or affected by the drawdown by lethal temperature changes. To better understand the risks posed by the proposed drawdown regime associated with the Expansion Project an extensive evaluation of lake trout spawning at a number of representative known and suspected spawning reefs was undertaken. The following components were studied:

- Quantification of egg deposition by depth on available habitat for 24 known or suspected shallow reef spawning sites in Nonacho Lake; and
- Evaluation of the preferred habitat type for lake trout spawning in Nonacho Lake.

Further to the analysis an effects assessment was conducted to determine the Expansion Project impacts to lake trout populations in Nonacho Lake.

### **2.2.2. Wildlife**

No additional wildlife studies were completed as a component of the Expansion Project.

### **2.2.3. Hydrology**

The focus of the hydrologic, ice and sedimentation/erosion study programs associated with the Expansion Project was to develop an understanding of the potential impacts associated with altering the current hydrologic regime. In order to provide a more generalized overview of the information gathered in support of the Expansion Project, specific information gathered has been summarized by component. The following components were studied in various locations throughout the Taltso River watershed:

- Hydrology, including water level fluctuations and flow regimes;
- Ice characteristics and freeze-up processes; and
- Sedimentation and erosion.

### **2.2.3.1. Hydrological Analysis for the Taltson River**

The Taltson River Basin Model was developed using the latest version of HEC-ResSim software developed by the United States Army Corps of Engineers (USACE) (HEC-ResSim 3.0). The software was developed to assist planners and engineers in predicting the hydrologic response of reservoir systems to changes in management and reservoir operations. This includes the simulation of hydropower operations and the subsequent changes to downstream flow conditions.

The latest version of HEC-ResSim includes all the technical components required for the Taltson River Basin model, namely the ability to:

- Model flow routing within river and lake systems;
- Include stage discharge relationships at key stream locations;
- Model control structures such as weirs and gated structures;
- Allow complex modeling of hydropower and reservoir operations; and
- Input flow hydrographs at all boundaries.

The model is essentially a flow routing model in that it simulates the movement of water through the Taltson River system. The model does not predict runoff generated from precipitation. Therefore, all inflows to the model must be provided. Hydrological inflows for the model were provided for the Taltson Basin upstream of Nonacho Lake and all major lateral inflows from Nonacho Lake to Great Slave Lake. The lateral inflows include local watersheds entering the Taltson River between Nonacho Lake and Great Slave Lake, as well as the Tazin, Tethul, and Rutledge Rivers.

Water Survey of Canada (WSC) has historically operated a total of eight gauging stations within the Taltson River system. Two of the eight stations were active prior to the Expansion Project studies: 07QD002 Nonacho Lake near Lutsel K'e (water level), and 07QD007 Taltson River below Hydro Dam (flow).

In June 2007, WSC was contracted by Dezé to re-install station 07QD004 Taltson River above Porter Lake Outflow, which had been deactivated in 1990, and to install a new station on the lowest reach of the Tazin River above the Taltson mainstem (07QC007 Tazin River near the Mouth). Data from these stations will be valuable and will be incorporated into future hydrologic studies related to the Expansion Project.

### **2.2.3.2. Hydrological Analysis for Trudel Creek**

To assist with the assessment and development of flow scenarios, a hydrological model was developed for Trudel Creek from the SVS through to the proposed tailrace in the Taltson River. The model uses HEC-RAS software developed by the US Army Corps of Engineers (USACE). The model was developed from field measurements including flow, elevation, river profile, water depths and velocity. The model outputs included water elevations, depths, and average velocities for various operating scenarios at each of 19 river transects.

### **2.2.3.3. Ice Characteristics of the Taltson River and Trudel Creek**

In addition to the icing information gathered during the 2003 WEMP, two ice study programs were completed in December 2006 and April 2007. The intent of the ice programs was to monitor ice thickness and freeze-up characteristics at key locations within the Taltson River watershed. These locations were monitored during the onset of winter (December 2006) and near the end of winter (April 2007) when ice thickness was anticipated to be its thickest.

### 2.3. Baseline Study Data Gaps

In review of the identified TOR information gaps (Appendix B), the primary deficiencies were related to the subsequent monitoring post, the two initial years of monitoring. Agency review and feedback on the TOR modifications proposed by NTPC provided a foundation for the critical information required to meet regulatory and local user concerns. The following list identifies the regulatory agency recommendations associated with the proposed TOR modifications:

1. Habitat mapping of littoral and riparian areas so that the impacts to habitat relating to water level fluctuations can be accurately assessed if operating changes were proposed;
2. Sediment and erosion conditions on Trudel Creek;
3. Potential effects of atypical water fluctuations; and
4. Hydrological monitoring programs are required to develop a model of the Taltson River watershed.

The Expansion Project baseline studies completed and/or initiated a significant portion of the above noted agency information recommendations. Habitat mapping of riparian and littoral zones was completed throughout the Taltson River watershed and was extensively evaluated within Trudel Creek. The development of the Taltson River Basin Hydrologic Model and installation of two additional water gauge systems adequately addresses the concerns raised in Items 3 and 4 above. In addition, preliminary works were initiated as it relates to sediment and erosion in Trudel Creek, ice monitoring characteristics and water temperature information.

### 3. TALTSON TWIN GORGES GENERATING STATION AEMP DESIGN

#### 3.1. Identification of Issues/Concerns and Problem Formulation

Issues and concerns with the continued operation of the Taltson Twin Gorges Generating Station, as identified during the Technical Session and Public Hearings associated with the Water Licence regulatory review process, are summarized in Table 1.

**Table 1. Identified Issues/Concerns with the Continued Operation of the Taltson Twin Gorges Facility**

Issue/Concern	Problem Formulation
Mercury contamination in fish	A 2010 assessment of mercury concentrations in Nonacho Lake Trout resulted in the issuance of a Public Advisory from the Government of Northwest Territories Department of Health. Mercury concentrations in fish flesh have been increasing in a number of watersheds across the Northwest Territories, including systems with no anthropogenic activities.
Parasites and cysts within Nonacho Lake fish	The Nonacho Lake Fishing Lodge has indicated that the presence of parasites and cysts within lake trout from Nonacho Lake has been increasing.
Fish stranding during plant shutdowns in Trudel Creek and the lower Taltson River	The Taltson Twin Gorges Generating Station is shutdown annually for maintenance of the turbine for approximately 10 days during summer/early fall. During the shutdown event water levels would increase in Trudel Creek and decrease below Elsie Falls. When the turbines are turned back on flows would decrease into Trudel Creek and increase below Elsie Falls. These changes in flow could result in stranding of juvenile and adult fish.
Entrainment of fish through the penstock and turbine	During normal operations of the Taltson Twin Gorges Generating Station fish could enter the penstock, become entrained, and pass through the turbine to habitats downstream. This process can result in the direct mortality of fish.
Alteration to littoral and riparian habitats due to flow regulation	Flow and water level fluctuations can alter the habitat conditions associated with littoral and riparian habitat areas. A variety of species and life-stage uses of littoral habitats have been documented within the Taltson River watershed, which could be influenced by fluctuation water levels and flow conditions.
Sediment and erosion in Nonacho Lake and Trudel Creek*	Erosion of shoreline conditions and sedimentation within Nonacho Lake and Trudel Creek has been reported. Extent, duration, frequency, and magnitude of such events have not been well documented and the potential effects to the aquatic environment are not well understood.
Appropriateness of minimum water levels and flows discharging Nonacho Lake and the Twin Gorges Generating Station	It has been requested that the identified minimum water level and flow conditions associated with Nonacho Lake and Twin Gorges be reviewed to determine if they are appropriate.

\*As a condition of the Water Licence a standalone Nonacho Lake and Trudel Creek Sediment and Erosion Monitoring Program is required. Therefore, there has been no inclusion of a sediment and erosion monitoring program within this AEMP TOR.

### 3.2. Data Quality Objectives and AEMP Monitoring Program Design

In order to address the specific issues/concerns identified by the regulatory agencies and stakeholders involved in the Water Licence regulatory review process (Table 1), a number of monitoring programs were developed. The intent of the monitoring programs is to:

- Determine the short and long-term effects associated with the continued operation of the facility;
- Determine if the aquatic ecosystems and their uses are being adequately protected;
- Evaluate and quantify the concerns identified in Table 1; and
- Identify the need for impact mitigation measures to reduce or eliminate project related effects on the aquatic environment.

The identified monitoring programs required to appropriately evaluate and quantify the concerns identified in Table 1 include:

1. **Riparian Habitat and Fish Usage Assessment:** A study to monitor the trends and fluctuations of the aquatic environment along the riparian zones within the Taltson River from Nonacho Lake to Twin Gorges facility, including fish species composition and condition, vegetative communities, and habitat characteristics. Completed to 2019 (Thornton *et al.* 2020).
2. **Trudel Creek and Lower Taltson River Fish Stranding Monitoring:** A study to determine the potential for fish to become stranded during the annual maintenance ramp down in Trudel Creek and the lower Taltson River. Completed to 2018 (Faulkner *et al.* 2015, 2016a, 2016b; Buchanan *et al.* 2017; and Parsamanesh *et al.* 2018).
3. **Mercury in Sediment and Fish Flesh Monitoring:** A study to monitor mercury concentrations in sediment and fish flesh within the Taltson River from Nonacho Lake to the Twin Gorges facility. Completed to 2019 (Ganshorn *et al.* 2020).
4. **Desktop Fish Mortality Assessment:** Evaluation on the probability of fish entering the penstock inlet in the Twin Gorges Forebay and becoming entrained through the turbines. Completed in 2016 (Buchanan *et al.* 2016).
5. **Nonacho Lake and Lower Taltson River Flow and Water Level Analysis:** Use the updated HEC-ResSim model to determine the appropriateness of permitted water level and flows in the Nonacho Lake and Twin Gorges Reservoirs. Analysis completed in 2015 (Imam and Cullen 2015).
6. **Taltson HEC-ResSim Hydrologic Modeling Update:** Continual updates to the existing Taltson River HEC-ResSim Hydrologic Model that incorporates data from recently installed monitoring stations. Complete as of 2020 (Akaoka *et al.* 2020).
7. **Sediment and Erosion Monitoring Program:** As outlined in Section F.8 of the Water Licence, a standalone Nonacho Lake and Trudel Creek Sediment and Erosion Management Plan (SEMP) was developed to address sediment and erosion concerns identified by stakeholders. This document was updated in 2019 (West *et al.* 2019).

All the issues/concerns identified in Table 1 and requirements of Schedule 2: Conditions Applying to Monitoring of the Water Licence have been included in this AEMP. Table 2 cross-references the location within this report that discusses the issues/concerns and Schedule 2 requirements.

**Table 2. Issue/Concern and Schedule 2 Requirement Index Table**

Issue/Concern	Schedule 2 Requirements	Location in Document
Alteration to littoral and riparian habitats due to flow regulation.	1(h) Riparian and Fish Usage Monitoring.	3.2.1 Riparian Habitat and Fish Usage Monitoring
Fish stranding during plant shutdowns in Trudel Creek and the lower Taltson River.	1(e) Identification of sites of high potential for fish stranding in Trudel Creek and the Taltson River downstream of the tailrace.	3.2.2 Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program
Mercury contamination in fish. Parasites and cysts within Nonacho Lake fish.	1(f) In addition to the other species listed in the Water Effects Monitoring Program Review Analysis provided with the application, a study of the mercury levels in Northern Pike from Nonacho Lake.	3.2.3 Mercury in Sediment and Fish Flesh Monitoring
Entrainment of fish through the penstock and turbine.	1(g) A fish mortality assessment.	3.2.5 Desktop Fish Mortality Assessment
Appropriateness of minimum water levels and flows  Discharging Nonacho Lake and the Twin Gorges Generating Station.	1(n) Using the current data set and the Taltson HEC-ResSim Hydrologic Model, an analysis with rationale to confirm whether the water levels and flows identified in Conditions C.2, C.3, C.4 of the licence are appropriate.	3.2.6 Nonacho Lake and Lower Taltson River Flow and Water Level Analysis
Information would be used and incorporated into each of the identified monitoring programs to assist in evaluating the identified issues/concerns.	No specific requirements outlined in Schedule 2: Conditions Applying to Monitoring regarding the Taltson HEC-ResSim Hydrology Model Update Program.	3.2.4 Taltson HEC-ResSim Hydrologic Model Update Program

**Table 2. Continued.**

Issue/Concern	Schedule 2 Requirements	Location in Document
None	<p>A list of requirements was identified in Schedule 2 that are specific to each monitoring program and have been included in the AEMP TOR. These specific requirements include:</p> <ul style="list-style-type: none"> <li>▪ 1(a) A description, including rationale, of the type, frequency, and duration of monitoring required to achieve the objectives included in the AEMP;</li> <li>▪ 1(b) A description of an Adaptive/Response Management Framework that allows potential environmental effects to be identified at an early stage, allowing opportunity to address the issue in time to prevent impacts to the aquatic environment;</li> <li>▪ 1(k) Description of monitoring protocols, methodologies, and parameters specific to each monitoring type;</li> <li>▪ 1(m) A description of quality assurance and quality control measures followed for each monitoring type; and</li> <li>▪ 1(o) a description of how the data will be analyzed for each monitoring type.</li> </ul>	Details are site specific and summarized in each detailed monitoring program review (Section 3.2.1 through to Section 3.2.6).
	1(d) A review and a description of the application of the Aboriginal Affairs and Northern Development Canada (AANDC) Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the NWT.	Section 1.5 Development of the Aquatic Effects Monitoring Plan and throughout Section 3.2.1 – Section 3.2.6.
	1(i) A description of how the monitoring required under the Surveillance Network Program can be incorporated into and help achieve the objectives of the AEMP.	3.5 Surveillance Network Monitoring Program
	1(l) A summary of relevant baseline data including: baseline data collected to date, identification of baseline data gaps, and description of methods to fill in baseline data gaps.	2 BASELINE STUDIES
	2. The Annual Aquatic Effects Monitoring Plan (AAEMP) Report referred to in F.6 shall include, but not be limited to, the following information.	3.8 Annual Aquatic Effects Monitoring Plan Report
	1(j) A map and attached table or detailed legend illustrating monitoring and sample locations.	3.6 Summary of Sample Site Monitoring Locations
Collection of water temperatures at various locations throughout the Taltson River watershed (data gap in previous baseline studies).	None.	3.2.1 Riparian Habitat and Fish Usage Monitoring

The following sections further describe the specific details associated with each monitoring program. The general approach used to develop the monitoring programs includes:

- State the problem to be investigated;
- Identify the specific monitoring program objectives;
- Describe the general approach to achieve the monitoring program objectives;
- Identify boundaries of the study program (i.e., a water body);
- Determine what analysis will be required; and
- Outline a field program, if required, to obtain appropriate data for analysis.

### **3.3. Riparian Habitat and Fish Usage Monitoring**

In the Taltson River watershed riparian habitat documentation is not available pre-construction of the Twin Gorges Generating Station; however, littoral habitat information was collected in 2003/2004 and 2008. Under the current operating regime, hydrologic conditions have not changed within the Taltson River for over 30 years; however, even under static flow conditions the aquatic environment can undergo changes, particularly in the riparian and/or littoral habitat zones. The information gathered during these years was incorporated into the long-term monitoring of riparian habitat monitoring within the system.

The DFO previously commented that insufficient data and habitat mapping of riparian areas was conducted as part of the original WEMP programs. The Expansion Project completed the initial monitoring and mapping of several sites within the Taltson River watershed; however, follow-up and subsequent monitoring was not conducted.

The riparian habitat and fish usage assessment is carried out in Nonacho Lake, various sections of the Taltson River, Trudel Creek and Lady Gray Lake. The fish and fish habitat conditions associated with the selected areas represents the diversity of habitat conditions associated with the Taltson River watershed. In addition, a considerable amount of baseline data and habitat mapping exists within these areas, which is used to analyze trends and/or fluctuations in both water levels and habitat conditions.

The Riparian Habitat and Fish Usage Assessment also monitors a control lake. Rutledge Lake was monitored as a control during Water Licence N1L4-0154 WEMP programs. Rutledge Lake represents a non-impacted lake with similarities to Nonacho in terms of species assemblage, physical and morphological features, shoreline characteristics, accessibility, and availability of support facilities.

Sampling under this program was completed in 2019 and will be repeated one more year in 2026.

The following provides a high-level overview of the Riparian Habitat and Fish Usage Monitoring Program.

#### **3.3.1. Specific Monitoring Program Objectives**

The primary objective of the Riparian Habitat and Fish Usage Assessment is to address the concerns associated with the alteration to littoral and riparian habitats due to flow regulation (Table 1). More specifically, the objectives of the monitoring program are to:

- Monitor fluctuation in habitat conditions (depth, cover, and substrate) and vegetation communities;
- Monitor fluctuation in fish community composition;
- Monitoring the long-term vegetation communities, fish species abundance and lifestage use of the littoral habitat;

- Establish Action Thresholds that are sufficiently conservative to provide adequate time to implement any required mitigation measures; and
- Present an Adaptive Management Approach. This will outline actions that will be taken if the Action Threshold is exceeded.

### **3.3.2. General Approach**

#### **3.3.2.1. Task 1: Desktop Analysis**

Riparian habitats are the habitats found on the shoreline that extend between terrestrial habitat and open water. The monitoring program proposed 5 monitoring sites in strategic locations in the Taltson River basin and 2 sites within Rutledge Lake. The monitoring sites are located in areas where the Expansion Project hydrological model shows the greatest changes in seasonal water levels and in areas that are anticipated to provide productive riparian fish habitat. Site selection represents the various habitat types present. Specific site locations were determined during the desktop analysis; however, in general terms, the proposed monitoring site locations were:

- 1 km to 10 km downstream of the Twin Gorges powerhouse, upstream of the first major constriction;
- Trudel Creek, upstream of the first lake;
- Trudel Lake;
- Nonacho Lake, near the outlet;
- Lady Gray Lake; and
- Rutledge Lake, site locations (2) to be determined.

The littoral habitat in the Twin Gorges Forebay is similar to other habitats proposed for sampling in the Monitoring Program and no critical spawning habitat was identified through previous assessments. The collection of data in the Twin Gorges Forebay was deemed to provide negligible value to the overall objectives of the monitoring program as no new habitat would be sampled. Therefore, no additional monitoring at the Twin Gorges Forebay was planned.

#### **3.3.2.2. Task 2: Field Sampling Plan**

The field programs are planned to occur in August when vegetation communities are in their peak growth phase. Additionally, littoral zones are typically used by juvenile fish, which have a higher potential to be present than earlier in the field season.

At each monitoring location identified during the desktop analysis, a series of transects is established within the overall site and a combination of the following data is collected:

- Water level data;
- Vegetation community type and position (i.e., slope distance and elevation) along established transects. Vegetation communities will be defined by visual dominance. The community types are anticipated to be terrestrial, meadow, riparian, emergent and aquatic;
- Species lists for each vegetative community type present. Multiple data plots within each community so that community structure and composition can be compared between sites;
- Aerial photos of the site (i.e., the 1+ km shoreline length). Georeferenced benchmarks will be established in 2026;

- Collection of in-situ water quality measurements;
- Fish assessments in the near shore / littoral zone within the overall site area. Specific assessment techniques are expected to include a combination of seine net, gill net, minnow trapping, angling, and electrofishing, as required; and
- Fish sampling including length, weight, external examination for parasites and cysts, and non-lethal age structure collection where applicable (i.e., scale samples).

Water temperature data for the study area is collated from suitable sources. Specifically, water temperature monitoring has been undertaken by NTPC as part of the Taltson fisheries monitoring programs. Further, temperature is continuously monitored in the lower Taltson River below the hydro facility (Water Survey of Canada Station 07QD007) and directly at the intake of the hydro facility.

Benthic invertebrate data have been collected from 2003, 2004 in Nonacho Lake, Twin Gorge Forebay and the control lake (Rutledge) as part of WEMP and for the Taltson River and Trudel Creek in 2008. Benthic invertebrate information provides an understanding of the dipteran diversity (number of genera and taxonomic richness found) in a waterbody and the availability of food for fish. Rescan (2005) showed that dipteran diversity in Nonacho Lake, Twin Gorges Forebay and Rutledge Lake were consistent with those in other lakes in northern Canada. As the flow regime within the Taltson River watershed has been consistent over the past 30 years and is not proposed to be changed as a condition of the Water Licence, changes to benthic invertebrate communities should not be impacted by the continued operation of the Taltson Twin Gorges Generating Station. Additional sampling for benthics would provide little to no value to the overall objectives of the Riparian Habitat and Fish Usage Assessment or the AEMP. As such, no benthic invertebrate sampling will be conducted.

Site names and waypoint information is provided in Table 3 through Table 5. Spatial distribution of the study areas and sampling sites in the Taltson River watershed are provided in Map 2 through Map 9.

#### **3.3.2.3. Task 3: Quality Assurance Project Plan**

A Quality Assurance/Quality Control system can be found in Section 3.3.

#### **3.3.2.4. Task 4: Evaluation, Compilation, Analysis, Interpretation and Reporting**

At the conclusion of each monitoring program, a data report will be prepared that summarizes fish species composition, catch-per-unit-effort, length-frequency distributions, weight-length regressions, sex, maturity, and condition. Additionally, an assessment of vegetation communities, position, and elevation growth range will be conducted.

As part of the evaluation and analysis process, a trend and fluctuation assessment of vegetative communities and fish species composition and distribution will be conducted. Analyses is expected to identify changes in fish habitat structure and cover conditions, fish presence, fish community composition, and vegetative community composition and distribution.

Results will be presented in a standalone report and will also be summarized in the Annual Report as outlined in Schedule 1: General Conditions of the Water Licence.

#### **3.3.2.5. Task 5: Adaptive Management**

Objectives of the Riparian Habitat and Fish Usage Adaptive Management Plan will be to:

- Establish Action Thresholds that are sufficiently conservative to provide adequate time to implement any required mitigation measures.

### Key issues

The key issue is to monitor the potential effect of continued operation of the Twin Gorges Generating Station on riparian habitat and fish usage of littoral zones in the Taltson River watershed. Specifically, to identify whether there is an adverse change in fish presence, community composition or life stage as well as a decline in vegetative communities or significant changes in rooted vegetation distribution.

### Action Threshold

An action threshold will be identified if a decline is observed in:

- Fish presence, community composition or life stage in the littoral zones, and
- Species composition of vegetation communities or rooted vegetation distribution.

Monitoring involves comparisons amongst the sites within the Taltson River watershed as well as with the control, Rutledge Lake. Each site will be assessed for localized change. If the site shows an adverse change in any of the variables listed above, an appropriate action threshold will be identified that represents a biologically significant change. The magnitude of change will then be compared with this action threshold. If the threshold is exceeded, then appropriate actions will be determined in consultation with regulatory agencies.

### Adaptive Management Approach

The following adaptive management approach will be followed within the term of the Water licence:

- If biologically significant changes to fish presence or community composition are identified within the littoral zones of the Taltson River watershed, then the cause will be evaluated and the need for additional monitoring/mitigation determined.
- If a specific life stage of fish that was previously confirmed to use littoral zones is not observed in the Taltson River watershed, then an investigation may be conducted to determine the reason for the change and the need for additional monitoring/mitigation will be determined.
- If there is decline in the species composition of vegetation in the littoral zones of the Taltson River watershed, then an investigation will be conducted to determine the reason of the decline and the need for additional monitoring/mitigation will be determined.
- If there is decline in the rooted depth of vegetation communities in the littoral zone of the Taltson River watershed, then an investigation will be conducted to determine the reason of the decline and the need for additional monitoring/mitigation will be determined.

As AEMP data are collected on riparian habitat and fish usage of littoral zones during the life of the project, a number of emerging issues may be identified that were not anticipated in the original impact predictions or in subsequent planning steps. The Riparian Habitat and Fish Usage AMP will be revised following the completion of each monitoring program to ensure that any such emerging issues are adequately addressed.

Ongoing review and refinement of the AEMP will ensure that it will continue to be relevant for supporting decisions on the management of the project as a whole.

### **3.3.3. Monitoring Program Schedule**

Intensive baseline studies and investigations have occurred within the Taltson River watershed from 2003 – 2010. The Riparian Habitat and Fish Usage Monitoring Program is conducted on a seven-year cycle with the first field program assessment completed in 2019 and the second scheduled for 2026. NTPC will

ensure that the data analysis done for annual reports includes the data from previous years for comparison and knowledge of whether effects are occurring or not.

