Appendix F

Final Surface Water Technical Support Document

MARTEN FALLS FIRST NATION
COMMUNITY ACCESS ROAD

Surface Water Technical Support Document: Existing Conditions and Effects Assessment

February 2026

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This limitations statement is considered an integral part of this report.

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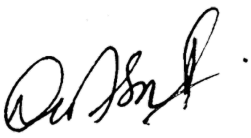

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Final	February 20, 2026	WSP Canada Inc.	Final Report for inclusion with Final EA / IS Report

Executive Summary

Marten Falls First Nation (Oji-Cree translation, *Wegwajihwana*) is a remote First Nation community in northern Ontario, approximately 430 km from Thunder Bay, Ontario, located at the junction of the Albany (Oji-Cree translation, *Keshijih'wano Wih Ziibih*) and Ogoki (Oji-Cree translation, *Zakamosgwanih' Ziibih*) rivers. Marten Falls First Nation is proposing a multi-purpose Community Access Road that will connect the community to the Ontario provincial highway network (the Project). This Report presents the existing conditions and effects assessment for the surface water discipline, which has been prepared in support of the *Marten Falls Community Access Road Environmental Assessment / Impact Statement Report*. This assessment includes consideration of both effects from the Project and cumulative effects from the Project, as well as other reasonably foreseeable developments. The surface water assessment used widely accepted scientific practices and incorporated Indigenous Knowledge, where available.

A combination of a desktop review and field investigations were completed to assess the existing surface water conditions within the Project area, including a review of relevant data from previous investigations (including Cliffs Chromite Project) and publicly available sources as well as the development of a waterbody crossing list for the Project. The field investigations involved a helicopter-assisted aerial reconnaissance along the length of the route alternatives (completed in 2019) as well as targeted ground-based field studies at a select set of waterbody crossing locations (completed between 2019 and 2022).

The key findings of the desktop review / compilation of existing surface water conditions included the following:

- **Watershed and river system characteristics**—The Project was shown to cross three tertiary watersheds (4GD-Upper Albany – Makokibatan, 4GE-Lower Ogoki, and 4GF-Upper Albany – Muswabik) that comprised 94 individual waterbody locations. These waterbodies included catchment areas that ranged from approximately less than 1 to 18,350 km² and generally drained to the east or north (ultimately discharging to James Bay [Oji-Cree translation, *Wee-nee-peg-kook*]). The surficial geology of the watersheds was observed to be dominated by organic deposits with instances of glaciolacustrine deposits, glaciofluvial deposits, till, and bedrock, while land cover in the catchments was characterized by mostly treed and moderate relief (ranging on average from 215 to 260 m);
- **Surface water use**—There were no active Permits to Take Water within or near the aquatics Local Study Area or Regional Study Area (based on Ministry of the Environment, Conservation and Parks records) at the time of the desktop review. Similarly, no active hydropower generating stations were shown to be located within the Local Study Area or Regional Study Area (according to publicly available mapping, Ontario Power Generation reports, and Ontario Hydro Network datasets).

The closest known hydropower facility to the Project is the Ontario Power Generation-operated Alexander station (Nipigon River). This facility is located approximately 210 km southeast of the Local Study Area and has a capacity of 92 megawatts. It is expected that local communities rely on surface water sources for domestic and recreational purposes;

- **Surface water yield and seasonal distribution**—Surface water flows and water levels from the available hydrometric monitoring records at locations within and slightly outside of the Regional Study Area were shown to be largely controlled by snowmelt- and rainfall-generated runoff patterns. The spring and fall hydrographs for these stations were typically characterized by high flows in response to the annual snowmelt event in April-May and rainfall-generated runoff in October-November, while hydrographs during the summer and winter months were marked by mostly low to moderate flows (due to comparatively dry or frozen conditions). Mean annual surface water yields were shown to vary from 122 to 384 mm based on data collected using the Ontario Watershed Information Tool and from Water Survey of Canada datasets; and

- **Surface water and sediment quality**—Surface water and sediment quality results from the available monitoring records collected at locations within and slightly outside of the Regional Study Area (including the available water quality monitoring results from the Cliffs Chromite Project) were shown to generally satisfy the relevant guideline values, noting that the observed concentrations of some metals (e.g., aluminum, cadmium, and iron for water and chromium, manganese, nickel for sediment) were observed to be elevated (and likely naturally abundant) at certain locations, while the concentrations of several other parameters (including methylmercury, polycyclic aromatic hydrocarbons, hydrocarbons, and hexavalent chromium) were shown to be at or below laboratory detection limits. Observed turbidity from the available water quality records collected at locations within and slightly outside of the Regional Study Area ranged from 0.49 to 7.50 nephelometric turbidity units, while pH generally demonstrated slightly acidic to alkaline conditions.