### **3.3.4. Monitoring Program Results**

The objective of the 2019 monitoring program was to assess changes in littoral (near shore) and riparian habitats and the associated fish community along the Taltson River from Nonacho Lake to the Taltson Twin Gorges Generating Station to understand the effects of flow regulation. Monitoring involved aerial photograph collection, vegetation sampling, and fish and fish habitat monitoring. The program focused on sites in Lady Gray Lake, Nonacho Lake, Rutledge Lake, the lower Taltson River, Trudel Creek/ Lake, and the Station forebay. Vegetation data was collected in six study areas to provide baseline information on vegetation community composition, distribution, condition, and cover. Fish community and fish habitat data were collected in six study areas using beach seining, electrofishing, gill netting and angling. Evaluations were completed to describe the suitability of a range of habitats for key fish species and life stages. At least eight fish species were captured, with Northern Pike most widely distributed and detected at all study areas. Water quality data were collected at the study areas to measure water temperature, dissolved oxygen concentrations, and water clarity. All measurements indicated typical values for moderately productive lakes in late summer (Thornton *et al.* 2020).

### **3.4. Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program**

Annual maintenance and inspection of the turbine and draft tube area is essential to ensure reliable power for the communities of the South Slave region and requires a temporary shutdown of the powerhouse for roughly two weeks every summer. Due to a legacy design from the original construction of the facility the annual maintenance shutdown results in the partial dewatering of the Taltson River below the plant, upstream of Elsie Lake. Throughout 2011-2013 NTPC renewed the water licence for the facility through the Mackenzie Valley Land and Water Board. An Aquatic Effects Monitoring Plan (AEMP) was developed as part of the licence renewal and one of the components of the AEMP was the Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program. In 2014 the results of this monitoring program formally identified that the annual maintenance shutdown results in fish stranding mortality downstream of the powerhouse. Fish mortality due to annual shutdowns is in contravention to Section 35(1) of the *Fisheries Act*. NTPC worked closely with DFO to define the fish stranding mortalities that result from the annual maintenance shutdown and investigate various mitigation measures. Throughout this process, mitigation measures that were tested were not able to eliminate all fish mortality. Based on a feasibility assessment, the mitigation measures that were retained by NTPC were partial night-time shutdown and pulse flows. These operating procedures were found to mitigate an estimated 30% of fish mortality in the tailrace. Other mitigation measures examined were not considered feasible due to prohibitively high costs, limited effectiveness of the mitigation measures, risk of failure and/or maintenance and reliability issues.

The following summary provides a high-level overview of the Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program.

#### **3.4.1. Specific Monitoring Program Objectives**

The primary objective of the Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program is to address the concerns associated with the fish stranding during plant shutdowns (Table 1). More specifically, the objectives of the monitoring program are to:

- Identify sites of potential high-risk for juvenile and adult fish stranding;
- Determine water level rate change in a variety of habitats (e.g., off-channel, riffle, glide) during a scheduled plant outage;

- Observe juvenile fish distribution during a shutdown event, with a specific focus on fish isolated in pools that could become dewatered;
- Quantify the risk of stranding to fish populations in Trudel Creek and the Lower Taltson River; and
- Determine the need for fish salvage operations during a scheduled plant shutdown.

### **3.4.2. General Approach**

#### **3.4.2.1. Task 1: Desktop Analysis**

Trudel Creek is approximately 33 km in length and is defined by a variety of complex habitats. Similarly, the lower Taltson River is defined by a variety of habitats that could result in stranding during a sudden decrease in water surface elevation. In order to identify potential areas of high-risk of stranding, an evaluation of low-level aerial photography was required to streamline the field program and identified:

- Off-channel habitat that could become disconnected to the mainstem channel during low flow events;
- Complex habitats along the stream margin that could result in the formation of isolation pools; and
- Riffle habitats that could become dewatered or lose connectivity to the mainstem channel.

Identified areas were mapped on the low-level aerial photographs as having a high, moderate, or low risk potential for fish stranding.

#### **3.4.2.2. Task 2: Field Sampling Plan**

Following the completion of the desktop analysis (Cullen and Cote, 2013), a reconnaissance assessment was conducted to ground truth assumptions and evaluate the potential risk of stranding at identified moderate and high-risk sites. The reconnaissance included an evaluation of river conditions, an observation of fish use in identified moderate and high-risk areas and establishment of site-specific monitoring locations. In addition, a series of staff gauges were installed at select monitoring locations.

As the turbine unit is turned offline, a reduction in water levels first occurs below the Taltson Twin Gorges Generating Station and in the lower Taltson River. At the same time flows increase over the SVS and into Trudel Creek. As such, during the initial stages of the annual turbine maintenance period (typically August/September), each monitoring station established in the lower Taltson River was observed and the following data were collected:

- Rate of water level change as recorded from staff gauges;
- Time-lapse photography of select sites;
- Evaluation of moderate and high-risk sites for stranding. If stranding was observed, fish were salvaged and transported to the mainstem channel; and
- Shoreline habitat mapping for isolation pools and other areas of stranding not identified in the reconnaissance assessment.

Observations of the lower Taltson River monitoring stations continued until flows discharging over the SVS traveled through Trudel Creek and recharged the habitats of the lower Taltson River.

A reduction in water levels occurs in Trudel Creek during plant start-up as flows pass through the turbine and are reduced over the SVS. As such, monitoring of the same parameters at each monitoring station in Trudel Creek occurred until water levels were documented to be stable (no longer dropping).

Based on the results of the 2014 monitoring plan (Faulkner *et al.* 2015), the area observed to be most affected by stranding risk was the tailrace area, located within Taltson River below the generating station downstream to the large pool above Elsie Falls (Elsie Lake). Map 10 shows the monitoring sites in Trudel Creek and the Lower Taltson River and Table 6 provides the waypoints for the monitoring sites in Trudel Creek and the Lower Taltson River. Additional monitoring work and mitigation assessment was done in 2015 and 2016 (Faulkner *et al.*, 2016a, 2016b) and salvage was employed in 2017 and 2018 (Buchanan *et al.*, 2017 and Parsamanesh *et al.* 2018).

The overall objective of the salvage program in 2017 and 2018 was to conduct fish salvage instead of intensive monitoring that had been conducted in previous years and allowed total mortality estimates to be made as communicated with DFO.

#### **3.4.2.3. Task 3: Quality Assurance Project Plan**

A Quality Assurance/Quality Control system can be found in Section 3.3.

#### **3.4.2.4. Task 4: Evaluation, Compilation, Analysis, Interpretation and Reporting**

At the conclusion of the monitoring programs, data reports were prepared that summarize high risk sites, water level changes, water level change rates, fish behaviour to ramp down events, the number of fish identified to become stranded, and an assessment of the need for a fish salvage program to coincide with the annual maintenance period.

Results were presented in standalone reports and were also be summarized in the Annual Report as outlined in Schedule 1: General Conditions of the Water Licence.

#### **3.4.2.5. Task 5: Adaptive Management**

Operational guidelines including the Pulse Flow Standard Operating Procedure (NTPC, 2020), were generated following the completion of the Fish Stranding Program and Desktop Mortality Assessment. These guidelines take into consideration the results of the monitoring programs in establishing an adaptive management response framework.

### **3.4.3. Monitoring Program Schedule**

Detailed monitoring of Project shutdowns was conducted in 2014, 2015 and 2016, monitoring of the upstream and downstream barriers was conducted in 2017 and fish salvages were undertaken in 2014, 2015, 2016, 2017 and 2018. Monitoring allowed mortality from operational shutdowns and the effectiveness of the mitigation measures to be assessed.

### **3.4.4. Monitoring Program Results**

Monitoring allowed mortality from operational shutdowns and the effectiveness of mitigation measures to be assessed. Total mortality estimates extrapolated from stranding search densities and stranding habitat classification were calculated by species and life stage in 2014, 2015 and 2016 (Faulkner *et al.* 2015, 2016a and 2016b), and presented in detail in the 2014, 2015 and 2016 annual reports.

Pursuant to subsection 35(1), DFO requested that NTPC provide a FAA application, including updated operational plans for a long-term solution to mitigate and offset operational impacts. On November 15, 2018, a FAA application was submitted under Section 35(2) of the *Fisheries Act* for the annual maintenance shutdowns of the generating station (Faulkner *et al.* 2018).

Issuance of the FAA from DFO was received on August 14, 2020 and is valid until August 30, 2027 (DFO 2020). As part of the FAA, mitigation measures that are to be conducted by NTPC are partial night-time shutdowns and pulse flows, which were found to mitigate an estimated 30% of fish mortality in the

tailrace. In addition, an offset plan is to be implemented to balance the residual serious harm which includes conducting a Walleye Spawning Study on the Little Buffalo and Slave River and the enhancement of critical spawning habitat for adfluvial Lake Whitefish, Lake Trout and Cisco below the Bluefish Hydroelectric facility.

The FAA (No. 18-HCAA-10487) provides further details on the mitigation and monitoring requirements (DFO 2020).

### **3.5. Mercury in Sediment and Fish Flesh Monitoring**

Within the Northwest Territories mercury concentrations in sediments and fish have been documented to be present at levels of concern to residents and local land users due to the significant sustenance fishery in the NWT. There have been numerous cases where lakes and rivers with no anthropogenic activities (past or current) are experiencing mercury concentrations of concern.

To monitor the change in mercury concentrations over time, a field program examining both sediments and fish flesh was designed (NTPC 2013). Sampling under this program has been completed in 2013 and 2019 and will be repeated one more year in 2026. An outline of the components of the program is provided in Table 7. Sampling efforts focus on fish populations within Trudel Creek, Nonacho Lake and Rutledge Lake (as a control lake). Trudel Creek and Nonacho Lake experienced significant shifts in water surface elevations as a result of the Twin Gorges Generating Station. In addition, Nonacho Lake currently supports a recreational sport fishery and has historically provided a sustenance fishery to local resource users.

The following summary provides a high-level overview of the Mercury in Sediment and Fish Flesh Monitoring Program.

#### **3.5.1. Specific Monitoring Program Objectives**

- The primary objective of the Mercury in Sediment and Fish Flesh Monitoring Program is to address the concerns associated with the mercury contamination (Table 1). More specifically, the objectives of the monitoring program are to:
- Collect mercury concentration levels within sediment and fish flesh within Nonacho Lake, Trudel Creek and Rutledge Lake;
- Collect stable isotope (carbon and nitrogen) data on the fish flesh sampled for mercury analysis;
- Collect aging structures from fish sampled for mercury concentrations;
- Identify trends in mercury concentrations;
- Determine if mercury concentrations in fish are above the Health and Welfare Canada and Canadian Food Inspection Agency guidelines for human consumption;
- Conduct an internal examination of sacrificed fish for parasites; and
- Document the stomach content composition and weight of fish sampled for mercury.

#### **3.5.2. General Approach**

##### **3.5.2.1. Task 1: Field Sampling Plan**

Mercury monitoring consists of sampling sediment, water quality and fish tissue. Both sediment and fish flesh samples are collected in Nonacho Lake, Trudel Creek, and Rutledge Lake, which have been sampled during the 2003/2004 WEMP programs and the 2013 and 2019 AEMP programs. Table 8 outlines the key

parameters collected in the 2013 and 2019 field programs and the availability of similar data from previous studies. Spatial distribution of study areas and sampling sites in Rutledge Lake, Trudel Creek and Nonacho Lake are provided in Map 11 through Map 13.

In 2026, water quality samples will be collected from the same sites sampled in 2019, i.e., in general from the same sites that sediment samples are collected from, will be tested for total mercury, methyl mercury, dissolved organic carbon, and biochemical oxygen demand. A summary of sample sites including coordinates, previous sampling dates, and sample depths is provided in Table 9. At a given site, water samples are collected in advance of sediment samples to avoid the potential for contaminating water samples with sediment that has been suspended because of sediment sampling. Water samples are collected with a sampling device that is suitable for trace metals analysis (e.g., Aquatic Research Instruments 2.2 L Van Dorn sampler). The sampler is washed with soapy deionized water and rinsed at each site prior to sample collection. Following collection of samples in each waterbody, a field blank is collected after thoroughly cleaning the sampler with soapy deionized water and rinsing it five times with deionized water. For each waterbody, a travel blank is collected. Sample bottles and preservatives (where applicable) are supplied by the laboratory and are consistent with best practices and current standard methodologies that are in place at the time the work is to be performed. Water samples are kept on ice or refrigerated in between collection and arrival at a certified laboratory.

In 2026, sediment samples will be collected at three deep water sites in Nonacho Lake and Rutledge Lake and one deep water site in Trudel Creek. Sediment samples will be tested for total mercury, methyl mercury, sulphate, total organic carbon, and moisture content to help assess what other parameters may be contributing to mercury levels in fish flesh. A summary of sample sites including coordinates, previous sampling dates, and sample depths is provided in Table 10. At each sample site, sediment will be collected with an Ekman grab or Ponar sediment grab sampler with samples collected from the surface (top 2.5 cm) and sub-surface (2.5 cm thick) layers from each sample. Sample sites in 2026 will match those sampled in 2019. Similarly sampling methodology will match that was employed in 2013 and 2019, including collection of composite samples (n=3 sediment grabs per sample) for each layer sampled at each site and cleaning of sampling equipment between sample sites with soapy deionized water. Sediment samples will be stored in containers provided by the laboratory and kept frozen if possible, and if not kept on ice or refrigerated in between collection and arrival at a certified laboratory.

In 2026, fish flesh will also be collected and analyzed for mercury concentrations and stable isotopes (carbon and nitrogen). Fish species composition varies between each system. Lake Trout, Lake Whitefish, and Northern Pike will be assessed within Nonacho Lake and Rutledge Lake. Within Trudel Creek, Lake Whitefish and Northern Pike will be assessed (no Lake Trout have been documented in Trudel Creek). Fish sampling site coordinates from work done in 2013 and 2019 are provided in Table 11 and Table 12, respectively. Fish will be collected in a range of sizes, with an emphasis on fish with fork lengths ranging from 500 mm to 800 mm, consistent with Environment Canada standards for testing mercury concentrations. In total, 20 specimens of each species in each waterbody will be collected for comparative purposes to historical data. All fish processing equipment will be washed with soapy deionized water and rinsed with deionized water after each sample is processed. Each sample will consist of a 100 g to 200 g filet taken from the left dorsal side of each fish and double bagged in Ziplock plastic bags and sealed with as little air as possible in the internal bag. Each sample will be frozen as soon as possible after collection and shipped on ice to the laboratory. For each fish, ageing structures will be collected (otoliths for Lake Trout and Lake Whitefish, otoliths and cleithra for North Pike).

For each fish captured for mercury analysis, the following data are recorded:

- Date and location of capture;

- Fork length to the nearest millimeter;
- Weight of the fish to the nearest gram;
- An external exam to document deformities, lesions, or tumors;
- An internal exam to document gender and document parasites on organs and in the body cavity;
- Description of and weight of stomach contents to the nearest gram; and
- Gonad weight to the nearest gram.

#### **3.5.2.2. Task 2: Quality Assurance Project Plan**

A Quality Assurance/Quality Control system can be found in Section 3.3.

#### **3.5.2.3. Task 3: Lab Analysis**

All water, sediment, and fish flesh samples will be sent to a certified laboratory for analysis of the parameters discussed above. To be consistent with work done in 2013 and 2019, it is expected that sediment, water, and fish flesh samples will be processed at ALS's facility in Burnaby, BC where there is a dedicated clean room for mercury analysis. Similarly, a subsample from each fish flesh sample will be extracted by ALS in the laboratory at the time the samples are being prepared for mercury analysis and sent to SINLAB (Stable Isotopes in Nature) in New Brunswick for stable isotope (carbon and nitrogen) analysis.

#### **3.5.2.4. Task 4: Evaluation, Compilation, Analysis, Interpretation and Reporting**

A summary report of the laboratory results will be prepared following each completed field program. A trend assessment of mercury concentrations will be conducted following each field assessment and will be compared to baseline data.

Results will be presented in a standalone report and will also be summarized in the Annual Report as outlined in Schedule 1: General Conditions of the Water Licence.

#### **3.5.2.5. Task 5: Adaptive Management Plan**

Objectives of the Mercury in Sediment and Fish Flesh Adaptive Management Plan (AMP) are to:

- Appropriately identify key issues relative to effects on the aquatic ecosystem and its uses, as indicated by monitoring data from the AEMP;
- Establish Action Thresholds for mercury concentrations that are sufficiently conservative to provide adequate time to implement any required mitigation measures; and
- Present an Adaptive Management Approach. This will outline actions that will be taken if the Action Threshold is exceeded.

#### **Key issues**

In general, baseline monitoring data is used to establish background conditions prior to water licensing. Background conditions are then used to define Action Thresholds. In the Taltson River watershed mercury concentrations are not available pre-construction of the Twin Gorges Generating Station; however, information was collected in 2003/2004 and 2010. The information gathered during these years was incorporated to the long-term monitoring of mercury within the system.

The key issue will be to monitor the potential effect of continued operation of the Twin Gorges Generating Station on mercury levels of fish in the Taltson River watershed. Specifically, the key issue is to identify

changes in mercury concentrations in fish flesh in Nonacho Lake, in relation to control lakes. As such a control lake was added to the sample sites to be conducted as a component of the monitoring program.

#### Action Threshold

If an increase in mercury concentration is identified within fish in the Taltson River watershed and subsequently no increase is identified in the control lake, an action threshold will be identified. If mercury concentration levels in fish tissue increase equally in the control lake and the Taltson River watershed it is assumed that the increase is not connected with the operation of the Twin Gorges facility. In this situation, no action threshold will be identified.

#### Adaptive Management Approach

The following adaptive management approach will be followed within the term of the water license:

- If mercury concentrations increase in Nonacho Lake but there is no increase in control systems, then an investigation will be conducted for the reason of the increase and the need for additional monitoring/mitigation will be determined in consultation with the Environment Canada;
- If mercury concentrations increase in both Nonacho and control lakes, no additional monitoring or investigation will be conducted as the increase will be outside the scope of the operation of the Twin Gorges Generating Facility; and/or
- If mercury concentrations decrease over multiple sampling programs, the frequency of the mercury monitoring will be re-evaluated in consultation with Environment Canada.

As AEMP data are collected on mercury concentrations during the life of the project, a number of emerging issues may be identified that were not anticipated in the original impact predictions or in subsequent planning steps. The AEMP will be revised following the completion of each monitoring program to ensure that any such emerging issues are adequately addressed. Ongoing review and refinement of the AEMP will ensure that it will continue to be relevant for supporting decisions on the management of the project as a whole.

### **3.5.3. Monitoring Program Schedule**

Intensive baseline studies and investigations have occurred within the Taltson River watershed from 2003 to 2010. Mercury concentrations were analyzed in 2003/2004 as a component of the 1999 TOR. Additionally, mercury testing in Lake Trout tissue was conducted in Nonacho Lake in 2010. The results obtained within Nonacho Lake in 2010 resulted in a Health Advisory and limitation of lake trout consumption. Therefore, it was proposed in the 2013 version of the AEMP that the Mercury in Sediment and Fish Flesh Monitoring Program be conducted in 2013, 2019, and 2026. Sampling was completed in 2013 and 2019 and is planned to occur again in 2026. NTPC will ensure that the data analysis done for annual reports includes the data from previous years for comparison and knowledge of whether effects are occurring or not.

### **3.5.4. Monitoring Program Results**

Results of samples collected in 2019 indicated that total mercury concentrations declined in Lake Trout from Nonacho Lake. In Rutledge Lake there were no clear differences in total mercury concentrations. Total mercury concentrations declined in Lake Whitefish from Nonacho Lake while concentrations were significantly higher in Nonacho Lake relative to Rutledge Lake. In 2019, the mercury concentrations in Rutledge Lake Whitefish were comparable to concentrations in Trudel Creek Whitefish. Total mercury concentrations in Northern Pike from Nonacho Lake declined. There were no differences in the methylmercury concentrations in fish from Nonacho Lake compared to fish from the Rutledge Lake or

Trudel Creek. Only one Lake Whitefish captured during 2013 and 2019 had a total mercury concentration that exceeded the subsistence guidelines. There were no Lake Whitefish that exceeded the commercial consumption guidelines (Ganshorn *et al.* 2020).

### **3.6. Taltson HEC-ResSim Hydrologic Model Update Program**

Change in a hydrological system can initiate change in biological or physical environment components associated with the system. Maintaining the HEC-ResSim hydrological model of the Taltson River will provide supportive information to the current and any future monitoring programs.

The following summary provides a high-level overview of the Taltson HEC-ResSim Hydrologic Model Updating Program.

#### **3.6.1. Specific Monitoring Program Objectives**

The primary objective of the Taltson HEC-ResSim Hydrologic Model Update Program was to provide supporting information to assess fish stranding potential and the appropriateness of requirements for minimum water levels and flows discharging Nonacho Lake and the Twin Gorges Generating Station (Table 1). The model allows an assessment of whether the requirements are operationally feasible given the existing operational control mechanisms and inflows. More specifically, the objectives of the monitoring program are to:

- Update the existing hydrologic model with data downloaded from installed Water Survey of Canada gauges; and
- Provide supportive data and analyses for other proposed monitoring programs.

#### **3.6.2. General Approach**

##### **3.6.2.1. Task 1: Hydrological Modeling**

Maintaining and updating the hydrologic model assumes the current operating WSC gauges remain operational and involves inputting data from the WSC gauges and any operational conditions (i.e., Nonacho dam controls and daily turbine flows). Suggested output is a basic model hydrograph reporting for the time period of interest.

##### **3.6.2.2. Task 2: Quality Assurance Project Plan**

No Quality Assurance/Quality Control system or Adaptive Management Plans were proposed for the Taltson HEC-ResSim Hydrologic Model Update program.

#### **3.6.3. Monitoring Program Schedule**

The hydrologic model was updated for two-consecutive years (2013-2014), and in 2019. A previously recommended update for 2024 is no longer recommended based on the findings of the most recent update (Akaoka *et al.* 2020).

#### **3.6.4. Monitoring Program Results**

The 2015 HEC-ResSim model was updated in 2019 (Akaoka *et al.* 2020). Results of the 2019 HEC-ResSim model confirm that the water level and flow requirements given in the Water License are achievable and appropriate under existing hydrological and operational conditions. The model now has 31 years of data that can be used to assess the impacts of changes in operations or inflows (e.g., with climate change) on water levels, power production, and downstream flow rates. This amount of data is considered sufficient to assess the inter-annual variability in effects of these changes, and as such the previously prescribed update to the model in 2024 is no longer recommended. Furthermore, the Water Licence

(MV2011L4-0002) does not include any further analysis that require application or future updates to the model.

Although not required, the model could be applied to assess numerous questions associated with water flows and levels in the Taltson system. Examples include (1) assessing the potential impacts of climate change on ability to achieve permitted water flows and levels, (2) assessing the risk of flooding associated with extreme high flows years, (3) assessing operational changes that could be implemented while maintaining permitted water flows and levels, and (4) assessing if any future excursions were preventable through operational adjustments.

### **3.7. Desktop Fish Mortality Assessment**

During normal operations of the Taltson Twin Gorges Generating Station fish within the Twin Gorges Forebay may enter the penstock and become entrained in the turbines. Fish passage through the turbines may result in fish mortality and injuries due to various stresses. These stress inducing mechanisms include cavitation (air bubbles that form due to low pressure and subsequently collapse), sudden shifts in water pressure, rapid changes in water acceleration or deceleration rates, and collisions with stationary or moving turbine parts.

Effects from fish entrainment include short-term injuries and mortalities as well as the long- term effects on fish health, survival, and reproduction abilities. Therefore, under normal operating conditions, the existing turbines could lead to fish entrainment and potential mortality.

The following summary provides a high-level overview of the Desktop Mortality Monitoring Program.

#### **3.7.1. Specific Monitoring Program Objectives**

The primary objective of the Desktop Fish Mortality Assessment was to address the concerns associated with entrainment (Table 1). More specifically, the objectives of the monitoring program were to:

- Estimate the probability of fish entrainment; and
- Assess the level of risk to fish populations in the Twin Gorges Forebay.

#### **3.7.2. General Approach**

##### **3.7.2.1. Task 1: Desktop Assessment**

A considerable amount of information is available on fish species composition within the Twin Gorges Forebay and habitat conditions directly adjacent to the existing penstock inlet. As such, a relatively robust assessment of potential entrainment could be completed at a desktop level. The steps involved in the desktop assessment included:

- Conducting a detailed literature review of the potential effects associated with fish entrainment;
- Calculating survivability rates of entrained fish;
- Characterizing the species and life-stage composition associated with the aquatic environment;
- Applying any physical or biological filters that may affect entrainment; and
- Determining the probability for entrainment.