As part of the ground-based field surveys, 55 potential waterbody crossing locations were visited between 2020 and 2022 (this included multiple visits to many of the sites). Of the 55 sites, 13 fall into the category of a small-sized watershed (less than 10 square kilometres [km^2]), 34 fall into the category of a medium-sized watershed (between 10 and 1,000 km^2), and 8 fall into the category of a large-sized watershed (greater than 1,000 km^2). The key findings of the field investigations component of the existing surface water conditions study included the following:

- **Surface Water Quantity**—The results of the surface water hydrology aspects of the field investigations demonstrated that the watercourses at the waterbody crossing locations were generally characterized by moderately to well-defined channels (with bankfull geometry ranging from less than 1 to 9 m, 2.3 to 40 m, and 43 to 210 m at small, medium, and large watersheds, respectively) that cut across broad tracts of bog and fen terrain.

These channels included mostly low sinuosity, low channel slopes (0.2% to 2.0%), and limited evidence of erosion–sedimentation processes (e.g., the bed and banks of the channels were generally stable with, in some instances, examples of minor bank erosion, bed aggradation, and planform adjustment). As expected, the observed bankfull and wetted geometry of the channels, as well as the measured flow rates on a seasonal scale, were well-correlated to catchment size (i.e., channel geometry and flows increased with each incremental change in watershed area). In addition, a review of the results from the current field investigations with the associated results from the Cliffs Chromite Project showed that, where concurrent results / observations were available at crossing locations, the physical conditions at the watercourses remained largely consistent; and

- **Surface Water and Sediment Quality**—The results of the surface water and sediment quality aspects of the field investigations demonstrated that, with some exceptions, the lakes and watercourses at the waterbody crossing locations generally satisfied the full suite of relevant water and sediment quality guidelines. However, for water quality, the observed concentrations of iron and manganese at several of the waterbody crossing locations were shown to be elevated relative to *Ontario Drinking Water Quality Standards, Ontario Provincial Water Quality Objectives*, and / or *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, while, for sediment quality, the observed concentrations of total Kjeldahl nitrogen, chromium, iron, manganese, nickel, and phosphorus at a number of the waterbody crossings were shown to be elevated relative to *Sediment Quality Guidelines for the Protection of Aquatic Life* and / or *Ontario Provincial Sediment Quality Guidelines*. The water and sediment quality results for most parameters included little to no correlation with catchment scale (i.e., concentrations remained relatively unchanged across the small-, medium-, and large-scale watersheds), but parameter concentrations for water quality demonstrated a marked correlation to the characteristic flow conditions at the time of the sampling, noting that water quality concentrations of several of the metals were shown to be higher under summer low flows vs. under moderate to high flows in spring and fall. In addition, a review of the water and sediment results from the completed field investigations with the associated results from Cliffs Chromite Project demonstrated that, where concurrent results / observations were available at crossing locations, the water and sediment quality conditions at the watercourses remained largely consistent.

Interactions were identified between the Project components and activities and the existing conditions of surface water. These interactions support the identification of potential effects, both direct and indirect, that may result in changes to surface water. An effects assessment was completed, including:

- The review of Project activities to identify potential Project–environment interactions;
- Characterization of the existing environment for both route alternatives;
- Identification of potential environmental effects of the Preferred Route and recommended mitigation measures including opportunities to enhance benefits to environment;

- Prediction and assessment of residual effects after implementation of mitigation and enhancement measures, and prediction of cumulative effects; and
- Identification of monitoring requirements.