##### **3.7.2.2. Task 2: Evaluation, Compilation, Analysis, Interpretation and Reporting**

Following the completion of the desktop assessment, an evaluation of risk to fish populations within the Twin Gorges Forebay was conducted. Based on the results, recommendations were provided on next steps required to substantiate the potential effects of entrainment.

### **3.7.2.3. Task 3: Adaptive Management**

An adaptive management framework was not proposed for the Desktop Fish Mortality Assessment.

### **3.7.3. Monitoring Program Schedule**

The desktop fish mortality assessment was completed in 2016.

### **3.7.4. Monitoring Program Results**

The assessment was completed by characterizing the probability of fish entrainment through the unscreened intake at the Twin Gorges Generating Station for a selection of fish species and life stages reported to be present and discussing the potential fate of entrained fish that may pass through the generating station infrastructure (Buchanan *et al.* 2016).

Although entrainment is likely occurring to some extent at the Twin Gorges Generating Station, the probability of occurrence is expected to be low. The fish community utilizing the Forebay consists of resident, non-migratory stocks, and therefore the behavioral impetus for downstream movement and dispersal is considered low. As a result, entrainment of fish through the Twin Gorges intake is most likely non-volitional (passive) in nature. The probability of fish encountering the intake entrance is low, considering its small size relative to the Forebay, and the lack of special habitat features that would be expected to attract or concentrate fish nearby. For fish that move past the intake, the probability of entrainment is further limited by the intake configuration, poor habitat quality for most species and life stages near the intake site, and low water velocities. The probability of occurrence is highest for fish with the weakest swimming ability: small-bodied fish (<100 mm in fork length) including juveniles (e.g., Lake Trout) followed by sub-adult Lake Cisco and Lake Whitefish. Large-bodied adult fish such as Lake Trout and Northern Pike are at negligible risk of non-volitional entrainment because of the high burst swimming speed of these species relative to the predicted penstock velocities.

Survival of entrained fish, should entrainment occur, is highest for small-bodied fish but is predicted to decrease with increased fish size. Mortality could be induced by mechanical injury and/or barotrauma as fish pass through the turbine. Estimates of the mortality rate due to barotrauma based on relationships from scientific literature, assuming a moderate pressure nadir, predict that this pathway of effect may be equally as important as mechanical injury for the smallest fish most at risk of entrainment. Displacement of fish to the waters downstream of the Forebay, via entrainment, is expected to have neutral consequences for surviving fish, provided habitat is available for them. These fish may contribute to downstream populations. However, given the low proportion of the population expected to be subject to entrainment, the overall impact upon the fish populations in the Forebay is expected to be low. The rate of entrainment may be similar to natural conditions when a small proportion of the Forebay population would have been displaced over Twin Gorges Falls.

Scientific confidence in the assessment is moderate and could be increased with additional fisheries data, particularly with regard to species composition and fish use of the shallow, near-shore habitats near the intake location relative to overall habitat use in the Forebay, more detailed information on the initial intake structure, and data on nadir pressure within the turbine. This assessment was further supported by measurement of velocities at the intake during August 2017, where in general the velocities calculated for the penstock and intake entrance were on average similar to those estimated in the desktop study (Faulkner *et al.* 2017a).

## **3.8. Nonacho Lake and Lower Taltson River Flow and Water Level Analysis**

Currently the Water Licence (MV2011L4-00002) has the following permitted conditions:

1. The Twin Gorges Forebay water level must not fall below 238.9 m;
2. The Nonacho Lake Reservoir water level must stay between 319.3 m and 321.6 m;
3. A minimum flow of 14 m<sup>3</sup>/s should be maintained in the river channel between the outflow of the control structure at Nonacho Lake and the Twin Gorges Forebay; and
4. A minimum flow of 28 m<sup>3</sup>/s should be maintained below the Twin Gorges Generating Station in the river channel at a point 100 m below the confluence of Trudel Creek and Taltson River.

In 1996, concerns were raised on the limited data used to establish the permitted water level conditions.

The following summary provides a high-level overview of the Nonacho Lake and Lower Taltson River Flow and Water Level Analysis Program.

### **3.8.1. Specific Monitoring Program Objectives**

The primary objective of the Nonacho Lake and Lower Taltson River Flow and Water Level Analysis was to address the concerns associated with hydrologic modeling and the appropriateness (operational feasibility) of the water license conditions (Table 1). More specifically, the objectives of the analysis were to:

- Review and update the HEC-ResSim hydrologic model with current data to confirm the model is consistent with current operating conditions and that the limits and conditions in the Water License are appropriate; and
- Review water level elevations and flow data within the Twin Gorges and Nonacho Lake Reservoirs annually to document any excursions from the conditions in the Water License.

### **3.8.2. General Approach**

#### **3.8.2.1. Task 1: Hydrological Modeling**

The HEC-ResSim hydrologic model was updated and operational scenarios were run to assess the appropriateness of permitted water levels and flows using data from 1987 to 2015 (Imam *et al.* 2015).

Hydrological parameters were the only conditions that were considered as a component of the assessment.

#### **3.8.2.2. Task 2: Reporting**

Results were presented in a standalone report (Imam and Cullen 2015) and water level elevations and flow data will also be summarized in the Annual Report as outlined in Schedule 1: General Conditions of the Water License.

#### **3.8.2.3. Task 3: Adaptive Management**

An adaptive management framework was not proposed for Nonacho Lake and Lower Taltson River Flow Analysis.

### **3.8.3. Monitoring Program Schedule**

The Nonacho Lake and Lower Taltson river flow and water level analysis was completed in 2015. The model may be used to evaluate further water levels and flow as required. Further updates to the model occurred through the Taltson HEC-ResSim Hydrologic Model Update Program (Section 3.2.4). Using the model, water levels and flows in the Nonacho Lake and Lower Taltson River can be continuously monitored.

### 3.8.4. Monitoring Program Results

The HEC-ResSim hydrologic model was reviewed for appropriateness in 2015 (Imam and Cullen 2015). Based on the model results, the water level and flow requirements given in the Water License were found to be achievable and appropriate under existing hydrological and operational conditions. Specific findings included:

- The observed water levels and flows were in the range specified by the Water License between 1987 and 2014 (Imam and Cullen 2015). For Nonacho Lake, model results indicated that occurrence of water level below the minimum level permitted in the Water License is unlikely under existing hydrological conditions and for any gate setting at the Nonacho Lake Dam;
- Exceedance of the maximum permitted water level is also unlikely with full opening of gates at the Nonacho Lake Dam. However, model results indicate that exceedances may occur during years of high inflow to Nonacho Lake with nearly fully closed gates on Nonacho Lake Dam. With full gate closure, simulated water level in Nonacho Lake exceeded the maximum permitted level for only ~1% of the simulation period of ~19 years from 1978 to 1990 and 2007 to 2013;
- For the Twin Gorges Forebay, simulation results indicated that releasing a steady flow of up to 54 m<sup>3</sup>/s from the Twin Gorges Generating Station would maintain the Forebay water level above the minimum level of 238.9 m permitted in the Water License. Releasing steady flows higher than 54 m<sup>3</sup>/s may lead to occurrences of water levels lower than permitted by the Water License, particularly during years with low inflows to Nonacho Lake and with fully closed gates at Nonacho Lake Dam; and
- For the current typical maximum electric power production at the Twin Gorges Generating Station, water level in the Twin Gorges Forebay is unlikely to decrease below the minimum level permitted in the Water License under existing hydrologic conditions.

### 3.9. Sediment and Erosion Monitoring Program

As part of the water license renewal process, a Sediment and Erosion Management Plan (SEMP) was developed for the Taltson Hydroelectric project to be completed throughout the term of water license. The SEMP was updated in 2016 and approved by the Mackenzie Valley Land and Water Board (MVLWB) in 2018 (NHC 2016). A condition of the approval was that an updated SEMP was to be submitted to the MVLWB for review by November 30, 2019. The objective of the 2019 monitoring program was to complete the erosion monitoring requirements of the SEMP and to update the SEMP based on the 2019 findings. The updated SEMP document (West *et al.* 2019) includes the updated monitoring plan, as well as results from the 2019 analysis as an appendix.

The following summary provides a high-level overview of the Sediment and Erosion Monitoring Program.

#### 3.9.1. Specific Monitoring Program Objectives

The primary objectives of the SEMP include:

- Assessment of the effect of continued operation of the Twin Gorges Generation Station on existing erosion rates and Total Suspended Solids (TSS) loading within Trudel Creek and Nonacho Lake;
- If contributing effects are significant, use erosion rate data to determine the effect to aquatic life;
- Identify the need for erosion prevention and mitigation procedures and practices; and
- Assess requirements for future monitoring based on possible effects to aquatic life.

### **3.9.2. General Approach**

The SEMP approach includes the following general actions:

- Collection of field data every five to seven years;
- Comparison of field data to previous years to assess changes in erosion rates and TSS levels;
- Assessment of significance of erosion, and if significant then, an assessment of risk to aquatic life; and
- If risk to aquatic life is high, develop erosion prevention and mitigation procedures. If risk to aquatic life is medium or low, continue monitoring as required for the remaining years of the program.

#### **3.9.2.1. Field Sampling Plan**

Field sampling locations are shown on Map 1, 2, 3, and 6 of Appendix A of the 2019 SEMP monitoring report (West *et al.* 2019) and in Map 14 through Map 19 in this report. The field sampling plan includes the following elements during each of the monitoring years:

- Erosion monitoring site assessment using erosion pins and repeated oblique and aerial photographs;
- Low-level aerial imagery in Trudel Creek;
- Oblique and aerial photographs from the South Valley Spillway to approximately 6 km past Taltson River and Trudel Creek confluence; and
- Continuous TSS monitoring for open water period.

#### **3.9.2.2. Quality Assurance Project Plan**

The quality assurance project plan follows the guidelines detailed in Section 3.3. Specifically, all field data, data entry, and interpretation is completed by a geomorphologist and reviewed by a certified geomorphologist.

#### **3.9.2.3. Evaluation, Compilation, Analysis, Interpretation and Reporting**

Following data collection, a similar report to Appendix A of West *et al.* (2019) is required during the next monitoring year (2026). The report will include an evaluation of erosion rates and turbidity levels by a qualified geomorphologist and assessment of whether these could be adversely affected by ongoing operations. If erosion and turbidity levels from ongoing operations are found to be significant, a qualified biologist will assess the impacts to aquatic life. The analysis and interpretation methods should follow those completed in West *et al.* (2019), depending on the significance of effects and risk to aquatic life.

#### **3.9.2.4. Adaptive Management**

If erosion is found to be significant on either Nonacho Lake or Trudel Creek, an assessment of the effects on the aquatic environment is required. Erosion rates are defined as significant when they are consistently above pre-background levels, and erosion is occurring across the landscape such that erosion is the 'norm'. If the effect to the aquatic environment is found to be high, then development of erosion prevention and mitigation procedures and practices is required. If the effect is found to be medium, then continued erosion monitoring is required. One of the comments from MVLWB's review of the 2016 SEMP update was that low-level mitigation options should be considered even if the effects to the aquatic environment were medium. These mitigation options were presented in West *et al.* (2019).

### **3.9.3. Monitoring Program Schedule**

As per the schedule of the SEMP developed in 2012 the next phase of monitoring is scheduled to take place in 2026. Previous monitoring was completed in 2008, 2013, 2014, and 2019. Further monitoring of Trudel Creek and Taltson River is recommended due to the medium risk to some fish species as detailed in West *et al.* (2019). The finding of no significant project effect of continued operations on current Nonacho Lake Erosion indicates that monitoring on Nonacho Lake is no longer required (West *et al.* 2019).

### **3.9.4. Monitoring Program Results**

Results of monitoring on Nonacho Lake and Trudel Creek in the summer of 2019 showed that the effects of continued operation of the hydroelectric project on existing erosion rates are not significant at Nonacho Lake and are significant at Trudel Creek. These findings agree with those of NHC (2016). Due to the finding of significant erosion on Trudel Creek, an assessment of the effects on the aquatic environment was completed, resulting in an assignment of medium risk to the aquatic environment due to ongoing morphological change and turbidity resulting from ongoing facility operations. This finding is similar to that of the aquatic environmental effects assessment completed in 2016 (Ganshorn and Lewis 2016) that found that the effects were in the form of ongoing morphological change and TSS loading resulting from Project operations. Based on the evaluation framework detailed in the original SEMP (NTPC 2012), this finding indicates that mitigation is not required but that ongoing monitoring of erosion rates is necessary at Trudel Creek. Monitoring of Nonacho Lake is no longer required.

#### 4. QUALITY ASSURANCE/QUALITY CONTROL SYSTEM

A Quality Assurance/Quality Control (QA/QC) System or Quality Assurance Project Plan for the AEMP ensures compliance with study parameters, standards, and permits, and provides assurances that reliable and accurate data are produced. The QA/QC System for the AEMP has been developed at an overview level with specific details to be developed prior to execution of the study program based on the sample parameters, duplicates, blanks, and other means to assure quality controls.

The QA/QC System is divided into four components. An overview of the four components is described below:

- QA/QC 1: Program/Study Scope

The primary purpose of Program/Study Scope is to develop and understand schedule, scope, and study purpose; to identify potential permit requirements; to identify Qualified Professionals to conduct the program; and to initiate the Study Standards and Work Plan (below).

- QA/QC 2: Study Standards and Work Plan

The Study Standards and Work Plan identifies the study standards/guidelines and prepares field check lists and resources/equipment lists based on the standards/guidelines and permit requirements.

- QA/QC 3: Field Data Collection and Confirmation

During the Field Data Collection and Confirmation, field personnel collect study data in accordance with standards and permits and use the check lists to record and cross reference study data and requirements. Information gaps are recorded and explanations for gaps are documented.

- QA/QC 4: Data Management and Reporting

Upon completion of the field data collection, data is organized and managed in accordance with the check lists, standards, and program work plan. Data is validated through a review and verification process to ensure data is complete, accurate and useable for reporting under the AEMP.

The four components of the QA/QC system outlined above will be incorporated into the field work plans required for each monitoring program and will be reviewed and approved by Qualified Environmental Professionals (QEP's).

## 5. TRADITIONAL KNOWLEDGE

NTPC is committed to the long-term collection of traditional knowledge throughout the term of the Water Licence. Where applicable, two (2) local technicians would be used to assist in collecting baseline data during field monitoring programs. NTPC will retain services of one elder with direct experience and knowledge of Nonacho Lake and the Taltson River Watershed and one youth be present during technical sampling associated with the AEMP. During the field component assessments, Aboriginal representatives would have the opportunity to provide Traditional Knowledge through a survey completed at each study area.

A copy of the traditional knowledge use survey form that will be used at each location is included on the following pages. Local and Traditional Knowledge obtained during the survey will be compiled and incorporated into the baseline annual reports for each monitoring program. The information will also be used in the adaptive management program.



## Traditional Knowledge Questionnaire

<b>Date:</b>	<b>Interviewee:</b>
<b>Location:</b>	<b>Interviewer:</b>
1. Have you or anyone from your community fished at this location before?	
2. What fish would you expect to catch here?	
3. How would you catch fish at this location? What kind of gear would you use?	
4. What is the best time of year to catch fish here?	
5. Have you ever seen diseased or dead fish here?	
6. Have you noticed a difference in the taste of fish here?	
7. Do the people in your community use any part of the fish for medicine? If so, which part and for what?	
8. Do you know where the females lay their eggs?	
9. Do you see non-First Nations people fishing here? If so, when, at what time of year?	
10. Can you remember a time when there were less fish here than there is now?	
11. Would you normally fish in an area with vegetation? Why or why not?	
12. Has the instream vegetation changed over the last 20 years at this location?	
13. Is this a typical water level for this time of year?	
14. When is the last time you or someone from your community have been at this location or used this for traditional use?	
15. Have you ever hunted or berry picked in this location?	



## **6. SURVEILLANCE NETWORK MONITORING PROGRAM**

NTPC is currently updating the Operation, Maintenance and Surveillance Manual for the Taltson Twin Gorges Generating Station. Water level and flow data recorded provide critical data for a number of the proposed monitoring programs. During the desktop scoping phase of each monitoring program, a review of the information available within the Surveillance Network Monitoring Program will be conducted and useful hydrological data will be utilized in the overall assessment.

## 7. SUMMARY OF SAMPLE SITE LOCATIONS

Schedule 2: Conditions Applying to Monitoring within the Water Licence indicates that a map and attached table or detailed legend illustrating monitoring and sampling locations are to be provided. As a component of the monitoring programs, the specific monitoring locations were to be determined through a desktop scoping assessment or a field reconnaissance assessment.

### 7.1.1. Riparian Habitat and Fish Usage Monitoring

Background information was reviewed to compile information about the aquatic environment and riparian habitat within the Taltson River from Nonacho Lake to the Facility to help inform site selection. Study areas were identified based on the following criteria:

- The potential to safely access the area and execute the proposed works (e.g., helicopter landing potential, wading conditions);
- Quality and character of data reported as part of the baseline study (Cambria Gordon Ltd. 2009);
- The suitability of sites for using the proposed fish sampling gear types; and
- Riparian and littoral habitat presence (i.e., sites were only selected in areas where submergent/emergent vegetation was present).

Study sites were evaluated and finalized in the field based on the above criteria. Based on the physical constraints identified at each site and ability to execute the work program, a single study area was established in each system. Sites sampled in 2019 will be sampled in 2026, assuming they remain representative of the criteria described above. Site names and waypoint information is provided in Table 3 through Table 5. Spatial distribution of study areas and sampling sites in the Taltson River watershed are provided Map 3 through Map 9.

### 7.1.2. Trudel Creek and Lower Taltson River Fish Stranding Monitoring

Stranding monitoring site selection was completed in a two-stage process. Initially, a reconnaissance level field survey and desktop analysis were completed to identify sensitive areas to focus on for specific site selection.

The on-site stranding monitoring site selection entailed helicopter overflight confirmation of sensitive areas and crews visiting these pre-identified areas. Stranding monitoring sites were established within these defined study sections and additional areas where a high risk of fish stranding was deemed to occur.

Two stranding monitoring sites were established within Trudel Creek in location of inundated vegetation to assess if fish would become stranded within these types of habitat. The other stranding monitoring sites in Trudel Creek and Taltson River were all non-vegetative sites: defined as having a shallow sloping stream margin, possessing depressions or small pools, and possessing substrates ranging from sand to large cobble.

Site names and waypoint information is provided in Table 6. Spatial distribution of sampling sites in the Taltson River watershed are provided in Map 10.

### 7.1.3. Mercury in Sediment and Fish Flesh Monitoring Program

The Mercury in Sediment and Fish Flesh Monitoring Program comprises three core study areas (Nonacho Lake, Rutledge Lake, and Trudel Creek). Fish sampling site coordinates from work done in 2013 and 2019 are provided in Table 11 and Table 12, respectively. Spatial distribution of sampling sites is provided in Map 11 through Map 13.

#### **7.1.4. Sediment and Erosion Monitoring Program**

The Sediment and Erosion Monitoring Program comprised two areas (Nonacho Lake and Trudel Creek). Field sampling locations are shown in Map 14 through Map 19. The findings of no significant project effect of continued operation on current Nonacho Lake erosion indicates that monitoring on Nonacho Lake is no longer required.

## **8. AEMP MONITORING SCHEDULE**

The AEMP monitoring program schedule is outlined in Table 13. All program components are up to date. Monitoring is scheduled in 2026 for the Riparian Habitat and Fish Usage Assessment, Mercury in Sediment and Fish Flesh Monitoring, and the Sediment and Erosion Monitoring programs.

## **9. ANNUAL AQUATIC EFFECTS MONITORING PLAN REPORT**

Annual reports detailing all data collected for the purpose of examining the effects with the continued operation of the Taltson Twin Gorges Generating Station are completed as outlined in Section F.6 of the Water Licence. The annual reports are produced in conjunction with the stand-alone monitoring program reports and submitted to the Mackenzie Valley Land and Water Board for approval by March 31<sup>st</sup> of the following year.

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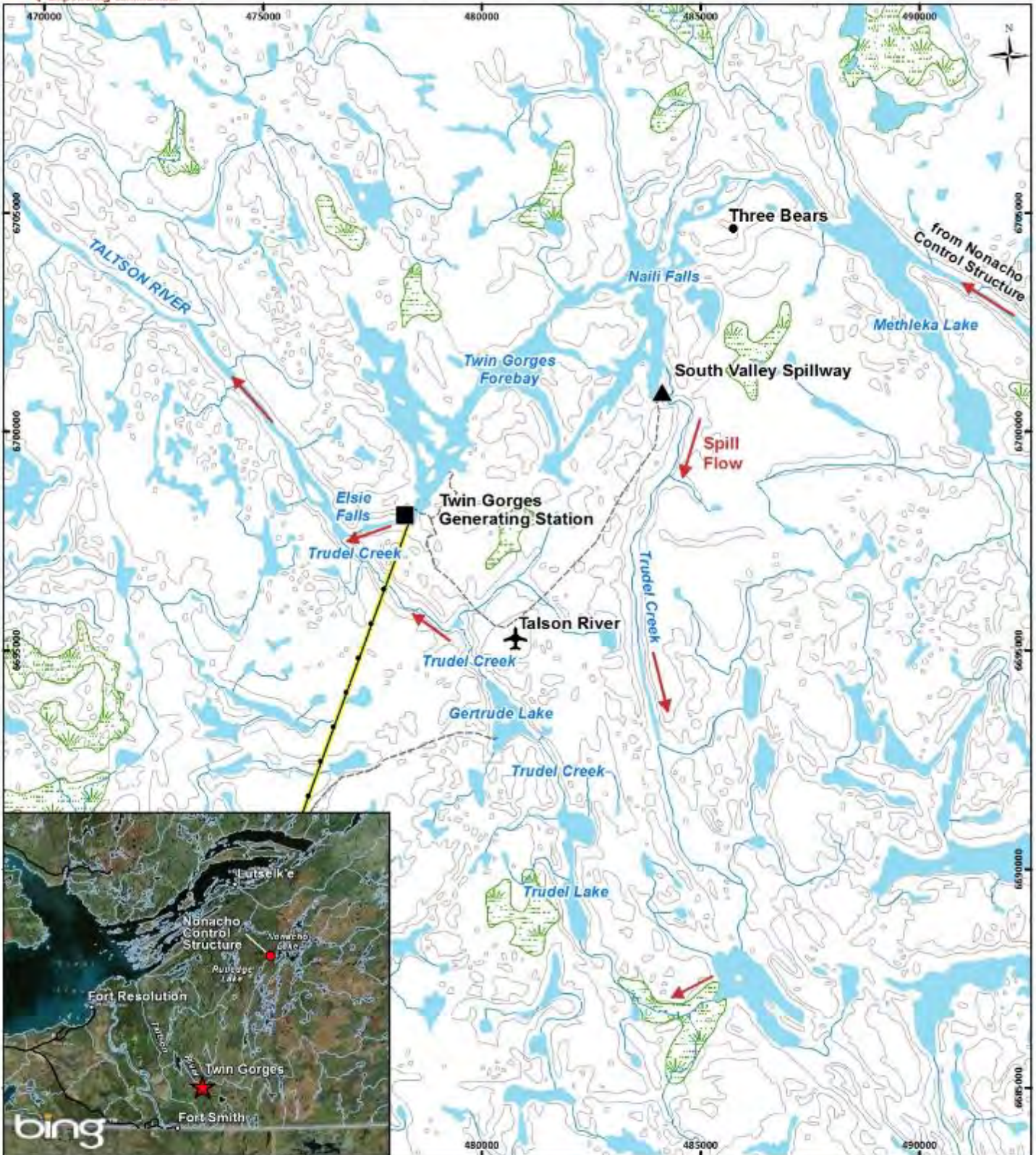
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**PROJECT MAPS**

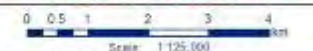
# Project Overview



**Legend**

- Runway
- South Valley Spillway
- Twin Gorges Powerhouse
- Transmission Line
- Road
- Contour (20 m)
- Wetland