The key findings of the effects assessment included the following:

- Potential effects on surface water Valued Components are anticipated due to Project–environment interactions during the Construction and the Operation and Maintenance Phases of the Project;
- Potential environment effects on the surface water Valued Components can be reduced or avoided by employing technically and economically feasible mitigation and enhancement measures. The proposed measures consist of industry-standard practices, federal and provincial standard specifications, regulator-mandated measures, Indigenous and community recommendations, and recommendations from industry and environmental professionals based on expertise, scientific publications, experience, and judgment;
- The residual effects assessment indicated that potential effects due to Project–environment interactions are negligible in magnitude, localized, largely indiscernible a short distance from the point of impact in the waterbody and will not have residual adverse effects on surface water quantity and surface water and sediment quality, with the proper implementation of the proposed mitigation and enhancement measures and proposed monitoring programs;
- Five residual effects were carried forward to the cumulative effects assessment:
    - Residual effects to surface water quantity from short-term water taking during Construction.
    - Residual effects to surface water quantity, surface water quality, and sediment quality from short-term water discharges during Construction.
    - Residual effects to surface water quantity, surface water quality, and sediment quality during short term water diversions at waterbody crossings during Construction.
    - Residual effects to surface water quantity, surface water quality, and sediment quality due to changes in land cover during Construction.
    - Residual effects to surface water quality and sediment quality from the wash-off of organic debris to nearby waterbodies, and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies during Construction.

- The predicted cumulative effects of surface water quantity, surface water quality and sediment quality are not expected to be significantly greater than the anticipated residual effects identified for the Project. As a best practice, it is suggested that monitoring programs of the Project for existing and future physical activities / project works share relevant monitoring data for areas where predicted effects may overlap, as well as share the timing of such construction activities. Additional timing and monitoring data of related works, such as short-term water takings or discharges, should be shared between projects as these potential impacts on surface water quantity, surface water quality and sediment quality could lead to compounding cumulative effects if the works occur during the same construction periods in the same spatial overlapping project areas; and
- Overall, prediction confidence levels, based on baseline data, the understanding of the Project-related effects, and the levels of certainty associated with the effectiveness of proposed mitigation measures, were considered to be moderate for predicted surface-water-related residual effects.

Monitoring programs for the pre-construction, construction, and operations components of the Project will be implemented to verify effects predictions and effectiveness of mitigation measures for surface water conditions, and apply adaptive management, if required. Monitoring programs include future commitments related to mitigating residual effects. As a best practice, monitoring programs developed for the Project, as well as those developed for the Northern Road Link, Anaconda and Painter Lake Road Upgrades, and Rapid Lynx Broadband projects should be shared for locations where overlapping construction works are being completed during the same time periods. Information pertaining to construction timing and monitoring data of related works, such as short-term water takings, discharges, and diversions, should be shared between projects as these potential impacts on surface water quantity, surface water quality, and sediment quality could lead to compounding cumulative effects if the works occur during the same construction periods in the same spatially overlapping project areas.

Prior to Construction, surface water surveys will be conducted at any waterbody crossing location that has not been previously assessed as part of the field investigations or at crossing locations where work is proposed below the high-water mark to meet permitting requirements. If new waterbodies are identified, an Aquatics Specialist will be required to assess the new waterbody. Depending on the nature of the waterbody, recommendations for construction methods, appropriate mitigation measures, and permitting requirements will be made by the Aquatics Specialist, local First Nation communities, and appropriate regulatory agencies including Fisheries and Oceans Canada and Ministry of Natural Resources will be engaged, if necessary.

During Construction, monitoring programs will be required for surface water in the Local Study Area, including monitoring of one or more surface water quantity and quality parameters. The monitoring parameters may include, but are not limited to, water taking and discharge rates, pH, total suspended solids, turbidity, temperature, dissolved oxygen, biochemical oxygen demand, and other contaminants of concerns as required, at water taking and / or discharge locations to satisfy the conditions / requirements of Water Taking and Discharge Plans related to applicable permits and approvals (e.g., Permit to Take Water, Environmental Compliance Approval and / or Environmental Activity and Sector Registry).

Additionally, monitoring / inspections of all erosion and sediment management measures, bank stabilization features, and cofferdams during Construction will be required to verify the performance and effectiveness of mitigation and enhancement measures. Monitoring of total suspended solids and / or turbidity (instrumented measurements and / or visual observations), as well as visual inspections to confirm the presence or absence of oil or sheen, will be coupled with monitoring of streamflow rates and / or water levels, as required. An Adaptive Management Plan will be developed in the event of an unexpected change to water quantity or quality (i.e., increase in turbidity in accordance with Canadian Council of Ministers of the Environment standards).

During Operation and Maintenance, monitoring / inspections will be required of all new permanent water crossing structures (culverts and bridges) and roadside drainage features. Monitoring of water quality and streamflow conditions at waterbodies will be completed at select locations that include greater sensitivity or implication to change from the standpoint of fish habitat, species at risk, channel stability, drainage pattern, or other environmental considerations.

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1 Introduction

This Report presents the existing conditions and effects assessment for the surface water discipline and is being prepared in support of the Marten Falls First Nation Community Access Road *Environmental Assessment / Impact Statement Report*.

Marten Falls First Nation (*Wegwajihwana*) is a remote First Nation community in northern Ontario, approximately 430 km from Thunder Bay, Ontario, located at the junction of the Albany (*Keshijih'wano Wih Ziibih*) and Ogoki (*Zakamosgwanih' Ziibih*) rivers. Marten Falls First Nation is proposing a multi-purpose Community Access Road (the Project) that will connect the community to the Ontario provincial highway network. The Project includes the construction and operation of a Community Access Road with the following key characteristics:

- Approximately 184 km (See **Section 6** for further details on the selection of the Preferred Route) of two-lane gravel all-season road on a new right-of-way;
- Approximately 100 m wide right-of-way cleared to a width of 60 m; and
- Proposed designated speed limit of 80 km per hour.

Marten Falls First Nation is currently accessible year-round by air transportation out of Thunder Bay, Ontario and Nakina, Ontario, and by a winter access road constructed on an annual basis, if winter conditions permit. Since the 1990s, Marten Falls First Nation has received provincial funding to maintain the 140 km of winter road to the community.

For the purposes of this document, waterbodies are defined as depressions in the ground with defined beds or banks that support surface water flow or wetted conditions, either seasonally or permanently, noting that waterbodies are understood to consist of watercourses, lakes, ponds, and reservoirs. A watercourse means an identifiable depression in the ground that conveys the flow of water regularly or continuously (Government of Ontario, 1990a; Stanfield, 2017) and that may represent a natural or constructed channel (such as a river, creek, stream, or ditch). In comparison, a lake (Oji-Cree translation, *zaakaihgan*), pond, or reservoir means a natural, or wholly or partially constructed, depression that supports standing water (Oji-Cree translation, *wanihbiiya*) regularly or continuously (Ministry of Natural Resources, 2011). A waterbody (i.e., watercourse or water feature) is considered permanent if it contains water for at least nine months of the year and seasonal (i.e., intermittent or ephemeral) if it contains water for less than nine months of the year (Jones & Schmidt, 2022; Toronto and Region Conservation Authority and Credit Valley Conservation, 2014). Wetlands are not discussed in this report but are described in WSP Canada Inc.'s *Vegetation Technical Support Document* (WSP, 2024).