**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**

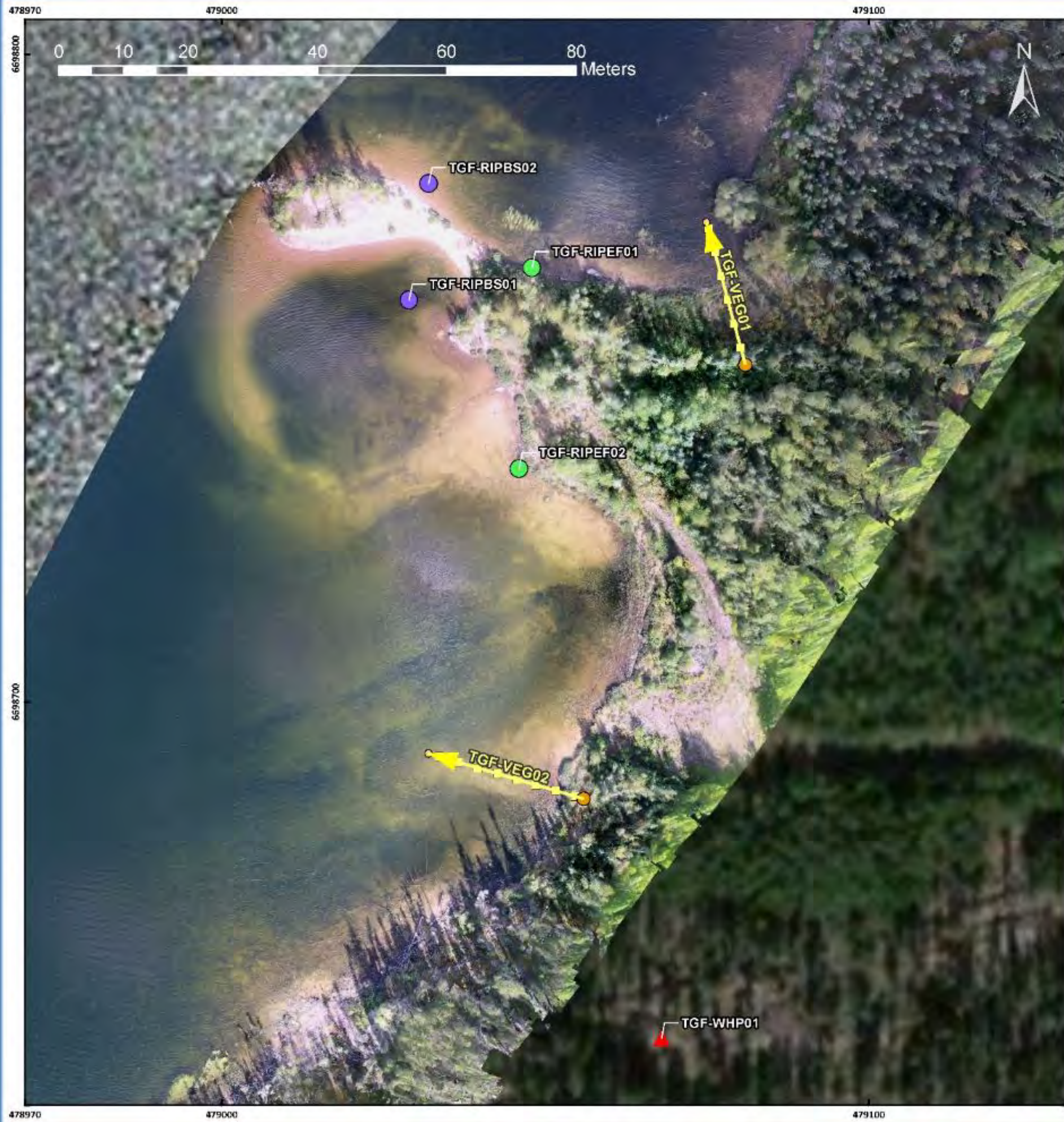


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Images courtesy of ESRI, National Atlas Database (NTDB) compiled by the government of Canada, Natural Resources Canada (NRCAN) at 1:2,000,000

Data Sourced: 1/19/2018  
 Coordinate System: NAD 1983 UTM Zone 12N





## Twin Gorges Forebay



### NTPC TALTSO Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▶ Transect Line
  - Transect Start
  - Transect End
  - Quadrat

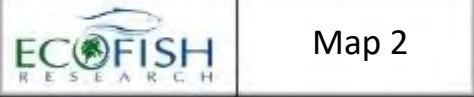


MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES



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Coordinate System: WGS 1984 UTM Zone 12N





## Trudel Lake



### NTPC TALTSON Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▶ Transect Line
  - Transect Start
  - Transect End
  - Quadrat

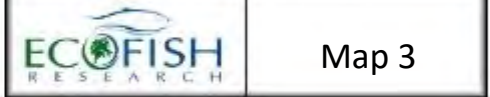


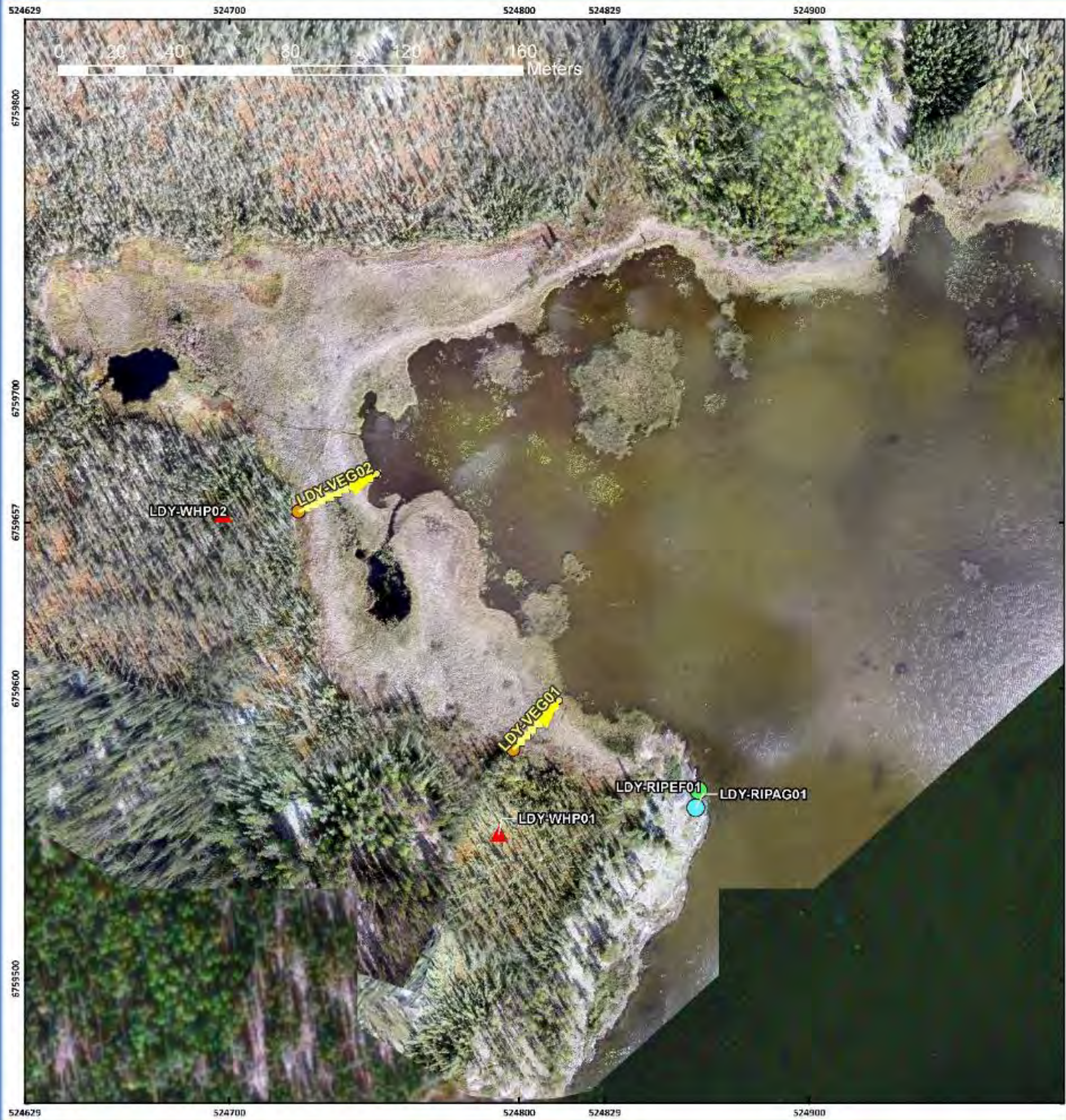
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NO.	DATE	REVISION	BY
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2			
3			
4			
5			

Date Saved: 4/27/2020  
Coordinate System: WGS 1984 UTM Zone 12N





## Lady Gray Lake

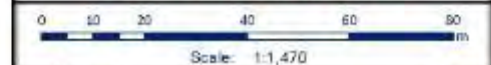


### NTPC TALTSON Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▶ Transect Line
  - Transect Start
  - Transect End
  - Quadrat

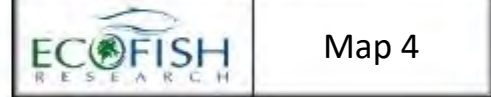


MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES



NO.	DATE	REVISION	BY
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2			
3			
4			
5			

Date Saved: 4/27/2020  
Coordinate System: WGS 1984 UTM Zone 12N



565887

565900

566000



### Nonacho Lake



### NTPC TALTSON Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▶ Transect Line
  - Transect Start
  - Transect End
  - Quadrat

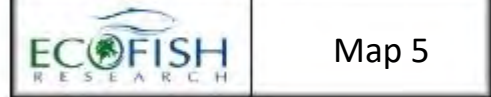


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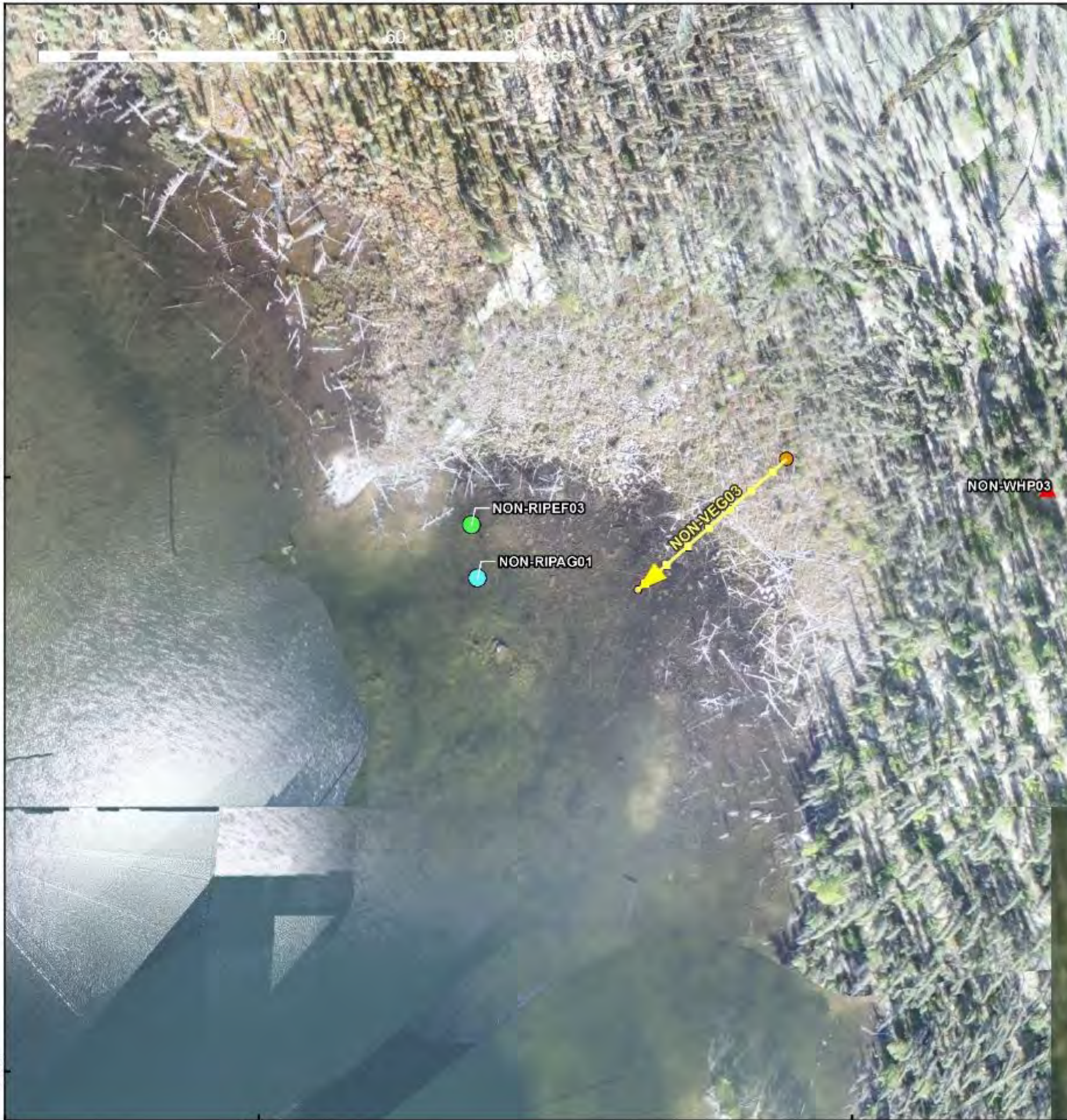
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Date Saved: 4/27/2020  
Coordinate System: WGS 1984 UTM Zone 12N



566257 566300 566400



6836500

6836400

566257 566300 566400

## Nonacho Lake



### NTPC TALTSON Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▶ Transect Line
  - Transect Start
  - Transect End
  - Quadrat

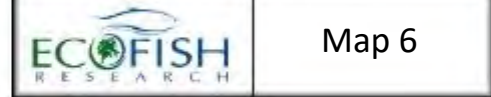


**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**

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NO.	DATE	REVISION	BY
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3			
4			
5			

Date Saved: 4/27/2020  
Coordinate System: WGS 1984 UTM Zone 12N





### Rutledge Lake



### NTPC TALTSON Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▬ Transect Line
  - Transect Start
  - Transect End
  - Quadrat

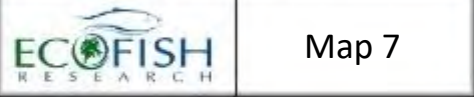


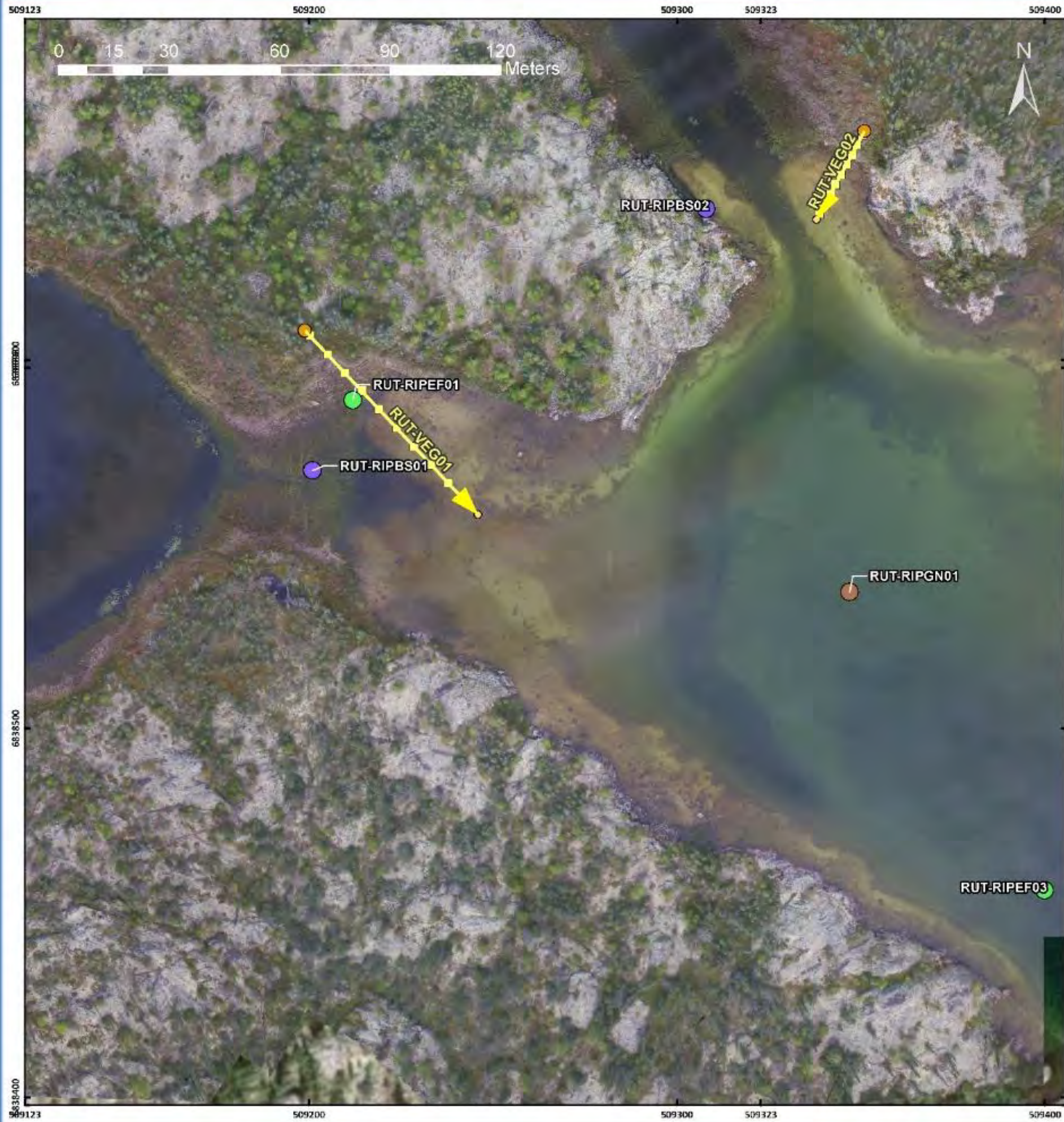
MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES



NO.	DATE	REVISION	BY
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2			
3			
4			
5			

Date Saved: 4/27/2020  
Coordinate System: WGS 1984 UTM Zone 12N





### Rutledge Lake



### NTPC TALTSON Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▬ Transect Line
  - Transect Start
  - Transect End
  - Quadrat



MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES



NO.	DATE	REVISION	BY
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2			
3			
4			
5			

Date Saved: 4/27/2020  
Coordinate System: WGS 1984 UTM Zone 12N





## Talston River



### NTPC TALTSON Twin Gorge Mitigation Taltson Riparian Habitat and Fish Use Assessment Sites (2019)

- Legend**
- Sampling Method**
- Angling
  - Beach Seine
  - Electrofishing
  - Gill Net
  - Water Quality
  - ▲ Vegetation Plot (WHP)
- Vegetation Transect**
- ▶ Transect Line
  - Transect Start
  - Transect End
  - Quadrat

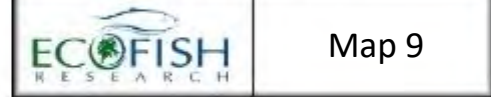


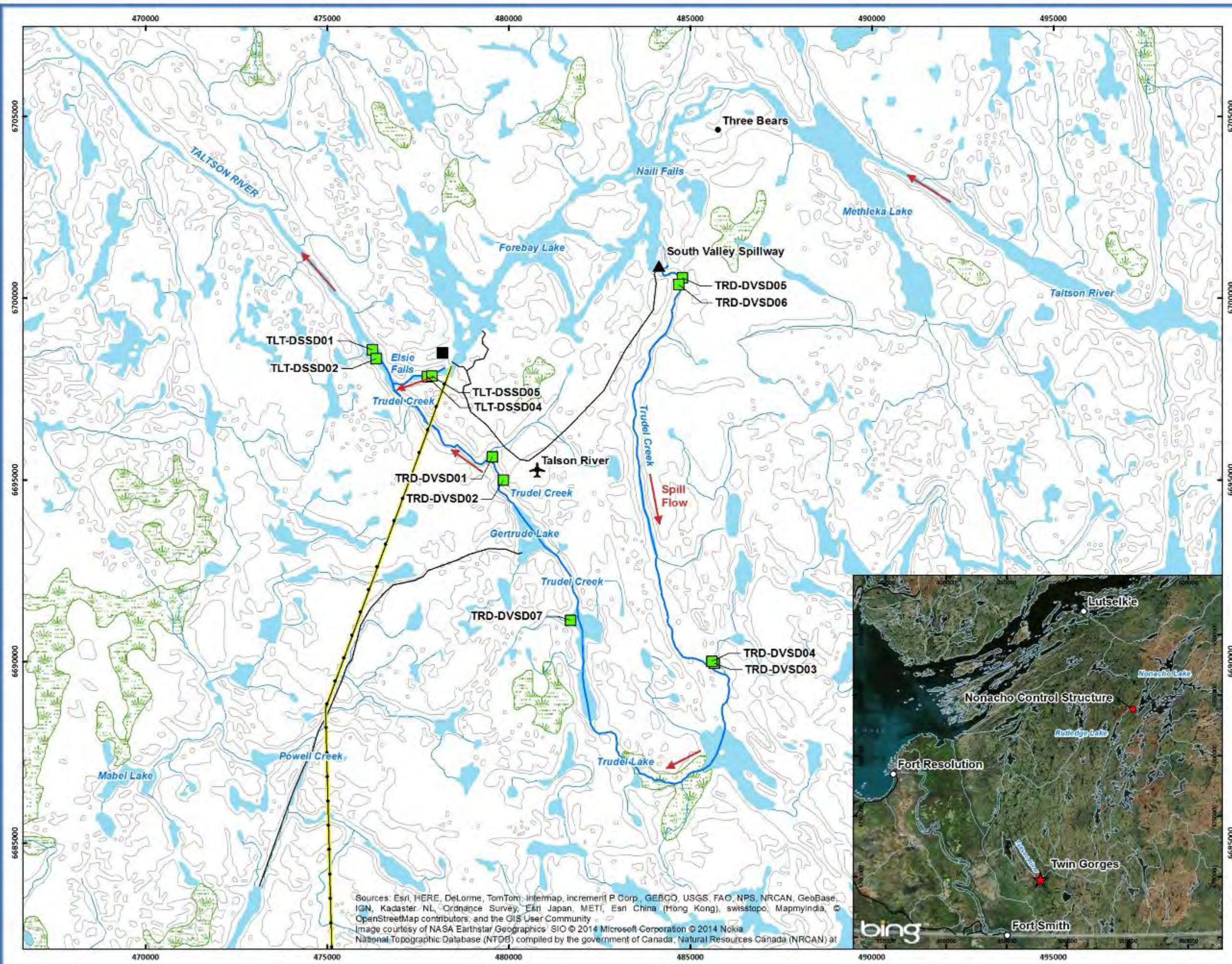
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3			
4			
5			

Date Saved: 4/27/2020  
Coordinate System: WGS 1984 UTM Zone 12N





**Legend**

- Stranding Site
- ✈ Runway
- ▲ South Valley Spillway
- Transformer Station
- Transmission Line
- Road
- Wetland
- Contour (20 m)