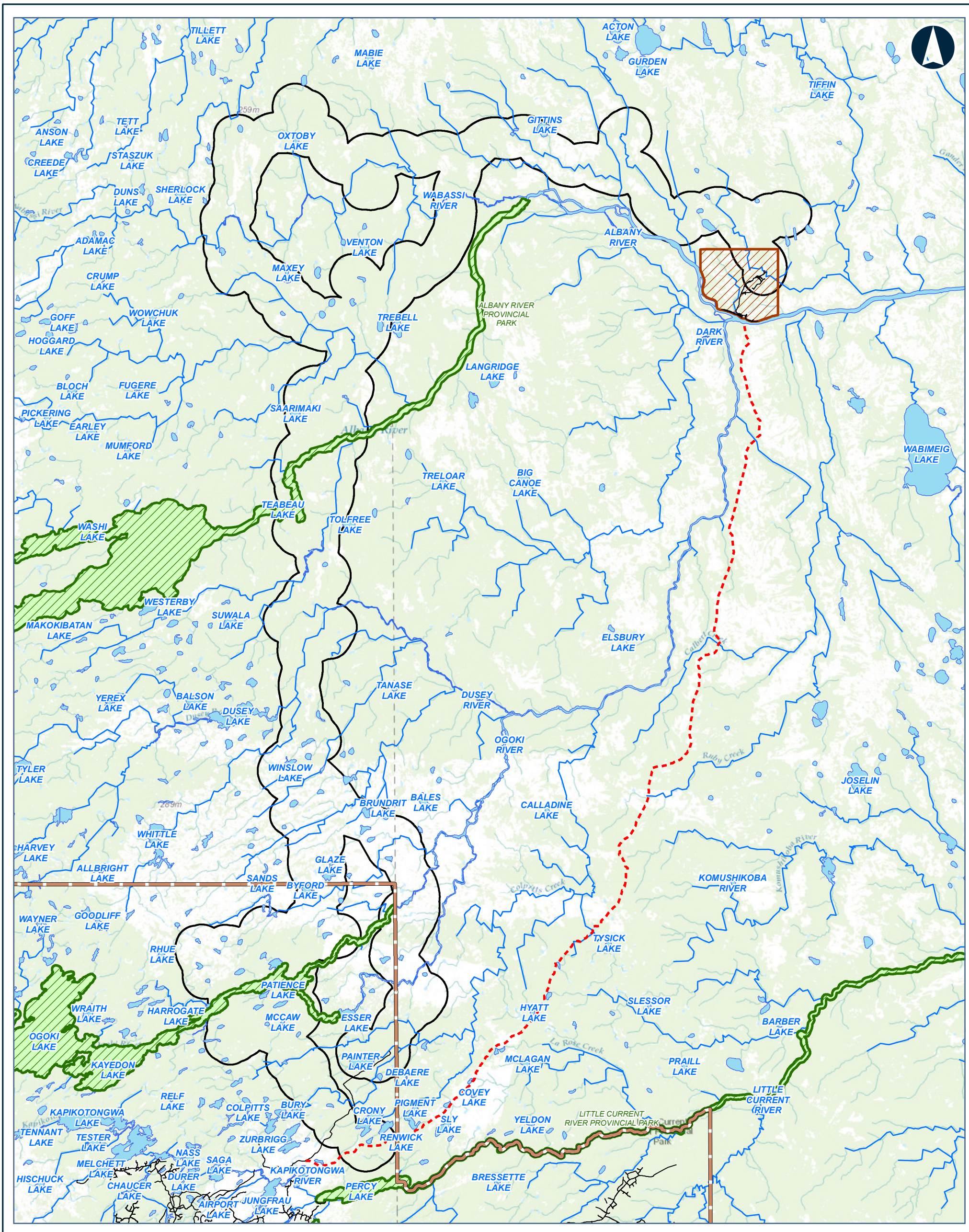
1.1 Project Overview

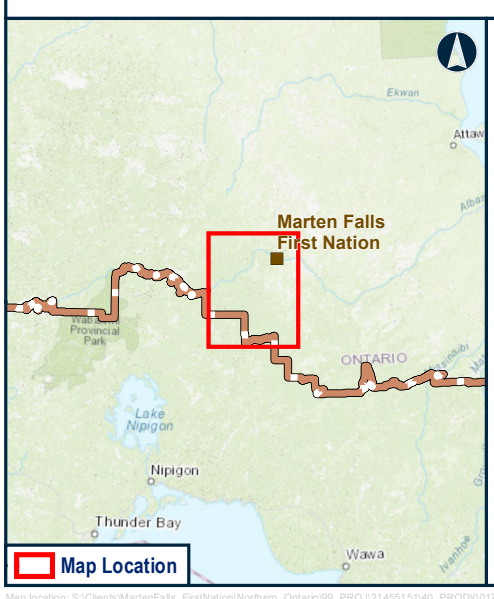
The Project consists of a new Community Access Road from Painter Lake Road, located approximately 57 km north of Nakina, Ontario, to the community of Marten Falls First Nation (**Figure 1-1**). The Community Access Road will serve community access and industrial supply needs for both the community (e.g., fuel, construction supplies, water treatment supplies) and industrial proponents (e.g., mining and forestry). Therefore, to minimize the number of infrastructure corridors in the Far North, the Project will be constructed as a multi-purpose road that is built to meet industrial use specifications.