**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**

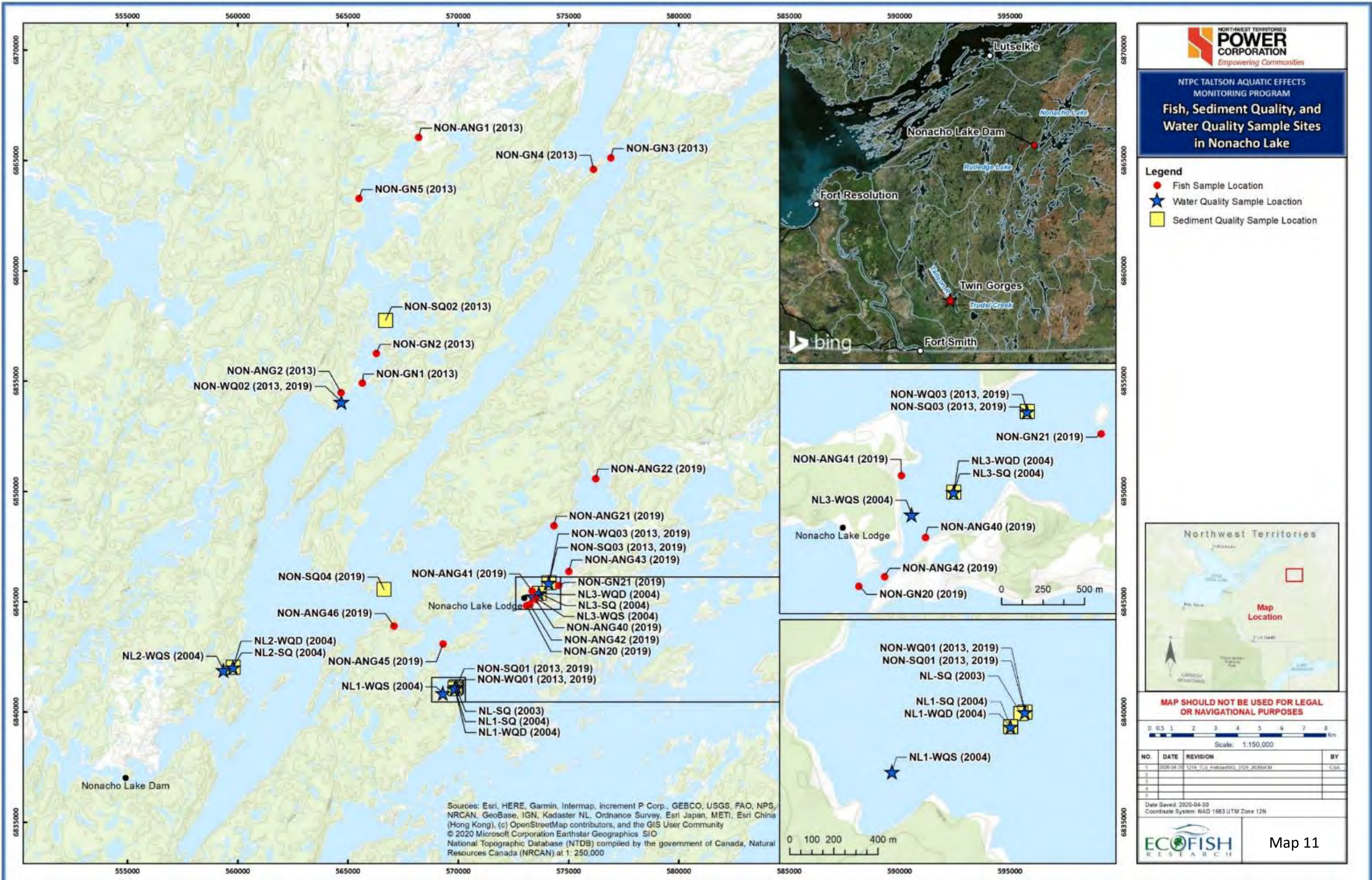


NO.	DATE	REVISION	BY
1	23/11/2014	1019 TLS Stranding Sites Overview 2014Rev01	CGA
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Date Printed: 20/11/2014  
Coordinate System: NAD 1983 UTM Zone 12N



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
Image courtesy of NASA Earthstar Geographics/ SIO © 2014 Microsoft Corporation © 2014 Nokia National Topographic Database (NTDB) compiled by the government of Canada, Natural Resources Canada (NRCAN) at



**NTPC TALTSO AQUATIC EFFECTS MONITORING PROGRAM**  
**Fish, Sediment Quality, and Water Quality Sample Sites in Nonacho Lake**

- Legend**
- Fish Sample Location
  - ★ Water Quality Sample Location
  - Sediment Quality Sample Location



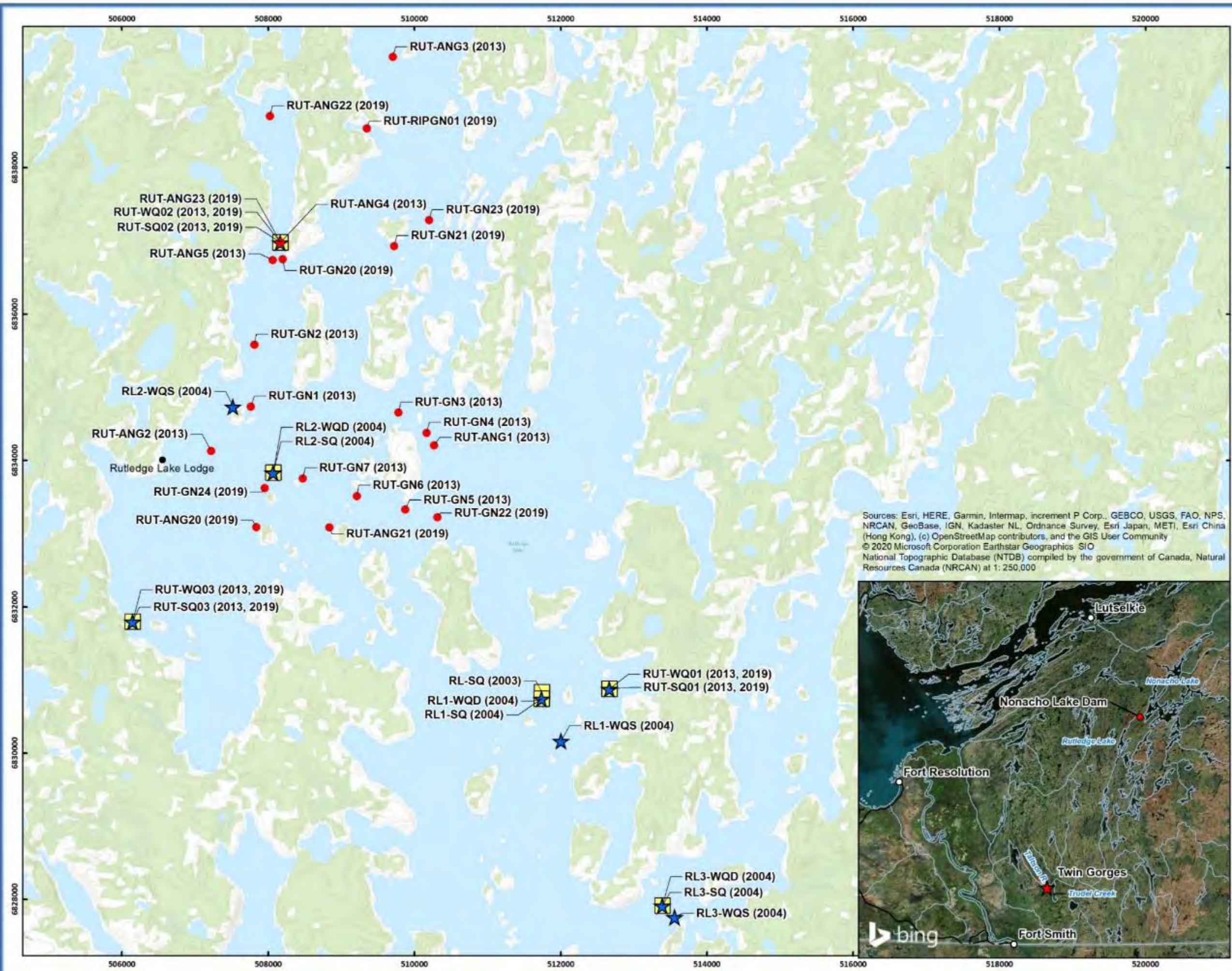
**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**

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Scale: 1:150,000

NO.	DATE	REVISION	BY
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3			
4			
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Date Saved: 2020-04-30  
Coordinate System: NAD 1983 UTM Zone 12N

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community  
© 2020 Microsoft Corporation Earthstar Geographics SIO National Topographic Database (NTDB) compiled by the government of Canada, Natural Resources Canada (NRCAN) at 1:250,000



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community  
 © 2020 Microsoft Corporation Earthstar Geographics SIO  
 National Topographic Database (NTDB) compiled by the government of Canada, Natural Resources Canada (NRCAN) at 1: 250,000

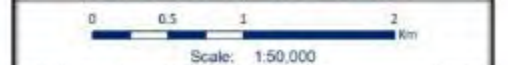


**NTPC TALTSON AQUATIC EFFECTS MONITORING PROGRAM**  
**Fish, Sediment Quality, and Water Quality Sample Sites in Rutledge Lake**

- Legend**
- Fish Sample Location
  - ★ Water Quality Sample Location
  - Sediment Quality Sample Location

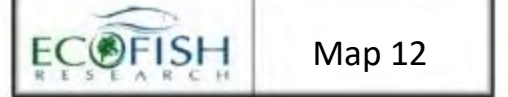


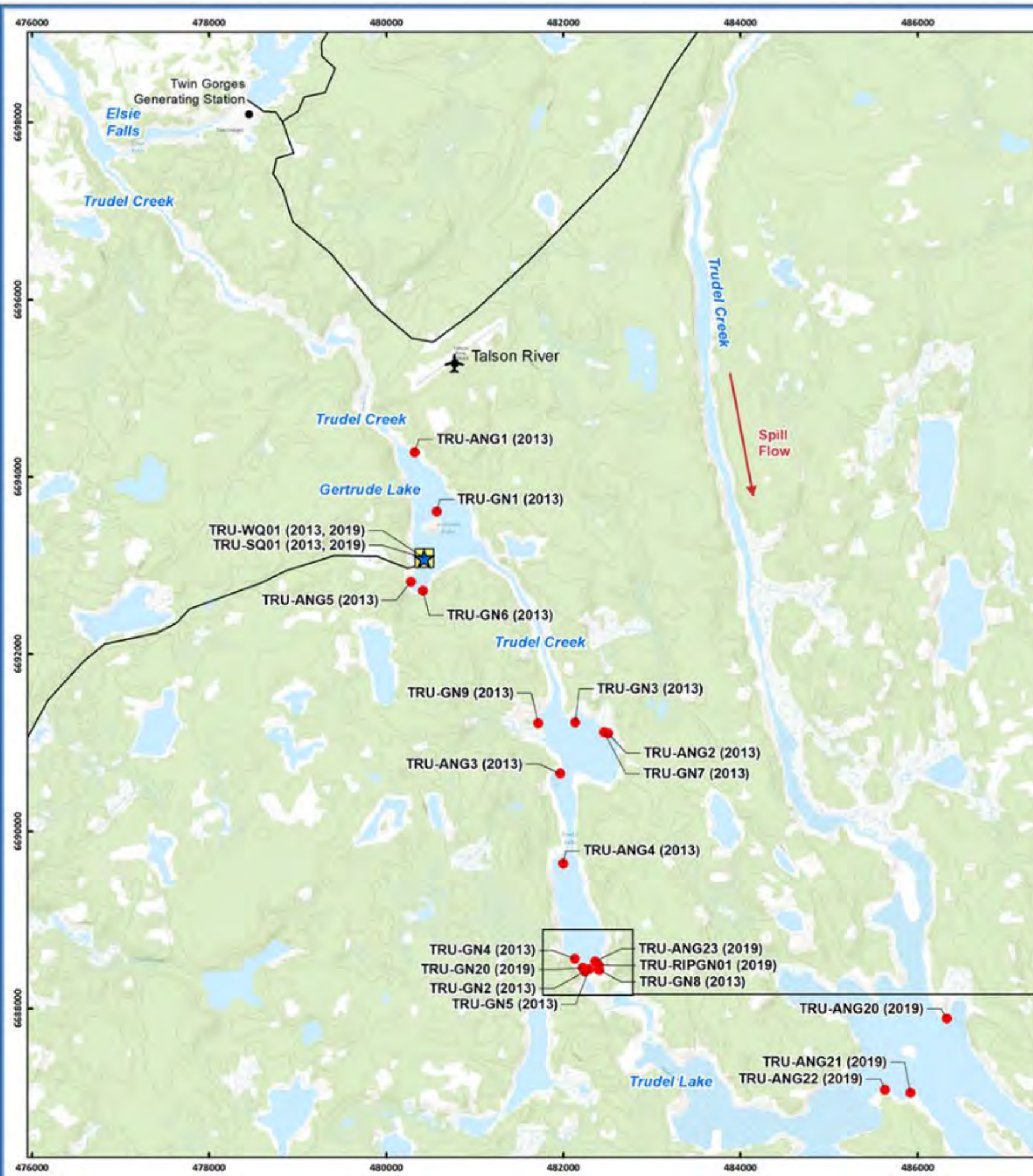
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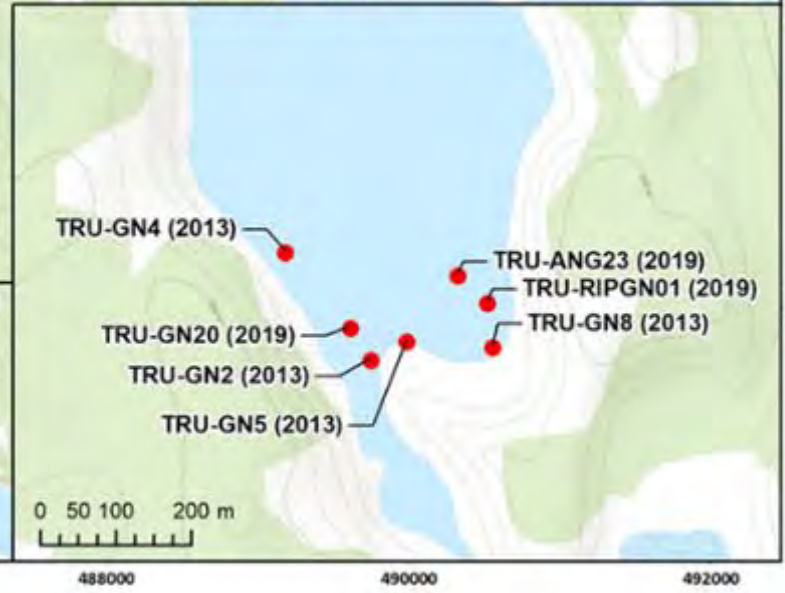
NO.	DATE	REVISION	BY
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3			
4			
5			

Date Saved: 2020-04-30  
 Coordinate System: NAD 1983 UTM Zone 12N





Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community  
 © 2020 Microsoft Corporation Earthstar Geographics SIO  
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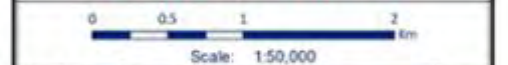


**NTPC TALSON AQUATIC EFFECTS MONITORING PROGRAM**  
**Fish, Sediment Quality, and Water Quality Sample Sites in Trudel Creek**

- Legend**
- Fish Sample Location
  - ★ Water Quality Sample Location
  - Sediment Quality Sample Location
  - ✈ Runway
  - Road



**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**



NO.	DATE	REVISION	BY
1	2020-04-30	1219 TLS FishSedWQ 3729 20200430	CGA
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3			
4			
5			

Date Saved: 2020-04-30  
 Coordinate System: NAD 1983 UTM Zone 12N



478200

478400

478600

6696200

6696200

6696000

6696000

478200

478400

478600



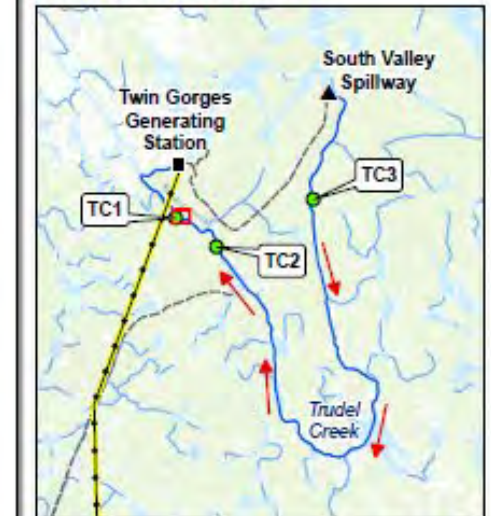
TALTSON HYDROELECTRIC PROJECT  
SEDIMENT AND EROSION MONITORING PROGRAM

**Trudel TC1**

**Legend**

- SEMP Site

Source:  
UAV imagery: Ecofish Research Ltd (Aug. 24, 2019)  
Base imagery: ESRI/DigitalGlobe



**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**



NO.	DATE	REVISION	BY
1	21/10/2019	12-19_TLS_TalsonSEMP_3439_20191015	CSA
2			
3			
4			
5			

Date Saved: 21/10/2019  
Coordinate System: NAD 1983 UTM Zone 12N



Map 14

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479800

480000



6695000

6695000

6694800

6694800



479600

479800

480000

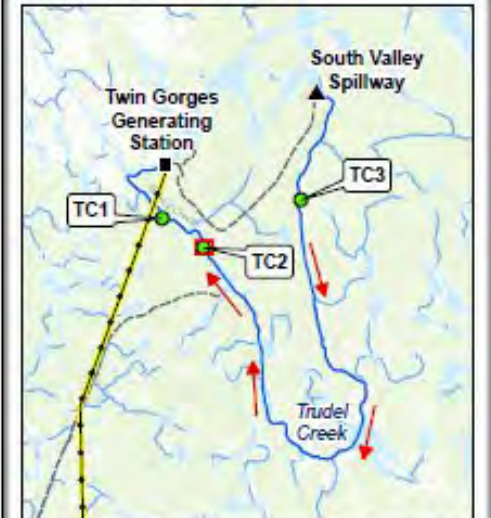


TALTSOON HYDROELECTRIC PROJECT  
SEDIMENT AND EROSION MONITORING PROGRAM  
**Trudel TC2**

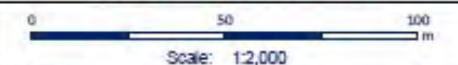
**Legend**

- SEMP Site

Source:  
UAV imagery: Ecofish Research Ltd (Aug. 24, 2019)  
Base imagery: ESRI/DigitalGlobe



**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**



NO.	DATE	REVISION	BY
1	21/10/2019	1219_TLS_TalsonSEMP_3439_20191015	CGA
2			
3			
4			
5			

Date Saved: 21/10/2019  
Coordinate System: NAD 1983 UTM Zone 12N



483400

483600

483800



Trudel  
Creek



TC3

TC3



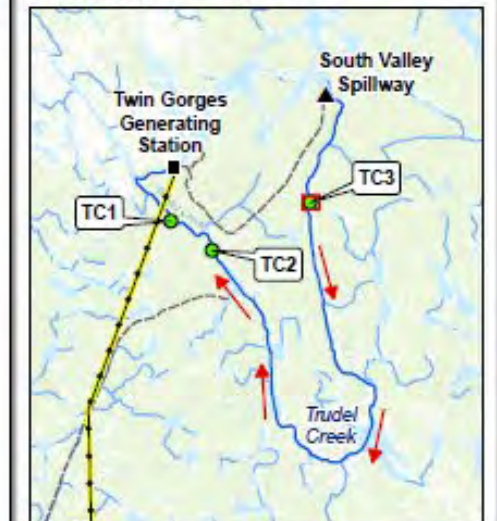
TALTSON HYDROELECTRIC PROJECT  
SEDIMENT AND EROSION MONITORING PROGRAM

Trudel TC3

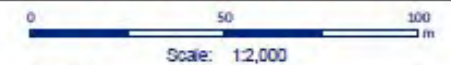
Legend

● SEMP Site

Source:  
UAV imagery: Ecofish Research Ltd (Aug. 25, 2019)  
Base imagery: ESRI/DigitalGlobe



MAP SHOULD NOT BE USED FOR LEGAL  
OR NAVIGATIONAL PURPOSES



NO.	DATE	REVISION	BY
1	21/10/2019	1219 TLS Taltsen SEMP 3436 20191015	CGA
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Date Saved: 21/10/2019  
Coordinate System: NAD 1983 UTM Zone 12N

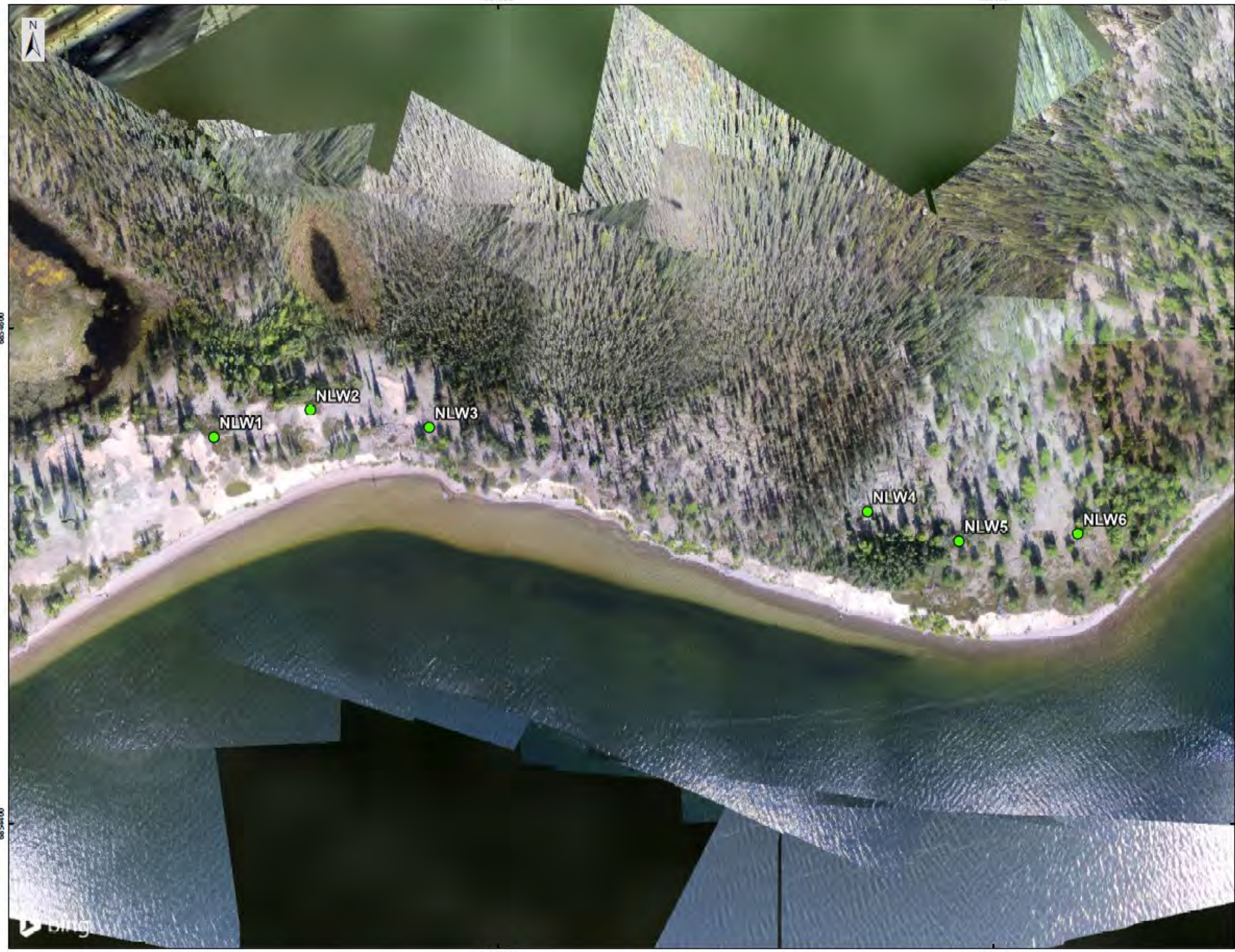


Map 16

483400

483600

483800



564800

565000

6854600

6854600

6854400

6854400

564800

565000



**TALTSON HYDROELECTRIC PROJECT  
SEDIMENT AND EROSION MONITORING PROGRAM  
Nonacho West**

**Legend**

- SEMP Site

Source:  
UAV imagery: Ecofish Research Ltd (Aug. 26, 2019)  
Base imagery: ESRI/DigitalGlobe



**MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES**



NO.	DATE	REVISION	BY
1	06/12/2019	Initial TLT Sediment EMP 3439_20191206	CGA
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3			
4			
5			

Date Saved: 06/12/2019  
Coordinate System: NAD 1983 UTM Zone 12N



572000

573000

574000



6845000

6845000

6844000

6844000



TALTSON HYDROELECTRIC PROJECT  
SEDIMENT AND EROSION MONITORING PROGRAM  
**Nonacho Central**

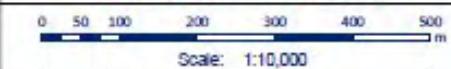
Legend

- SEMP Site

Source:  
UAV imagery: Ecofish Research Ltd (Aug. 26, 2019)  
Base imagery: ESRI/DigitalGlobe



MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES



NO.	DATE	REVISION	BY
1	21/10/2019	0219 TLS TaltsonSEMP_3439_20191015	CGA
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3			
4			
5			

Date Saved: 21/10/2019  
Coordinate System: NAD 1983 UTM Zone 12N



Map 18

572000

573000

574000

477000

478000

479000

480000

6697000

6696000

6695000

6697000

6696000

6695000

477000

478000

479000

480000



TALTSON HYDROELECTRIC PROJECT  
SEDIMENT AND EROSION MONITORING PROGRAM  
**Trudel Creek Banklines and  
Transect Measurement Locations**

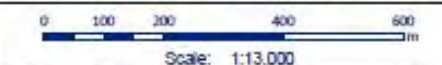
**Legend**

- Shoreline 2019
- Shoreline 2014
- Shoreline 2011
- Shoreline 1980
- Shoreline 1955
- Transects (NHC 2016)

Source:  
UAV imagery: Ecofish Research Ltd (Aug. 24, 2019)  
Base imagery: ESRI/DigitalGlobe



**MAP SHOULD NOT BE USED FOR LEGAL  
OR NAVIGATIONAL PURPOSES**



NO.	DATE	REVISION	BY
1	04/11/2019	1219_TLT_TrudelBanklinesTransect_Locs_3439_20191104	CGA
2			
3			
4			
5			

Date Saved: 04/11/2019  
Coordinate System: NAD 1983 UTM Zone 12N



**Appendix A:**  
**AQUATICS EFFECTS MONITORING PROGRAM TABLES 2021 AEMP**

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**Table 3. Riparian Habitat and Fish Usage Monitoring: Sampling Locations.**

Waterbody	Sampling Method	Site	Zone	Easting	Northing
Lady Grey Lake	Electrofishing	LDY-RIPEF01	12V	524862	6759565
Lady Grey Lake	Angling	LDY-RIPAG01	12V	524861	6759559
Nonacho Lake	Angling	NON-RIPAG01	12V	566337	6836483
Nonacho Lake	Electrofishing	NON-RIPEF01	12V	565950	6836258
Nonacho Lake	Electrofishing	NON-RIPEF02	12V	565939	6836287
Nonacho Lake	Electrofishing	NON-RIPEF03	12V	566336	6836492
Nonacho Lake	Gill Netting	NON-RIPGN01	12V	566024	6836257
Rutledge Lake	Angling	RUT-RIPAG01	12V	509402	6838535
Rutledge Lake	Beach Seining	RUT-RIPBS01	12V	509201	6838570
Rutledge Lake	Beach Seining	RUT-RIPBS02	12V	509308	6838641
Rutledge Lake	Beach Seining	RUT-RIPBS03	12V	509427	6838443
Rutledge Lake	Electrofishing	RUT-RIPEF01	12V	509212	6838589
Rutledge Lake	Electrofishing	RUT-RIPEF02	12V	509411	6838597
Rutledge Lake	Electrofishing	RUT-RIPEF03	12V	509400	6838456
Rutledge Lake	Gill Netting	RUT-RIPGN01	12V	509347	6838537
Taltson River	Angling	TLT-RIPAG01	12V	475781	6699031
Taltson River	Beach Seining	TLT-RIPBS01	12V	475831	6698935
Taltson River	Beach Seining	TLT-RIPBS02	12V	475816	6698993
Trudel Creek	Angling	TRD-RIPAG01	12V	482356	6688533
Trudel Creek	Beach Seining	TRD-RIPBS01	12V	482447	6688438
Trudel Creek	Beach Seining	TRD-RIPBS02	12V	482412	6688436
Trudel Creek	Electrofishing	TRD-RIPEF01	12V	482443	6688542
Trudel Creek	Gill Netting	TRD-RIPGN01	12V	482395	6688497
Twin Gorges Forebay	Angling	TGF-RIPAG01	12V	479015	6698778
Twin Gorges Forebay	Beach Seining	TGF-RIPBS01	12V	479029	6698762
Twin Gorges Forebay	Beach Seining	TGF-RIPBS02	12V	479032	6698780
Twin Gorges Forebay	Electrofishing	TGF-RIPEF01	12V	479048	6698767
Twin Gorges Forebay	Electrofishing	TGF-RIPEF02	12V	479046	6698736

**Table 4. Riparian Habitat and Fish Usage Monitoring: Vegetation Transect Locations.**

Waterbody	Site (Transect Start Point)	Zone	Easting	Northing	Transect End Point	Zone	Easting	Northing
Rutledge Lake	RUT-VEG01	12V	509199	6838608	RUT-VEG01-end	12V	509246	6838558
Rutledge Lake	RUT-VEG02	12V	509351	6838662	RUT-VEG02	12V	509338	6838638
Nonacho Lake	NON-VEG01	12V	565922	6836257	NON-VEG01	12V	565929	6836245
Nonacho Lake	NON-VEG02	12V	565915	6836203	NON-VEG02	12V	565926	6836212
Nonacho Lake	NON-VEG03	12V	566389	6836503	NON-VEG03	12V	566364	6836481
Twin Gorges Forebay	TGF-VEG01	12V	479081	6698752	TGF-VEG01	12V	479075	6698774
Twin Gorges Forebay	TGF-VEG02	12V	479056	6698685	TGF-VEG02	12V	479032	6698692
Trudel Creek	TRD-VEG01	12V	482388	6688377	TRD-VEG01	12V	482376	6688432
Trudel Creek	TRD-VEG02	12V	482439	6688397	TRD-VEG02	12V	482427	6688442
Lady Grey Lake	LDY-VEG02	12V	524724	6759661	LDY-VEG02	12V	524751	6759674
Lady Grey Lake	LDY-VEG01	12V	524798	6759579	LDY-VEG01	12V	524814	6759596
Taltson River	TLT-VEG01	12V	475809	6698855	TLT-VEG01end	12V	475862	6698886
Taltson River	TLT-VEG02	12V	475772	6698934	TLT-VEG02end	12V	475826	6698960

**Table 5. Riparian Habitat and Fish Usage Monitoring: Riparian Vegetation Plot Locations.**

Waterbody	Site	Zone	Easting	Northing
Rutledge Lake	RUT-WHP01	12V	509477	6838625
Nonacho Lake	NON-WHP01	12V	565910	6836282
Nonacho Lake	NON-WHP03	12V	566433	6836498
Twin Gorges Forebay	TGF-WHP01	12V	479068	6698648
Lady Grey Lake	LDY-WHP01	12V	524793	6759550
Lady Grey Lake	LDY-WHP02	12V	524698	6759660
Taltson River	TLT-WHP01	12V	475732	6698940

**Table 6. Trudel Creek and Lower Taltson River Fish Stranding Monitoring: Sampling site locations on a) the Taltson River, and b) Trudel Creek in August 2014.**

a)

Site	UTM		Distance from Powerhouse (m)
	Zone	Easting Northing	
TLT-DSSD01	12V	476234 6698588	2,638
TLT-DSSD02	12V	476340 6698344	2,364
TLT-DSSD04	12V	477746 6697842	525
TLT-DSSD05	12V	477856 6697863	422

b)

Site	UTM		Distance from South Valley Spillway (m)
	Zone	Easting Northing	
TRD-DVSD01	12V	479511 6695600	28,708
TRD-DVSD02	12V	479839 6695002	28,093
TRD-DVSD07	12V	481774 6690856	23,093
TRD-DVSD03	12V	485639 6689951	12,921
TRD-DVSD04	12V	485574 6690009	12,833
TRD-DVSD05	12V	484767 6700573	1,113
TRD-DVSD06	12V	484671 6700381	884

**Table 7. Outline of the Mercury in Sediment and Fish Flesh Monitoring as completed in 2013 and 2019, and as will be completed in 2026.**

Waterbody	Component	Parameter	Target Sample Quantity and Methodology
Nonacho Lake and Rutledge Lake	Water	Total Mercury	3 deep water sites per lake (same as sediment sampling sites) - Samples collected from 1 m below the surface and 1 m above the bottom of the lake at each site  - Samples collected in triplicate at one site (surface and depth) in each waterbody; single samples collected at the remaining  - Secchi Depth and dissolved oxygen and temperature profiles were not a requirement of the 2013 AEMP, however data were collected when time permitted in 2013 and at all water quality sites in 2019.
		Methylmercury	
		Dissolved Organic Carbon	
		Biological Oxygen Demand	
		Secchi Depth	
		Vertical Dissolved Oxygen Profile	
	Sediment	Total Mercury	3 deep water sites per lake, with surface (~2.5 cm thickness) and sub-surface (~2.5 cm thickness) samples collected at each site  - Each sample is a composite of three Ponar grabs - Samples collected in triplicate at one site (both layers) in each waterbody; single samples collected at the remaining two sites in each waterbody
		Methylmercury	
		Moisture	
	Fish	Sulfate	
		Total Mercury	20 Lake Trout per lake <sup>1</sup>
		Methylmercury	20 Lake Whitefish per lake <sup>1</sup>
Moisture Content		20 Northern Pike per lake <sup>1</sup>	
Length			
Weight			
Age			
Stable Isotopes (nitrogen and carbon)			
Internal and External Parasite Assessment			
Gender			
Stomach Content Assessment			
Trudel Creek	Water	Total Mercury	1 deep water site (same as sediment sampling site) - Samples collected from 1 m below the surface and 1 m above - Samples collected in triplicate at both depths - Secchi Depth and dissolved oxygen and temperature profiles were not a requirement of the 2013 AEMP, however data were collected when time permitted in 2013 and at all water quality sites in 2019.
		Methylmercury	
		Dissolved Organic Carbon	
		Biological Oxygen Demand	
		Secchi Depth	
		Vertical Dissolved Oxygen Profile	
	Sediment	Total Mercury	1 deep water site, with surface (~2.5 cm thickness) and sub-surface (~2.5 cm thickness) samples collected - Each sample is a composite of three Ponar grabs - Samples collected in triplicate (both layers)
		Methylmercury	
		Moisture	
	Fish	Sulfate	
		Total Mercury	20 Lake Whitefish <sup>1</sup>
		Methylmercury	20 Northern Pike <sup>1</sup>
		Moisture Content	
		Length	
		Weight	
Age			
Stable Isotopes (nitrogen and carbon)			
Internal and External Parasite Assessment			
Gender			
Stomach Content Assessment			

<sup>1</sup>Preferred fork length: Lake Trout/Northern Pike: 500 mm to 800 mm; Lake Whitefish: no preference.

**Table 8. Mercury in Sediment and Fish Flesh Monitoring: Key parameters collected in the 2013 and 2019 field programs and availability of similar data from previous studies.**

Sample Type	Parameter	Unit	Laboratory used in 2013 and 2019	Parameter Quantified in DFO 1975 and 1986 Dataset <sup>2</sup>	Parameter Quantified in 2003? <sup>*</sup>	Parameter Quantified in 2004? <sup>*</sup>	Parameter Quantified in 2010 Dataset <sup>2</sup>
Water Quality	Total Mercury	µg/L	ALS Vancouver	No	No	No	No
	Methylmercury	µg/L	ALS Vancouver	No	No	No	No
	Dissolved Organic Carbon (DOC)	mg/L	ALS Vancouver	No	No	Yes	No
	Biochemical Oxygen Demand (BOD)	mg/L	Taiga Yellowknife	No	No	No	No
Sediment Quality	Total Mercury	mg/kg dry weight	ALS Vancouver	No	Yes	Yes	No
	Methylmercury	mg/kg dry weight	ALS Vancouver	No	No	No	No
	Moisture	%(based on drying sample out)	ALS Vancouver	No	Yes	Yes	No
	Total Organic Carbon (TOC)	% of Total Carbon	ALS Saskatoon	No	No	No	No
	Saturation	%(total volume of water present in a saturated paste (in mL) divided by the dry weight of the sample (in grams))	ALS Vancouver	No	No	No	No
	Sulfate (SO <sub>4</sub> )	mg/kg dry weight	ALS Vancouver	No	No	No	No

<sup>2</sup> Samples collected by Rescan (2004) and Rescan (2005) were sent to ALS Vancouver for analysis.

Only Nonacho Lake was sampled in 1975 (Lake Trout, Lake Whitefish) and 1986 (Lake Trout, Lake Whitefish, Northern Pike). Data from 1975 and 1986 were extracted from DFO's fish mercury database and were provided by Marlene Evans (National Water Research Institute, Environment Canada, Saskatoon).

Rescan (2004) sampled both Nonacho and Rutledge Lakes in 2003 and measured mercury in Lake Trout and Lake Whitefish.

Rescan (2005) sampled both Nonacho and Rutledge Lakes in 2004 and measured mercury in Lake Trout and Lake Whitefish.

In 2010, only Lake Trout were sampled in Nonacho Lake (Côté 2011).

**Table 8. Continued.**

Sample Type	Parameter	Unit	Laboratory used in 2013 and 2019	Parameter Quantified in DFO 1975 and 1986 Dataset?	Parameter Quantified in 2003?*	Parameter Quantified in 2004?*	Parameter Quantified in 2010 Dataset?
Fish	Total Mercury	mg/kg wet weight	ALS Vancouver	Yes	Yes	Yes	Yes
	Methylmercury	mg/kg wet weight	ALS Vancouver	No	No	No	No
	Moisture	% (based on drying sample out)	ALS Vancouver	No	No	Yes	Yes
	Stable Isotopes (nitrogen and carbon)	ratio in thousandths of a percent	SINLAB (University of New Brunswick)	No	No	No	Yes
	Age	age in years	North-South Consultants	No	Yes	Yes	Yes
	Fork Length	mm	Field measurement	Yes	Yes	Yes	Yes
	Weight	g	Field measurement	Yes	Yes	Yes	Yes
	Gender	male or female	Field assessment	No	Yes	Yes	Yes
	Parasites (internal and external)	#	Visual field assessment	No	Yes	Yes	No
	Stomach Contents	mass (g), % fullness, description of contents	Visual field assessment	No	Yes	Yes	No

\* Samples collected by Rescan (2004) and Rescan (2005) were sent to ALS Vancouver for analysis.

Only Nonacho Lake was sampled in 1975 (Lake Trout, Lake Whitefish) and 1986 (Lake Trout, Lake Whitefish, Northern Pike). Data from 1975 and 1986 were extracted from DFO's fish mercury database and were provided by Marlene Evans (National Water Research Institute, Environment Canada, Saskatoon).

Rescan (2004) sampled both Nonacho and Rutledge Lakes in 2003 and measured mercury in Lake Trout and Lake Whitefish.

Rescan (2005) sampled both Nonacho and Rutledge Lakes in 2004 and measured mercury in Lake Trout and Lake Whitefish.

In 2010, only Lake Trout were sampled in Nonacho Lake (Côté 2011).

**Table 9. Mercury in Sediment and Fish Flesh Monitoring: Locations, dates, and sampling depths for water quality samples.**

Waterbody	Site Type (Deep or Shallow)	Site Name	UTM Coordinates (Zone 12 V)		Sampling Dates	Sample Depth (m) <sup>1</sup>	Comment	
			Easting (m)	Northing (m)				
Nonacho Lake	Shallow	NL1-WQS(2004)	569,301	6,840,873	18-Aug-04	1	2004; Rescan Site Name: NL 1 Shallow	
		NL2-WQS(2004)	559,356	6,841,914	19-Aug-04	1	2004; Rescan Site Name: NL 2 Shallow	
		NL3-WQS(2004)	573,404	6,845,251	18-Aug-04	1	2004; Rescan Site Name: NL 3 Shallow	
	Deep	NL1-WQD(2004)	569,839	6,841,077	18-Aug-04	1, 15	2004; Rescan Site Name: NL 1 Deep	
		NL2-WQD(2004)	559,794	6,842,038	19-Aug-04	1, 13	2004; Rescan Site Name: NL 2 Deep	
		NL3-WQD(2004)	573,657	6,845,387	18-Aug-04	1, 15	2004; Rescan Site Name: NL 3 Deep	
			NON-WQ01	569,904	6,841,144	23-Aug-13; 23-Aug-19	1.0, 17.0 / 1.0, 16.0	2013, 2019
			NON-WQ02	564,706	6,854,066	23-Aug-13; 23-Aug-19	1.0, 13.5 / 1.0, 20.0	2013, 2019
			NON-WQ03	574,101	6,845,874	23-Aug-13; 22-Aug-19	1.0, 13.8 / 1.0, 15.0	2013, 2019
Rutledge Lake	Shallow	RL1-WQS(2004)	512,006	6,830,170	20-Aug-04	1	2004; Rescan Site Name: RL 1 Shallow	
		RL2-WQS(2004)	507,518	6,834,739	20-Aug-04	1	2004; Rescan Site Name: RL 2 Shallow	
		RL3-WQS(2004)	513,558	6,827,759	21-Aug-04	1	2004; Rescan Site Name: RL 3 Shallow	
	Deep	RL1-WQD(2004)	511,741	6,830,745	20-Aug-04	1, 15	2004; Rescan Site Name: RL 1 Deep	
		RL2-WQD(2004)	508,070	6,833,835	20-Aug-04	1, 15	2004; Rescan Site Name: RL 2 Deep	
		RL3-WQD(2004)	513,392	6,827,918	21-Aug-04	1, 19	2004; Rescan Site Name: RL 3 Deep	
			RUT-WQ01	512,668	6,830,881	24-Aug-13; 19-Aug-19	1.0, 12.0 / 1.0, 14.0	2013, 2019
			RUT-WQ02	508,168	6,836,982	24-Aug-13; 18-Aug-19	1.0, 19.0 / 1.0, 14.0	2013, 2019
			RUT-WQ03	506,147	6,831,800	24-Aug-13; 19-Aug-19	1.0, 7.0 / 1.0, 7.0	2013, 2019
Trudel Creek	Deep	TRU-WQ01	480,429	6,693,084	27-Aug-13, 26-Aug-19	1.0, 10.1 / 1.0, 8.0	2013, 2019	

<sup>1</sup>Sample depth includes the surface sampling depth (1.0 m below the surface) and the lower sampling depth (1.0 m above the bottom of the lake or creek).

**Table 9 Continued.**

Waterbody	Site	UTM Coordinates (Zone 12 V)		Sampling Dates	Sample Depth (m) <sup>1</sup>	Comment
		Easting (m)	Northing (m)			
Nonacho Lake	NL-SQ(2003)	569,885	6,841,137	7-Aug-03	17.5	2003; Rescan Site Name: NL
	NL1-SQ(2004)	569,839	6,841,077	18-Aug-04	18.6	2004; Rescan Site Name: NL1 Deep
	NL2-SQ(2004)	559,794	6,842,038	19-Aug-04	24.4	2004; Rescan Site Name: NL2 Deep
	NL3-SQ(2004)	573,657	6,845,387	18-Aug-04	29.3	2004; Rescan Site Name: NL3 Deep
	NON-SQ01	569,904	6,841,144	23-Aug-13; 23-Aug-19	15.0 / 17.0	2013, 2019
	NON-SQ02	566,693	6,857,756	23-Aug-13	5.0	2013
	NON-SQ03	574,101	6,845,874	23-Aug-13; 22-Aug-19	15.0 / 15.0	2013, 2019
	NON-SQ04	566,622	6,845,571	23-Aug-19	40.0	2019
Rutledge Lake	RL-SQ(2003)	511,744	6,830,833	6-Aug-03	20.0	2003; Rescan Site Name: RL
	RL1-SQ(2004)	511,741	6,830,745	20-Aug-04	22.3	2004; Rescan Site Name: RL 1 Deep
	RL2-SQ(2004)	508,070	6,833,835	20-Aug-04	37.5	2004; Rescan Site Name: RL 2 Deep
	RL3-SQ(2004)	513,392	6,827,918	21-Aug-04	23.8	2004; Rescan Site Name: RL 3 Deep
	RUT-SQ01	512,668	6,830,881	24-Aug-13; 19-Aug-19	16.0 / 15.0	2013, 2019
	RUT-SQ02	508,168	6,836,982	24-Aug-13; 18-Aug-2019; 19-Aug-19	20.0 / 15.0	2013, 2019
	RUT-SQ03	506,147	6,831,800	24-Aug-13; 19-Aug-19	9.0 / 8.0	2013, 2019
Trudel Creek	TRU-SQ01	480,429	6,693,084	27-Aug-13	9.1 to 9.5 / 9.0	2013, 2019

<sup>1</sup> Sample depth refers to the water depth at the sediment sampling site. Sediment samples were collected from surface and sub-surface layers at each site.

Triplicate sampling at RUT-SQ02 occurred over two days due to poor weather. RUT-SQ02-A and RUT-SQ02-B were collected on August 18, 2019, and RUT-SQ02-C was collected on August 19, 2019.

**Table 10. Mercury in Sediment and Fish Flesh Monitoring: Locations, dates, and sampling depths for sediment samples.**

Waterbody	Site	UTM Coordinates (Zone 12 V)		Sampling Dates	Sample Depth (m) <sup>1</sup>	Comment
		Easting (m)	Northing (m)			
Nonacho Lake	NL-SQ(2003)	569,885	6,841,137	7-Aug-03	17.5	2003; Rescan Site Name: NL
	NL1-SQ(2004)	569,839	6,841,077	18-Aug-04	18.6	2004; Rescan Site Name: NL1 Deep
	NL2-SQ(2004)	559,794	6,842,038	19-Aug-04	24.4	2004; Rescan Site Name: NL2 Deep
	NL3-SQ(2004)	573,657	6,845,387	18-Aug-04	29.3	2004; Rescan Site Name: NL3 Deep
	NON-SQ01	569,904	6,841,144	23-Aug-13; 23-Aug-19	15.0 / 17.0	2013, 2019
	NON-SQ02	566,693	6,857,756	23-Aug-13	5.0	2013
	NON-SQ03	574,101	6,845,874	23-Aug-13; 22-Aug-19	15.0 / 15.0	2013, 2019
	NON-SQ04	566,622	6,845,571	23-Aug-19	40.0	2019
Rutledge Lake	RL-SQ(2003)	511,744	6,830,833	6-Aug-03	20.0	2003; Rescan Site Name: RL
	RL1-SQ(2004)	511,741	6,830,745	20-Aug-04	22.3	2004; Rescan Site Name: RL 1 Deep
	RL2-SQ(2004)	508,070	6,833,835	20-Aug-04	37.5	2004; Rescan Site Name: RL 2 Deep
	RL3-SQ(2004)	513,392	6,827,918	21-Aug-04	23.8	2004; Rescan Site Name: RL 3 Deep
	RUT-SQ01	512,668	6,830,881	24-Aug-13; 19-Aug-19	16.0 / 15.0	2013, 2019
	RUT-SQ02	508,168	6,836,982	24-Aug-13; 18-Aug-2019; 19-Aug-19	20.0 / 15.0	2013, 2019
	RUT-SQ03	506,147	6,831,800	24-Aug-13; 19-Aug-19	9.0 / 8.0	2013, 2019
Trudel Creek	TRU-SQ01	480,429	6,693,084	27-Aug-13	9.1 to 9.5 / 9.0	2013, 2019

<sup>1</sup> Sample depth refers to the water depth at the sediment sampling site. Sediment samples were collected from surface and sub-surface layers at each site.

Triplicate sampling at RUT-SQ02 occurred over two days due to poor weather. RUT-SQ02-A and RUT-SQ02-B were collected on August 18, 2019, and RUT-SQ02-C was collected on August 19, 2019.

**Table 11. Mercury in Sediment and Fish Flesh Monitoring: Fish sampling site coordinates in 2013.**

Waterbody	Site *	UTM Coordinates (Zone 12 V)	
		Easting (m)	Northing (m)
Nonacho Lake	NON-GN1	565,641	6,854,909
	NON-GN2	566,282	6,856,255
	NON-GN3	576,909	6,865,123
	NON-GN4	576,122	6,864,601
	NON-GN5	565,490	6,863,278
	NON-ANG1	568,193	6,866,058
	NON-ANG2	564,683	6,854,487
Rutledge Lake	RUT-GN1	507,760	6,834,738
	RUT-GN2	507,811	6,835,586
	RUT-GN3	509,779	6,834,656
	RUT-GN4	510,166	6,834,379
	RUT-GN5	509,871	6,833,330
	RUT-GN6	509,210	6,833,513
	RUT-GN7	508,471	6,833,756
	RUT-ANG1	510,268	6,834,209
	RUT-ANG2	507,218	6,834,130
	RUT-ANG3	509,704	6,839,517
	RUT-ANG4	508,168	6,836,982
	RUT-ANG5	508,062	6,836,738
Trudel Creek	TRU-GN1	480,568	6,693,609
	TRU-GN2	482,241	6,688,422
	TRU-GN3	482,131	6,691,232
	TRU-GN4	482,128	6,688,564
	TRU-GN5	482,289	6,688,446
	TRU-GN6	480,413	6,692,717
	TRU-GN7	482,456	6,691,123
	TRU-GN8	482,402	6,688,439
	TRU-GN9	481,713	6,691,222
	TRU-ANG1	480,319	6,694,278
	TRU-ANG2	482,502	6,691,109
	TRU-ANG3	481,964	6,690,656
	TRU-ANG4	481,995	6,689,639
	TRU-ANG5	480,276	6,692,818

\* GN = gillnet, ANG = angling

Grey shading indicates sites where fish that were caught were not included in the study, either because they were non-target species or because the quota for the species of fish caught had already been filled.