In April 2018, Marten Falls First Nation signed an agreement with the Ministry of the Environment, Conservation and Parks to prepare an Environmental Assessment under the *Ontario Environmental Assessment Act*, 1990 (Government of Ontario, 1990b) to support the development of the Community Access Road. A study under the *Ontario Environmental Assessment Act* (Government of Ontario, 1990b) was formally initiated by Marten Falls First Nation in March 2019 when the *Notice of Commencement for a Terms of Reference* for the Project was published.

All-season public roads that require 75 kilometres or more of new right-of-way, as per Schedule 1 (51) of the Physical Activities Regulations under the *Impact Assessment Act*, may be subject to the Act (Government of Canada, 2019b). After considering the detailed Project Description, the Agency determined that a federal Impact Assessment is required for the Community Access Road, and an Impact Statement needs to be submitted to the Agency for review and approval. The Agency prepared and released the Marten Falls Community Access Road Project: Tailored Impact Statement Guidelines in February 2020 (Impact Assessment Agency of Canada, 2020a) to outline the information and studies necessary to conduct the Impact Assessment.

The federal and provincial governments are cooperating on the assessment of the Community Access Road, in accordance with the Cooperation Plan (Impact Assessment Agency of Canada, 2020b). The Cooperation Plan allows Marten Falls First Nation to prepare one single Environmental Assessment / Impact Statement submission to satisfy both the federal and provincial processes (Government of Canada).





Legend

- ROAD
- WINTER ROAD
- WATERBODY
- WATERCOURSE
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- PROJECT STUDY AREA

Notes:
None

Data Source:
Base Data: Provided by MNRF 2019; Route Infrastructure - Provided by AECOM 2019. Contains Information licensed under the Open Government Licence Ontario.
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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

PROJECT LOCATION

0 5 10 20
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:450,000 * when printed 11"x17"
Rev:0	

Figure 1-1

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1.2 Report Overview

This Report includes the following:

- A summary of the Project components and activities (**Section 2, Project Description**);
- A compilation of information shared by Indigenous Peoples and other interested persons related to surface water (**Section 3, Information Shared by Indigenous Peoples and Other Interested Persons Which Informed This Report**);
- Study methods and assessment scope (**Section 4, Study Methods and Assessment Scope**);
- A description of existing surface water conditions (**Section 5, Existing Conditions**);
- A summary of the selection of the Preferred Route as it relates to surface water (**Section 6, Selection of the Preferred Route**);
- The residual effects assessment (**Section 7, Residual Effects Assessment**);
- The cumulative effects assessment (**Section 8, Cumulative Effects Assessment**);
- A summary of monitoring programs and future commitments related to surface water (**Section 9, Monitoring Programs and Future Commitments**); and
- An overall summary and recommendations (**Section 10, Summary and Recommendations**).

As described in the *Environmental Assessment / Impact Statement Report* and in **Section 6** of this Report, the characterization of existing conditions for the Project was completed on two alternative routes (Alternative 1 and 4). The data collected through the characterization of existing conditions were used to inform the selection of the Preferred Route (**Section 6**). The residual (**Section 7**) and cumulative (**Section 8**) effects assessments were completed on the selected Preferred Route.

1.3 Qualifications of Individuals

A list of names and qualifications of the authors and technical reviewers of this report is presented in **Table 1-1**.

Table 1-1: Qualifications of Individuals

Name	Title / Role	Years of Experience	Qualifications
Mohsin Siddique	Water Resources Engineer	13 years	P.Eng.
Craig DeVito	Water Resources Engineer	17 years	P.Eng.

P.Eng. = professional engineer.

2 Project Description

2.1 Project Components

2.1.1 Community Access Road

The Project consists of an approximately 184 km all-season road within a 100 m wide right-of-way, 60 m of which will be cleared of vegetation. The road will be approximately 11 m wide to accommodate a two-lane gravel road with culverts and two-lane bridges at water crossing locations. Traffic levels for the Project have been estimated at 700 vehicles per day for the north–south section and 100 vehicles a day for the east–west section of the Marten Falls First Nation Community Access Road. These volumes are reflective of the anticipated peak traffic in 2046.