**Table 12. Mercury in Sediment and Fish Flesh Monitoring: Fish sampling site coordinates in 2019.**

Waterbody	Site	Site Type	UTM Coordinates (Zone 12 V)	
			Easting (m)	Northing (m)
Nonacho Lake	NON-ANG21	Angling	574,327	6,848,451
	NON-ANG22	Angling	576,218	6,850,586
	NON-ANG40	Angling	573,486	6,845,119
	NON-ANG41	Angling	573,342	6,845,493
	NON-ANG42	Angling	573,240	6,844,882
	NON-ANG43	Angling	575,004	6,846,386
	NON-ANG45	Angling	569,300	6,843,092
	NON-ANG46	Angling	567,072	6,843,910
	NON-GN20	Gill Net	573,083	6,844,825
	NON-GN21	Gill Net	574,548	6,845,747
	NON-GN22	Gill Net	510,314	6,833,224
	NON-GN23	Gill Net	510,200	6,837,285
Rutledge Lake	RUT-ANG20	Angling	507,835	6,833,091
	RUT-ANG21	Angling	508,837	6,833,086
	RUT-ANG22	Angling	508,022	6,838,708
	RUT-ANG23	Angling	508,168	6,836,982
	RUT-GN20	Gill Net	508,194	6,836,752
	RUT-GN21	Gill Net	509,722	6,836,932
	RUT-GN22	Gill Net	510,314	6,833,224
	RUT-GN23	Gill Net	510,200	6,837,285
	RUT-GN24	Gill Net	507,951	6,833,625
	RUT-RIPGN01	Gill Net	509,347	6,838,537
Trudel Creek	TRU-ANG20	Angling	486,325	6,687,893
	TRU-ANG21	Angling	485,918	6,687,051
	TRU-ANG22	Angling	485,626	6,687,089
	TRU-ANG23	Angling	482,356	6,688,533
	TRU-GN20	Gill Net	482,214	6,688,464
	TRU-RIPGN01	Gill Net	482,395	6,688,497

**Table 13. AEMP Monitoring Schedule**

Monitoring Program	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Riparian Habitat and Fish Usage Assessment								X							X	
Trudel Creek and Lower Taltson River Fish Stranding Monitoring			X	X	X	X	X									
Mercury in sediment and Fish Flesh Monitoring		X						X							X	
Desktop Fish Mortality Assessment					X											
Nonacho Lake and Lower Taltson River Flow and Water Level Analysis				X												
Taltson HEC-ResSim Hydrologic Model Update		X	X					X								
Sediment and Erosion Monitoring		X	X					X							X	

**Appendix B:**  
**WATER EFFECTS MONITORING PROGRAM SUMMARY TABLES FROM 2013**  
**AEMP**

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**Table 14. Completion status of fish and aquatics monitoring program.**

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics							Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Parameter / Indicator or Activity	Sampling Tool	Measurement	Sample Size				1999 TOR Monitoring Schedule	Implemented Modifications to 1999 TOR	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operations
			NL	TL	TR	RL						
<b>FISH ABUNDANCE</b>												
Lake trout	Exp. Gill net	Count / mesh / set	100	100	N/A	100	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Lake whitefish	Exp. Gill net	Count / mesh / set	100	N/A	N/A	100	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Pickereel	Exp. Gill net	Count / mesh / set	N/A	N/A	100	N/A	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>FISH CONDITION</b>												
Lake trout	Exp. Gill net	Count / mesh / set	100	100	N/A	100	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Lake whitefish	Exp. Gill net	Count / mesh / set	100	N/A	N/A	100	2 consecutive years; then 3	New sampling locations	2 consecutive years	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics							Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Parameter / Indicator or Activity	Sampling Tool	Measurement	Sample Size				1999 TOR Monitoring Schedule	Implemented Modifications to 1999 TOR	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operations
			NL	TL	TR	RL						
							years later followed by a 5 year cycle	added in 2004 – TG, GL, and SL	completed (2003, 2004)		thereafter	
Pickereel	Exp. Gill net	Count / mesh / set	N/A	N/A	100	N/A	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>POPULATION AGE STRUCTURE</b>												
Lake trout	Exp. Gill net	Count / mesh / set	100	100	N/A	100	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Lake whitefish	Exp. Gill net	Count / mesh / set	100	N/A	N/A	100	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Pickereel	Exp. Gill net	Count / mesh / set	N/A	N/A	100	N/A	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>DEFORMITIES AND LESIONS</b>												
All species	Exp. Gill net	Number and percent type	All fish captured will be examined				2 consecutive	New sampling	2 consecutive	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics							Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Parameter / Indicator or Activity	Sampling Tool	Measurement	Sample Size				1999 TOR Monitoring Schedule	Implemented Modifications to 1999 TOR	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operations
			NL	TL	TR	RL						
		by species					years; then 3 years later followed by a 5 year cycle	locations added in 2004 – TG, GL, and SL	years completed (2003, 2004)	<b>Program</b>		change; 5 year cycle thereafter
<b>MERCURY IN FISH FLESH</b>												
Lake trout	Exp. Gill net	Muscle-[Hg]	36	36	N/A	36	1 year, then 4 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2006 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Lake whitefish	Exp. Gill net	Muscle-[Hg]	36	36	N/A	36	1 year, then 4 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2006 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Pickereel	Exp. Gill net	Muscle-[Hg]	N/A	N/A	36 + 36	N/A	1 year, then 4 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2006 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>MERCURY IN AQUATIC PLANTS</b>												
<i>Potamogeton sp.</i>	Weed whacker	g/g dry weight	10	N/A	N/A	10	1 year, then 4 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG	2 consecutive years completed (2003, 2004)	<b>2006 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>PARASITES IN FISH FLESH</b>												
Lake trout	Exp. Gill net	Counts per 100 g	30	30	N/A	30	1 year, then 4 years later followed by a 5 year	New sampling locations added in	2 consecutive years completed	<b>2006 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics							Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Parameter / Indicator or Activity	Sampling Tool	Measurement	Sample Size				1999 TOR Monitoring Schedule	Implemented Modifications to 1999 TOR	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operations
			NL	TL	TR	RL						
							cycle	2004 – TG, GL, and SL	(2003, 2004)			
Lake whitefish	Exp. Gill net	Counts per 100 g	30	30	N/A	30	1 year, then 4 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2006 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>INTERNAL DISCOLOURATION</b>												
Lake trout	Exp. Gill net	Visual examination	30	30	N/A	30	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Lake whitefish	Exp. Gill net	Visual Examination	30	30	N/A	30	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>FEEDING HABITATS</b>												
Lake trout	Exp. Gill net	Weight and counts	30	30	N/A	30	2 consecutive years; then 3 years later followed by a 5 year cycle	New sampling locations added in 2004 – TG, GL, and SL	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
Lake whitefish	Exp. Gill net	Weight and counts	30	30	N/A	30	2 consecutive years; then 3 years later followed by	New sampling locations added in 2004 – TG,	2 consecutive years completed (2003, 2004)	<b>2007 Monitoring Program</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics							Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Parameter / Indicator or Activity	Sampling Tool	Measurement	Sample Size				1999 TOR Monitoring Schedule	Implemented Modifications to 1999 TOR	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operations
			NL	TL	TR	RL						
							a 5 year cycle	GL, and SL				
<b>MERCURY IN SEDIMENTS</b>												
Sediment	Sediment corer	[Hg] in core strata	1	N/A	N/A	1	1 year only	Sampled in both 2003 and 2004; new sample location in TG added in 2004	2 consecutive years completed (2003, 2004)	<b>None</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter
<b>BENTHIC INVERTEBRATE COMMUNITY</b>												
Benthic Invertebrate	Sediment corer	Species abundance	36	N/A	N/A	36	1 year only	Sampled in both 2003 and 2004; new sample location in TG added in 2004	2 consecutive years completed (2003, 2004)	<b>None</b>	No further studies required	Implement WEMP 1 year after operation change; 5 year cycle thereafter

**Table 15. Completion status of beaver and muskrat monitoring program.**

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics							Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Parameter / Indicator or Activity	Sampling Tool	Measurement	Sample Size				1999 TOR Monitoring Schedule	Implemented Modifications to 1999 TOR	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operations
			NL	TL	TR	RL						
<b>BEAVER</b>												
Beaver Abundance	Boat and aerial survey	Active house counts	Yes	N/A	Yes	Yes	Year 1 then 4 years later followed by a 5 year cycle	None	2 years completed (2000, 2003)	<b>2008 Monitoring Program</b>	No additional monitoring required	Monitoring beaver every 3 years. Link hydrology model to beaver habitat.
<b>MUSKRAT</b>												
Muskrat Abundance	Aerial survey	Push-up counts	Yes	N/A	Yes	Yes	Year 2 then 3 years later followed by a 5 year cycle	None	2 years completed (2001, 2004)	<b>2009 Monitoring Program</b>	No additional monitoring required	Monitor muskrat every 3 years. Link hydrology model to muskrat habitat.

**Table 16. Completion status of hydrology, ice, and sedimentation/erosion.**

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
<b>1. Changes in water levels and ice cover characteristics on Nonacho Lake and on lakes upstream of Nonacho Lake.</b>											
1.1 Extent of flooding around lake	1. Assemble and compare pre and post regulation maps and aerial photos to determine flooded area  2. Determine water level increases on upstream lakes and identify submerged hydraulic controls between lakes	1. From either aircraft observations or analysis of aerial photos categorize the degree of inundation around lake (i.e., Percent of flooded area according to depth of inundation).	None	1. Monitor daily inflows into Nonacho Lake from hydro- meteorologic stations upstream.	1999/00	1 year only	NL, HL & GAL	Pre-and post-flooding maps available	Initiate monitoring and survey	No study required: maps provide adequate interpretation of flooding	Remove flow monitoring requirement.  Survey former control points at Hjalmar and Gray Lakes.
1.2 Outflows from lake	1. Define explicitly the outflow rating curve of the Nonacho Lake control structure	None	1. None, unless there is poor reliability in the rating curve, and then measure outflows below structure for a variety of gate settings	1. Report daily lake levels, gate settings, inflows, and outflows, along with expected operating procedures (gate settings) and outflows for one week in advance	1999/00 and annual reporting for life of project	4 consecutive years, thereafter 5 year cycle	NG, NS, TCG, TG, SVS	Initial measurements taken at some locations	3 to 4 additional measurements required	No study required	Task can be completed with one additional year of flow monitoring; therefore, one or two measurements on a 5 year cycle.

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
1.3 Traditional and potential future travel routes in vicinity of lake and the ice regime of the lake	1. Interview residents and identify historical and potential future crossing sites and frequency of use. 2. Identify water level changes at these sites and determine extent of potential flow changes at the crossing sites	1. Monitor freeze- up and breakup patterns and the extent/duration of open water in the vicinity of potential future or historical crossing sites 2. Identify three to five most critical crossing points for characterization	1. Survey crossing points during winter to determine bathymetric and hydraulic characteristics 2. Measure lake water temperature profiles, snow depths, and ice thicknesses three times during each winter at a point upstream of each crossing site. 3. Measure ice thickness, snow depths, and water temperatures in reference lake during each field trip to Nonacho Lake	None.	1999/00 2000/01 2001/02	3 consecutive years	Nonacho Lake to Great Slave Lake	None	Survey on Taltson River with local people	No study required	Task can be completed with a 4 to 5 day survey; second and third year survey not required. Task may require an additional survey during ice cover period.
1.4 Water temperatures on Taltson River downstream of Nonacho Lake.	1. Examine meteorological data from stations in vicinity of basin (Fort Smith, Twin Gorges, etc.) and determine a method to provide regional meteorology for the Taltson River basin	1. Observe freeze-up and breakup pattern downstream of control structure	1. Measure lake water temperature profiles three times during each winter at a point upstream of the control structure. 2. Measure water temperatures downstream of the control structure at three sites along outlet channel on a daily basis	1. Provide summaries of daily temperatures and precipitation for the basin using appropriate meteorologic stations in the region	1999/00 2000/01 2001/02 Annual reporting for life of project	3 consecutive years	D/S of NL; D/S of TG	One profile taken on NL and just d-s	Install continuous monitoring devices at key locations	Continuous monitoring not required, remove from 1999 TOR	Continuous monitoring not required, remove from 1999 TOR.

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
<b>2. Ice-related water level fluctuations on Taltson River between Elsie Falls and Tsu Lake, particularly related to freeze-up, mid-winter overflows, and breakup</b>											
2.1 Freeze up processes on Trudel Creek and Taltson River downstream of Twin Gorges Forebay.	<p>1. Establish a study reach that is representative of the overall river.</p> <p>2. Use the existing surveys to characterize the channel hydraulic characteristics, differentiating between the pools and riffles.</p> <p>3. Identify critical areas along the river where ice related flooding and winter crossings are an issue.</p>	<p>1. Observe the freeze-up processes five times over a period of two to three weeks during the freeze-up period, documenting the following: concentration of flowing ice formation of ice cover in pools, upstream progression of ice cover, open areas within riffles, formation of hanging dams. See 1.2 above</p>	<p>1. Measure the freeze-up levels along a study reach in the vicinity of the WSC gauge and relate these levels to the stage variability during freeze-up at the WSC gauge.</p> <p>2. Measure freeze-up levels at critical use points along the river.</p> <p>3. Measure ice thicknesses over one or two pool/riffle sequences and investigate the characteristics of hanging dams if they occur.</p>	None	1999/00 2000/01	2 consecutive years	TG/SVS to TSL	One year of monitoring complete	Use data from 2003 and a subsequent year to develop model for key traditional use locations	No study required	Specific monitoring before and after shutdown. One more year of monitoring.

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
2.2 Mid-winter ice conditions and overflow patterns on Trudel Creek and Taltson River downstream of Twin Gorges Forebay.	1. Compile temperature and precipitation records for the area over the winter period. 2. Contract local observer to monitor ice conditions and water temperatures on a daily basis while in area. Photographs of ice conditions should be made and local water levels measured	1. Observe the ice conditions at monthly intervals over the winter, noting the following: existence of overflows, aufeis deposits from local inflows, development of open water, behaviour of hanging dams, position of the head of the ice cover	1. Measure water levels at selected critical locations if ice conditions change dramatically over the winter period or if the local ice conditions are not represented by the ice conditions at the WSC gauge. 2. Characterize the ice cover as opportunity presents itself if the water level measurements are being undertaken	None	1999/00 2000/01	2 consecutive years	TG/SVS to TSL	None	Begin monitoring	No study required	Specific monitoring before and after shutdown. Can be completed with one year of monitoring.
2.3 Water temperatures on the Taltson River below Twin Gorges	None	None	1. Measure water temperatures in Twin Gorges tailrace on a daily basis throughout year. 2. Measure water temperatures on Trudel Creek below	None	Annually for life of project	3 consecutive years	D/S of NL; D/S of TG	One profile taken on NL and just d-s	Install continuous monitoring devices @ key locations	Continuous monitoring not required, remove from 1999 TOR.	Continuous monitoring not required, remove from 1999 TOR.

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
			South Valley spillway on a weekly basis throughout year. 3. Measure vertical water temperatures in the Twin Gorges Forebay upstream of Twin Gorges and South Valley at two week intervals during winter period when ice cover is competent. 4. Measure water temperatures at three locations along Trudel Creek and six locations along the Taltson River between Twin Gorges Forebay and Tsu Lake for a period between August and December to establish heat transfer rates at the water surface. 5. During late fall, prior to formation of an ice cover, measure the thermal structure of a pool and riffle sequence within the reach defined by the existing channel surveys.								

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
2.4 Breakup processes on Trudel Creek and Taltson River downstream of Twin Gorges Forebay.	1. Identify critical areas along the river where ice related flooding and winter crossings are an issue. 2. Establish a study reach that is representative of the overall river.	1. Observe the freeze-up processes five times over a period of one to two weeks during the breakup period, documenting the following: thermal erosion of ice front, open water development in riffles, stage increases and ice cover, effects of hanging dams on jams, formation of ice jams	1. Measure peak breakup levels along a study reach in the vicinity of the WSC gauge and relate these levels to the stage variability during freeze-up at the WSC gauge. 2. Measure breakup levels at critical use points along the river. 3. Measure ice jam profiles and heights of shear walls should ice jams occur. 4. Measure water temperatures at the head of the receding ice cover as opportunities develop during the observations.	None	1999/00 2000/01 2001/02	3 consecutive years	TG/SVS	None	Begin monitoring	No study required	Specific monitoring before and after shutdown. Can be completed with one year of monitoring.

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
<b>3. Atypical water level fluctuations below Nonacho Lake and downstream of Twin Gorges, on Trudel Creek, on the Taltson River between Elsie Falls and Tsu Lake, and on the Taltson River between Tsu Lake and the mouth.</b>											
3.1 Outflows from Nonacho Lake.	See 1.2 above	See 1.2 above	See 1.2 above	See 1.2 above	1999/00 and then annual reporting for life of project	See 1.2 above	NG, NS, TCG, TG, SVS	See 1.2 above	See 1.2 above		
3.2 Water level fluctuations at critical points along waterway between Nonacho Lake and Twin Gorges Forebay.	1. Examine flood routing procedures for flows along Taltson River and identify attenuation of outflows from Nonacho Lake. 2. Determine water level fluctuations for selected hydraulic control point(s) that may be due to changes in gate settings at Nonacho Lake, using the data collected in the field.	1. Identify hydraulic controls along Taltson River, and characterize according to degree of control and importance with respect to local water users.	1. Measure hydraulic characteristics of selected control(s).	1. Include the expected water level changes in the weekly forecast of water releases from Nonacho Lake.	2001/02 2002/03	3 consecutive years	NL to TG; TG/SVS to TSL; and TSL to GSL	Benchmarks, flows and water levels were established /recorded	-Continue with flow measurements and water level records -Develop mathematical model	No study required	Monitoring flows and water levels downstream of Tsu Lake should only be conducted if results from Twin Gorge/SVS to Tsu Lake show an effect at Tsu Lake outflow. Forecasting flows not required but an information session with locals should take place once the potential effects are understood. Model could be developed after one more full year of monitoring

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
3.3 Water level fluctuations along Trudel Creek.	1. Determine rating curve of South Valley spillway. (See 1.2 above) 2. Identify a significant water use reach along Trudel Creek.	1. Examine changes in the water levels in the Twin Gorges Forebay during shut down of Twin Gorges. 2. Determine routing characteristics of flow through the channel and lakes along Trudel Creek using the response of the WSC gauge below Twin Gorges to detect changes in flows during shutdown at Twin Gorges.	1. Measure hydraulic characteristics of selected control(s). 2. Characterize the slope and hydraulic characteristics of the reach by field surveys during summer. 3. Measure water levels at four different flow conditions through the South Valley spillway.	1. Report daily outflows, along with expected outflows for one week in advance. 2. Report daily stages along with expected stage changes for one week in advance for the most important reach along Trudel Creek.	2000/01  2002/03 then annual reporting for life of project	3 consecutive years	NL to TG; TG/SVS to TSL; and TSL to GSL	Benchmarks, flows and water levels were established /recorded	-Continue with flow measurements and water level records -Develop mathematical model		

NTPC 1999 WEMP Taltson Hydro Project: Table 2 Fish and Aquatics						Outstanding WEMP Items as Identified by Rescan 2006 Taltson Hydro Project 1999 (WEMP) ToR Review				2006 NTPC Proposed TOR Modifications	
Component	Preparatory Work	Reconnaissance Level Survey	Short Term Field Monitoring	Reporting / Long Term Monitoring	Schedule	1999 TOR Monitoring Schedule	1999 TOR Monitoring Location	Progress (as of January 2006)	Outstanding WEMP Items from 1999 TOR	No Operating Change	Changes in Operating
<b>4. Sedimentation due to erosion and instability of the channel platform of Trudel Creek and on the Taltson River between Twin Gorges and Tsu Lake and between Tsu Lake and the Mouth</b>											
4.1 Geomorphic characteristics of the waterway.	1. Examine historical flow records over the South Valley spillway and estimate dominant flows in the waterway. 2. Establish surface area of lakes and determine attenuation affects on flows (if any) and storage areas for suspended sediment load. 3. Compare pre and post regulation aerial photography to determine changes in channel platform.	1. During summer, describe geomorphic characteristics, degree of bedrock control (if any) and locations where channel instability may be a problem.	None	None	2000/01 2002/03	2 consecutive years	SVS through TC	None	Begin survey	1 year study to characterize conditions.	
4.2 Extent of bank erosion and channel instabilities along waterway.	None	1. From above aerial reconnaissance identify areas of active erosion	1. Establish one or two cross sections at one or two representative erosion sites, and install reference pins to monitor bank erosion on an annual basis. 2. Sample the eroding material for grain size analysis.	1. Measure bank erosion rates each year and relate to flows own the waterway.	2002/03 continuing if required.	1 year, more if required	SVS through TC	None	Begin survey	1 year study to characterize conditions and predict future erosion	

## **Appendix C: CONFORMITY TABLE**

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TALTSON TWIN GORGES GENERATING STATION  
Aquatic Effects Monitoring Plan

**Table 17. 2021 AEMP conformity table.**

Taltson 2021 update Aquatic Effects Monitoring Plan Conformity Table			
Review Comment Table			
Page		Section/Scope	Edit/Comment - Rationale
1		Title	Title page updated to state “January 2021 First Issue: (February 2013)”.
ii		Table ES1: AEMP Monitoring Schedule	Removed 2024 requirement for HEC-ResSim update. This is a new recommendation based on the 2020 HEC-ResSim modelling update.
3	Introduction	1.4. Regulatory Review Environment	Updated to reflect operation dates and the specific water license (N1L4-0154) the facility was operating under. The first paragraph now reads: “The Taltson Twin Gorges Generating Station was constructed under the authority of the <i>Dominion Waters Act</i> and from 1970 until 2012 operated under water licence (N1L4-0154) issued under the <i>Northern Inland Waters Act</i> (since superseded by the <i>Northwest Territories Water Act</i> ).” The following text was removed: “development of the project; however, several investigations of potential impacts to the aquatic environment within the Taltson River watershed have occurred over the last 15 years” and “the objective of providing efficient and effective identification of short-term, long-term and cumulative changes throughout the Taltson River aquatic environmen.” As well as the following section (was removed): “Part F of Water Licence MV2011L4-0002, covering the period from August 31, 2012 to August 30, 2027 requires: “The Licensee shall submit to the Board for approval within thirty (30) days of the issuance of this Licence the Terms of Reference for an Aquatic Effects Monitoring Plan (AEMP). In addition to the information contained in the Water Effects Monitoring Plan Terms of Reference dated May 2011, this plan shall also contain the information described in Schedule 2, Item 1, attached to the Licence.” Language and content has been updated throughout the AEMP to reflect writing in the current day (2021), and relevant events that have occurred since the 2013 version.
3	Introduction	1.4. Regulatory Review Environment	Language and content has been updated throughout the AEMP to reflect writing in the current day (2021), and relevant events that have occurred since the 2013 version. Thus, the following text was added: “In June 2011, Northwest Territories Power Corporation (NTPC) applied for Renewal of Water License N1L4-0154 to the Mackenzie Valley Land and Water Board (MVLWB). A new Water License (MV2011L4-00002) was approved for the Project for 15 years (August 29, 2012 - August 28, 2027). This Water License entitles NTPC to store and divert water to create hydroelectric power associated with the Twin Gorges facilities on the Taltson River in the Northwest Territories. The water licence was subject to an Aquatics Effects Monitoring Program (AEMP) (NTPC 2013) and a Sedimentation and Erosion Management Plan (SEMP; NTPC 2012) for Nonacho Lake and Trudel Creek. The objective of the AEMP was to provide efficient and effective identification of short-term, long-term, and cumulative changes throughout the Taltson River aquatic environment. Through the regulatory review process conducted by the MVLWB, the AEMP was approved in May 2013 and includes six specific monitoring plans: Riparian Habitat and Fish Usage Assessment, Trudel Creek and Lower Taltson River Fish Stranding Monitoring, Mercury in Sediment and Fish Flesh Monitoring, Desktop Fish Mortality Assessment, Nonacho Lake and Lower Taltson River Flow Analysis, and a Taltson HEC-ResSim Hydrologic Modeling

TALTSON TWIN GORGES GENERATING STATION  
Aquatic Effects Monitoring Plan

Taltson 2021 update Aquatic Effects Monitoring Plan Conformity Table			
Review Comment Table			
Page		Section/Scope	Edit/Comment - Rationale
			Update. In 2014, the results of Trudel Creek and Lower Taltson River Fish Stranding Monitoring designed to investigate the potential for fish to become stranded during the generating station annual maintenance ramp down in Trudel Creek and the lower Taltson River formally identified that the annual maintenance shutdown results in fish stranding mortality downstream of the powerhouse. Fish mortality due to annual shutdowns is in contravention to Section 35(1) of the <i>Fisheries Act</i> . Fisheries and Oceans Canada (DFO) became the lead regulator under the <i>Fisheries Act</i> . Mitigation measures tested were not able to eliminate all fish mortality and it was determined that an <i>Fisheries Act</i> authorization (FAA) under Section 35(2) of the <i>Fisheries Act</i> was required to continue these shutdowns. Consequently, NTPC applied for a FAA in 2018 which was obtained on August 14, 2020.”
11	Baseline Studies; Fish & Aquatics	2.2.1.6. Lake Trout Spawning Habitat Assessment	Removed “but at present this information is not available” in “Estimates of the actual threat posed by the drawdown and the need for mitigation are dependent on the proportion of lake trout eggs deposited within the proposed drawdown zone or affected by the drawdown by lethal temperature changes, but at present this information is not available.”  This section referred to pre 2013 AEMP information, which now been studied under the Riparian and Fish Use Monitoring program.
11	Baseline Studies; Fish & Aquatics	2.2.1.6. Lake Trout Spawning Habitat Assessment	“Analysis of the data collected during the field program is still in process; however, the outcome of the data is anticipated to” changed to “The following components were studied:”. Updated to reflect that monitoring has been conducted.
15	AEMP Design	3.2. Data Quality Objectives and AEMP Monitoring Program Design	Added “Completed to 2019” including relevant reference to each of the listed monitoring programs.
18	Riparian Habitat and Fish Usage Monitoring	3.3 Riparian Habitat and Fish Usage Monitoring	In an effort to update language to be reflective of the current day, 2021 AEMP, “A significant amount of baseline information has been collected on fish and fish habitat conditions within the Taltson River, with intensive programs completed from 2003 through to 2008” was removed and replaced with “In the Taltson River watershed riparian habitat documentation is not available pre-construction of the Twin Gorges Generating Station; however, littoral habitat information was collected in 2003/2004 and 2008.”
Modified text in the first paragraph to read “The information gathered during these years was incorporated into the long-term monitoring of riparian habitat monitoring within the system.”			
Added “Sampling under this program was completed in 2019 and will be repeated one more year in 2026.” This is so that the AEMP reflects current scheduling, what has occurred and what is yet to come.			
“Can” changed to “may” to reflect uncertainty regarding the comparability of all baseline data, as identified during a background review undertaken in in 2020 (Thornton <i>et al.</i> 2020).			
19		3.3.1. Specific Monitoring	“Velocity” deleted.

TALTSON TWIN GORGES GENERATING STATION  
Aquatic Effects Monitoring Plan

Taltson 2021 update Aquatic Effects Monitoring Plan Conformity Table			
Review Comment Table			
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		Program Objectives	<p>Spot measurements are insufficient to assess changes in water velocity in the river but changes to hydraulic conditions will be examined with the hydrologic model. Velocity measurements in lakes are not necessary for this study.</p> <p>Removed:</p> <ul style="list-style-type: none"> <li>- Identify fish species and life-stage usage of littoral zone habitat and preferred habitat conditions of each identified species;</li> <li>- Conduct an external exam of captured fish for cysts and parasites and provide general comments on fish health;</li> </ul> <p>This was updated to provide a more accurate description of objectives, some wording was moved to other more appropriate sections.</p>
20		3.3.2.2 Task 2: Field Sampling Plan "Daily water level data"	<p>Changed to: "At each monitoring location identified during the desktop analysis, a series of transects is established within the overall site and a combination of the following data is collected: Water level data;"</p> <p>Water level data for this study will be obtained from stations that are monitored near-continuously by NTPC in at least three locations as part of water licence monitoring requirements. Further, although not explicitly reported on in the 2019 report, water surface elevation can be inferred based on georectified imagery collected at each riparian habitat site. In addition, the HEC-RAS model can be used to infer water surface elevations (model was developed as part of the Taltson Hydro Expansion Project and updated in 2013 as part of the AEMP commitments). Thus, NTPC expects that sufficient water elevation data are being collected to meet the requirements of the program and support analysis in 2026.</p>
20		3.3.2.2 Task 2: Field Sampling Plan "Aerial photos of the site (i.e., the 1+ km shoreline length)."	<p>Changed to "Aerial photos of the site (i.e. the 1+ km shoreline length). Georeferenced benchmarks should be established in 2026"</p> <p>Updated based on recommendation from Thornton et al. (2020). This will allow 2019 transect start points to be tied into benchmarks, and elevations can then be expressed in units of masl to allow for direct comparisons among sites and through time.</p>
20		3.3.2.2 Task 2: Field Sampling Plan "Collection of water quality samples and installation of temperature data loggers"	<p>Changed to: "Collection of in-situ water quality measurements". In-situ sampling is appropriate to collect suitable data (e.g., pH, DO) about fish habitat characteristics.</p> <p>Regarding water temperature, the following has been added to the plan: "Water temperature data for the study area should be collated from suitable sources. Specifically, water temperature monitoring has been undertaken by NTPC as part of the Taltson fisheries monitoring programs. Further, temperature is continuously monitored in the lower Taltson River below the hydro facility (Water Survey of Canada Station 07QD007) and directly at the intake of the hydro facility." NTPC's expectation is that these two datasets (i.e., Water Survey Canada and Taltson Hydro) can be monitored to evaluate fluctuations in temperature as part of the 2026 report.</p>
20		3.3.2.2 Task 2: Field Sampling Plan Fish assessment methods	<p>"snorkel survey" has been deleted.</p> <p>Snorkel surveys have not been undertaken because they were not deemed an effective methodology due to</p>

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			constraints associated with a large sample area, depth, visibility, and repeatability.
21		3.3.2.4 Task 4: Evaluation, Compilation, Analysis, Interpretation and Reporting	“age frequency distributions” deleted. Age is not being monitored and the study design is not appropriate to monitor changes in age.
			“life stage usage of riparian habitats” has been deleted as it is vague.
			“stand alone” changed to “standalone”
21		3.3.2.5 Task 5: Adaptive Management Key Issues	Text clarified to state what the study design is appropriate to monitor. The word “abundance” has been removed because the study design was not intended to monitor abundance (see existing text on pages 13 and 21).
			“fish presence, community composition or life stage in the littoral zones” changed to “fish presence, community composition or life stage in the littoral zones”, consistent with rationale provided above.
			Edits have been made to outline a more appropriate process as it is not logical to establish thresholds after assessments have been completed. The revised text reads: “Each site will be assessed for localized change. If the site shows an adverse change in any of the variables listed above, an appropriate action threshold will be identified that represents a biologically significant change. The magnitude of change will then be compared with this action threshold. If the threshold is exceeded, then appropriate actions will be determined in consultation with regulatory agencies.”
			Text modified to be consistent with the edits described above. The modified text reads: “If biologically significant changes to fish presence or community composition are identified within the littoral zones of the Taltson River watershed, then the cause will be evaluated and the need for additional monitoring/mitigation determined. If a specific life stage of fish that was previously confirmed to use littoral zones is not observed in the Taltson River watershed, then an investigation may be conducted to determine the reason of the change and the need for additional monitoring/mitigation will be determined.”
22		3.3.4 Monitoring Program Results	<p>This section was added to detail results of the monitoring program since the last (2013) version of the AEMP.</p> <ul style="list-style-type: none"> <li>“The objective of the 2019 monitoring program was to assess changes in littoral (near shore) and riparian habitats and the associated fish community along the Taltson River from Nonacho Lake to the Taltson Twin Gorges Generating Station to understand the effects of flow regulation. Monitoring involved aerial photograph collection, vegetation sampling, and fish and fish habitat monitoring. The program focused on sites in Lady Gray Lake, Nonacho Lake, Rutledge Lake, the lower Taltson River, Trudel Creek/ Lake, and the Station forebay. Vegetation data was collected in six study areas to provide baseline information on vegetation community composition, distribution, condition, and cover. Fish community and fish habitat data were collected in six study areas using beach seining, electrofishing, gill netting and angling. Evaluations were completed to describe the suitability of a range of habitats for key fish species and life stages. At least eight fish species were captured, with Northern Pike most widely</li> </ul>

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			distributed and detected at all study areas. Water quality data were collected at the study areas to measure water temperature, dissolved oxygen concentrations, and water clarity. All measurements indicated typical values for moderately productive lakes in late summer (Thornton et al., 2020)."
23	Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program	3.4. Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program	<p>These 3 paragraphs were replaced to reflect current day methods, specifically the following text was added:                      "Annual maintenance and inspection of the turbine and draft tube area is essential to ensure reliable power for the communities of the South Slave region and requires a temporary shutdown of the powerhouse for roughly two weeks every summer. Due to a legacy design from the original construction of the facility the annual maintenance shutdown results in the partial dewatering of the Taltson River below the plant upstream of Elsie Lake. Throughout 2011-2013 NTPC renewed the water licence for the facility through the Mackenzie Valley Land and Water Board. An Aquatic Effects Monitoring Plan (AEMP) was developed as part of the licence renewal and one of the components of the AEMP was the Trudel Creek and Lower Taltson River Fish Stranding Monitoring Program (NTPC 2013). In 2014 the results of this monitoring program formally identified that the annual maintenance shutdown results in fish stranding mortality downstream of the powerhouse. Fish mortality due to annual shutdowns is in contravention to Section 35(1) of the Fisheries Act. NTPC worked closely with DFO to define the fish stranding mortalities that result from the annual maintenance shutdown and investigate various mitigation measures.</p> <ul style="list-style-type: none"> <li>Mitigation measures for the existing facility that were tested throughout this process were not able to eliminate all fish mortality. Based on the feasibility assessment, the mitigation measures that will be retained by NTPC are partial night-time shutdown and pulse flows, which were found to mitigate an estimated 30% of fish mortality in the tailrace. Other mitigation measures examined were not considered feasible due to prohibitively high costs, limited effectiveness of the mitigation measures, risk of failure and/or maintenance and reliability issues."</li> </ul>
25		3.4.3. Monitoring Program Schedule	<p>This section was added to detail the monitoring program schedule that was previously not included for this program, specifically the following text was added:                      "Detailed monitoring of Project shutdowns was conducted in 2014, 2015 and 2016, monitoring of the upstream and downstream barriers was conducted in 2017 and fish salvages were undertaken in 2014, 2015, 2016, 2017 and 2018. Monitoring allowed mortality from operational shutdowns and the effectiveness of the mitigation measures to be assessed."</p>
25	Mercury in Sediment and Fish Flesh Monitoring	3.5. Mercury in Sediment and Fish Flesh Monitoring	<p>Edits have been made to more generally represent mercury concentrations.                      "steadily increase over the last 5 years" was replaced with "be present at levels of concern to residents and local land users due to the significant sustenance fishery in the NWT".                      The following text was removed: "Due to the significant sustenance fishery in the NWT, this issue is very important to residents and local land users".                      "large spikes in mercury levels" was replaced with "mercury concentrations of concern".</p>

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26		3.5.2.1 Task 1: Field Sampling Plan	<p>Added “and the 2013 and 2019 AEMP programs” to reflect all periods sampled.</p> <p>Added “In 2026, sediment samples will be collected at three deep water sites in Nonacho Lake and Rutledge Lake and one deep water site in Trudel Creek. Sediment samples will be tested for total mercury, methyl mercury, sulphate, total organic carbon, and moisture content to help assess what other parameters may be contributing to mercury levels in fish flesh. A summary of sample sites including coordinates, previous sampling dates, and sample depths is provided in Table 10. At each sample site, sediment will be collected with an Ekman grab or Ponar sediment grab sampler with samples collected from the surface (top 2.5 cm) and sub-surface (2.5 cm thick) layers from each sample. Sample sites in 2026 will match those sampled in 2019. Similarly sampling methodology will match that was employed in 2013 and 2019, including collection of composite samples (n=3 sediment grabs per sample) for each layer sampled at each site and cleaning of sampling equipment between sample sites with soapy deionized water. Sediment samples will be stored in containers provided by the laboratory and kept frozen if possible, and if not kept on ice or refrigerated in between collection and arrival at a certified laboratory.”</p> <p>Previously, the AEMP did not include methods for sediment sampling, this has been added to accurately reflect the monitoring being conducted.</p> <p>Added “Fish sampling site coordinates from work done in 2013 and 2019 are provided in Tables 11 and 12, respectively.”</p> <p>Added to reflect the new addition of sampling site locations to the AEMP, previously not reflected in the 2013 version.</p> <p>Replaced “baseline” with “historical” data.</p> <p>Language updated throughout to reflect the current day AEMP update (2021).</p> <p>Methods were added to more accurately detail sample handling and data collection processes. The following text was added: All fish processing equipment will be washed with soapy deionized water and rinsed with deionized water after each sample is processed. Each sample will consist of a 100 g to 200 g filet taken from the left dorsal side of each fish and double bagged in Ziplock plastic bags and sealed with as little air as possible in the internal bag. Each sample will be frozen as soon as possible after collection and shipped on ice to the laboratory. For each fish, ageing structures will be collected (otoliths for Lake Trout and Lake Whitefish, otoliths and cleithra for North Pike).</p> <p>For each fish captured for mercury analysis, the following data are recorded:</p> <ul style="list-style-type: none"> <li>• Date and location of capture;</li> </ul>

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			<ul style="list-style-type: none"> <li>Fork length to the nearest millimeter;</li> <li>Weight of the fish to the nearest gram;</li> <li>An external exam to document deformities, lesions, or tumors;</li> <li>An internal exam to document gender and document parasites on organs and in the body cavity;</li> <li>Description of and weight of stomach contents to the nearest gram; and</li> <li>Gonad weight to the nearest gram.</li> </ul>
26		3.5.2.1 Task 1: Field Sampling Plan	<p>Only lethal sampling was employed in 2013 and 2019. If parasites are a concern, they should be evaluated in all systems. Accordingly, the following text was removed:</p> <p>“In order to collect mercury concentrations in fish flesh, individuals have typically needed to be sacrificed. Non lethal methods are now available, such as fish tissue plugs or dermal punches. These methods will be considered in Trudel Creek. In Nonacho and Rutledge lakes, some stakeholders are concerned about parasites, which will require sacrificing the fish. To maximize the scientific value under these conditions, aging structures and stomach analysis would also be conducted in addition to parasite analysis and determination of mercury concentrations.”</p>
28		3.5.2.3. Task 3: Lab Analysis	<p>Specific lab processes were updated to be more detailed, and reference to guidelines not employed were removed (CCME guidelines for human consumption).</p> <p>Revised text now reads “All water, sediment, and fish flesh samples would be sent to a certified laboratory for analysis of the parameters discussed above mercury contamination analysis. Results would be compared to the CCME guidelines for human consumption and for the protection of aquatic life. To be consistent with work done in 2013 and 2019, it is expected that sediment, water, and fish flesh samples will be processed at ALS’s facility in Burnaby, BC where there is a dedicated clean room for mercury analysis. Similarly, a subsample from each fish flesh sample will be extracted by ALS in the laboratory at the time the samples are being prepared for mercury analysis and sent to SINLAB (Stable Isotopes in Nature) in New Brunswick for stable isotope (carbon and nitrogen) analysis.”</p>
30		3.5.3. Monitoring Program Schedule	<p>The monitoring program components completed were outdated, the sampling completed to-date was updated by the addition of “Sampling was completed in 2013 and 2019 and is planned to occur again in 2026.”</p> <p>Added “NTPC will ensure that the data analysis done for annual reports includes the data from previous years for comparison and knowledge of whether effects are occurring or not.”</p>
30		3.5.4. Monitoring Program Results	<p>This entire section was added, to reflect monitoring results since 2013, when the last AEMP version was written. The following text was added along with this new section:</p> <p>“Results of samples collected in 2019 indicated that total mercury concentrations declined in Lake Trout from Nonacho Lake. In Rutledge Lake there were no clear differences in total mercury concentrations. Total mercury</p>

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			concentrations declined in Lake Whitefish from Nonacho Lake while concentrations were significantly higher in Nonacho Lake relative to Rutledge Lake. In 2019, the mercury concentrations in Rutledge Lake Whitefish were comparable to concentrations in Trudel Creek Whitefish. Total mercury concentrations in Northern Pike from Nonacho Lake declined. There were no differences in the methylmercury concentrations in fish from Nonacho Lake compared to fish from the Rutledge Lake or Trudel Creek. Only one Lake Whitefish captured during 2013 and 2019 had a total mercury concentration that exceeded the subsistence guidelines. There were no Lake Whitefish that exceeded the commercial consumption guidelines (Ganshorn et al. 2020)."
30	Taltson Hec-ResSim Hydrologic Model Update Program	3.6.1. Specific Monitoring Program Objectives	Added "The model allows an assessment of whether the requirements are operational feasible given the existing operational control mechanisms and inflows."  Text was added to clarify the capabilities and thus the relevant application of the model.
31	Taltson Hec-ResSim Hydrologic Model Update Program	3.6.3. Monitoring Program Schedule	Added "A previously recommended update for 2024 is no longer recommended based on the findings of the most recent update (Akaoka et al. 2020)."  Given study results since the implementation of the program in 2013, the text was updated to reflect new recommendations and request by NTPC.
31		3.6.4. Monitoring Program Results	Remaining consistent with the 2021 AEMP update approach, a section of monitoring program results since the last version of the AEMP (2013) has been included for the Taltson Hec-ResSim Hydrologic Model Update Program component. This new section now includes the following added results information: "The 2015 HEC-ResSim model was updated in 2019 (Akaoka et al. 2020). Results of the 2019 HEC-ResSim model confirm that the water level and flow requirements given in the Water License are achievable and appropriate under existing hydrological and operational conditions. The model now has 31 years of data that can be used to assess the impacts of changes in operations or inflows (e.g., with climate change) on water levels, power production, and downstream flow rates. This amount of data is considered sufficient to assess the inter-annual variability in effects of these changes, and as such the previously prescribed update to the model in 2024 is no longer recommended. Furthermore, the Water Licence (MV2011L4-0002) does not include any further analysis that require application or future updates to the TRB model. Although not required, the TRB model could be applied to assess numerous questions associated with water flows and levels in the Taltson system. Examples include (1) assessing the potential impacts of climate change on ability to achieve permitted water flows and levels, (2) assessing the risk of flooding associated with extreme high flows years, (3) Assessing operational changes that could be implemented while maintaining permitted water flows and levels, and (4) assessing if any future excursions were preventable through operational adjustments."
32	Desktop Fish Mortality Assessment	3.7.3. Monitoring Program Schedule	Added "The desktop fish mortality assessment was completed in 2016." Updated schedule information for each monitoring program has been added throughout the AEMP, to be consistent with the format of the report. As the monitoring for this program has been completed since 2013, the

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			text was updated to reflect his.
34	Nonacho Lake and Lower Taltson River Flow and Water Level Analysis	3.8. Nonacho Lake and Lower Taltson River Flow and Water Level Analysis	<p>The permitted conditions were incomplete, this has been updated to include more detail and minimum flow requirements. The text now reads as follows:                      “Currently the Water Licence (MV2011L4-00002) has the following permitted conditions:</p> <ol style="list-style-type: none"> <li>1. The Twin Gorges Forebay water level must not fall below 238.9 m.</li> <li>2. The Nonacho Lake Reservoir water level must stay between 319.3 m and 321.6 m.</li> <li>3. A minimum flow of 14 m3/s should be maintained in the river channel between the outflow of the control structure at Nonacho Lake and the Twin Gorges Forebay.</li> <li>4. A minimum flow of 28 m3/s should be maintained below the Twin Gorges Generating Station in the river channel at a point 100 m below the confluence of Trudel Creek and Taltson River.</li> </ol> <p>In 1996, concerns were raised on the limited data used to establish the permitted water level conditions.”                      “As a robust hydrological model has been developed for the Taltson River watershed, the appropriateness of the permitted minimum water levels can be re-evaluated” was removed.</p>
34		3.8.1 Specific Monitoring Program Objectives	<p>Objectives of the flow and water level analysis as a stand alone study were updated and clarified. The section now reads:                      “The primary objective of the Nonacho Lake and Lower Taltson river flow and water level analysis was to address the concerns associated with hydrologic modeling and the appropriateness (operational feasibility) of the water license conditions (Table 1). More specifically, the objectives of the analysis was to:</p> <ul style="list-style-type: none"> <li>• Review and update the HEC-ResSim hydrologic model with current data to confirm the model is consistent with current operating conditions and that the limits and conditions in the Water License are appropriate.</li> <li>• Review water level elevations and flow data within the Twin Gorges and Nonacho Lake Reservoirs annually to document any excursions from the conditions in the Water License.”</li> </ul>
34		3.8.2.1 General Approach – Hydrological Modelling	<p>The general approach was updated to reflect the modelling conducted and its intended applications, which were outdated. The text now reads: “The HEC-ResSim hydrologic model was updated and operational scenarios were run to assess the appropriateness of permitted water levels and flows using data from 1987 to 2015 (Imam <i>et al.</i> 2015). Hydrological parameters were the only conditions that were considered as a component of the assessment.”</p> <p>The following text was deleted “Hydrological parameters are the only conditions that would be considered as a component of this assessment; no environmental concerns would be addressed.” And was replaced with “The water level and flow data are to be reviewed annually to document any excursions from the conditions in the Water License.”</p>
		3.8.3 Monitoring Program Schedule	<p>Updated schedule information for each monitoring program has been added throughout the AEMP. This new section reads as follows:                      “The Nonacho Lake and Lower Taltson river flow and water level analysis was completed in 2015. The model may be used to evaluate further water levels and flow as required. Updates to the model occur through the Taltson</p>

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			Hec-ResSim Hydrologic Model Update Program Section 3.2.4. The water levels and flows in the Nonacho Lake and Lower Taltson River will be continuously monitored and the excursions from the conditions in the Water License will be reported annually.”
	Nonacho Lake and Lower Taltson River Flow and Water Level Analysis	3.8.4 Monitoring Program Results	<p>Remaining consistent with the 2021 AEMP update approach, a section of monitoring program results since the last version of the AEMP (2013) has been included for the Nonacho Lake and Lower Taltson River Flow and Water Level Analysis component. This new section now includes the following added results information:                      “The HEC-ResSim hydrologic model was reviewed for appropriateness in 2015 (Imam and Cullen 2015). Based on the model results, the water level and flow requirements given in the Water License were found to be achievable and appropriate under existing hydrological and operational conditions. Specific findings included:</p> <ul style="list-style-type: none"> <li>• The observed water levels and flows were in the range specified by the Water License between 1987 and 2014 (Imam and Cullen 2015). For Nonacho Lake, model results indicated that occurrence of water level below the minimum level permitted in the Water License is unlikely under existing hydrological conditions and for any gate setting at the Nonacho Lake Dam;</li> <li>• Exceedance of the maximum permitted water level is also unlikely with full opening of gates at the Nonacho Lake Dam. However, model results indicate that exceedances may occur during years of high inflow to Nonacho Lake with nearly fully closed gates on Nonacho Lake Dam. With full gate closure, simulated water level in Nonacho Lake exceeded the maximum permitted level for only ~1% of the simulation period of ~19 years from 1978 to 1990 and 2007 to 2013;</li> <li>• For the Twin Gorges Forebay, simulation results indicated that releasing a steady flow of up to 54 m<sup>3</sup>/s from the Twin Gorges Generating Station would maintain the Forebay water level above the minimum level of 238.9 m permitted in the Water License. Releasing steady flows higher than 54 m<sup>3</sup>/s may lead to occurrences of water levels lower than permitted by the Water License, particularly during years with low inflows to Nonacho Lake and with fully closed gates at Nonacho Lake Dam; and</li> <li>• For the current typical maximum electric power production at the Twin Gorges Generating Station, water level in the Twin Gorges Forebay is unlikely to decrease below the minimum level permitted in the Water License under existing hydrologic conditions.</li> </ul>
35	Sediment and Erosion Monitoring Program	3.9 Sediment and Erosion Monitoring Program	This is an entirely new section added, to detail the Sediment and Erosion Management Plan (SEMP) that was developed for the Taltson Hydroelectric project and was not included as part of the previous AEMP version (2013). The program is described consistently as per all other programs contained within the AEMP, including general approach, monitoring program objectives, schedule, and results of monitoring sections.
41	Section 7	7. Summary of Sample Site Monitoring Locations	This section has been largely overhauled and significant information has been added to detail the sample site monitoring locations, which were largely not yet defined during the writing of the previous AEMP iteration. A sub-section has been created for each monitoring program, with specific location information detailed for each. Additionally, maps have been added to help illustrate these locations (Section 5).