Road embankment design mitigations are being further considered in high-suitability habitat for caribou where feasible. Operational mitigations such as lower speed limits, signage about wildlife risks, roadside vegetation management, and snow berm height management will be further planned and implemented to facilitate safe wildlife crossing of the road.

The predominant building materials used to construct the road will be blasted rockfill and composite excavation material capped with granular surface material. The majority of blasted rockfill will be obtained from rock outcrops within and / or adjacent to the right-of-way. Building materials will be primarily obtained through the pits and quarries developed specifically to support construction of the Project (**Section 2.1.3**).

Early investigations on permafrost have shown the Project is located within the isolated patches permafrost zone (Heginbottom et al., 1995), with some possible locations identified in test holes and helicopter reconnaissance by KGS Group (2019a,b). Excavation within identified permafrost areas will be avoided, whenever possible, as cutting into surface vegetation can disturb the permafrost regime resulting in thaw and unstable ground. As a precaution, the design will primarily use fill to minimize any permafrost degradation and will follow the recommendations outlined in a Permafrost Management Plan.

The proposed approach to road construction through peatlands endeavours to keep peat in place while promoting natural water flow. A permeable embankment made of quarried rock or selected granular material will be placed over the peat, supported by heavy geogrid to prevent clogging and allow settlement. To preserve peatland hydrogeology, 900-mm equalization culverts will be installed at appropriate intervals, informed by additional field programs and studies (i.e. peatlands hydrogeological monitoring, water budget study, and a field program to develop a detailed map of peat thickness), to be carried out during subsequent design phases of the Project.

For further information on the proposed construction approach, please refer to *Appendix W* under the *Final Environmental Assessment / Impact Statement Report*.

For specific details on the Preferred Route, please refer to **Section 6**.

2.1.2 Bridges and Culverts

Permanent bridges and culverts will be required for the various waterbodies to be crossed by the Community Access Road. Based on initial design and planning, the proposed waterbody crossing structure was initially determined based on bankfull width for each waterbody identified in the crossing list as follows.

- For waterbody crossings with bankfull widths less than 5 m, it was assumed that culverts would be used (requiring in-water work);
- For waterbody crossings with bankfull widths greater than 5 m and less than 30 m, it was assumed that clear span bridges would be used (no in-water work);
- For waterbody crossings greater than 30 m, it was assumed that bridges with piers and abutments would be used (requiring in-water work); and
- For waterbody crossings in flooded / impounded wetlands where wetted widths were greater than bankfull width at the time of the assessment, it was assumed that in-water work would be required.

The type of crossing structure for individual waterbodies may change during detailed design based on site-specific conditions.

The bridges will range in size from clear span to multi-span bridges and will accommodate two lanes of traffic with appropriate shoulder widths. The foundation supports for the bridge abutments are expected to consist of driven steel piles, drilled concrete piles, or concrete spread footings. Bridges will be designed to meet the 1-in-100-year flood scenario design, fish passage requirements, and navigation requirements, as required, based on federal and provincial regulations. Where feasible, bridges will be installed above the high-water mark; however, abutments and / or reinforcement material may be installed below the high-water mark. Permanent bridges along the Community Access Road will be designed to accommodate increased flooding and rainfall under expected and anticipated climate change conditions.

For certain waterbody crossings, culverts will be constructed using either corrugated steel pipe culverts or box culverts with minimum culvert diameters of 900 mm. The culverts will either be closed or open bottom depending on fisheries sensitivities and soil conditions. The culverts will be designed to accommodate fish passage, where appropriate. Permanent culverts along the Community Access Road will be designed to withstand expected and anticipated climate change conditions, such as increased rainfall, higher temperatures, frequent freeze-thaw cycles, and heightened flooding risks.

Equalization culverts will also be installed at locations where it is determined that spring-melt or storm runoff needs to pass from one side of the Community Access Road to the other to prevent flooding and / or erosion. The purpose of equalization culverts is to maintain the existing surface water drainage patterns in the area. Culverts will be put in place as construction progresses along the Project.

Additional design measures and wildlife crossing mitigation options will be incorporated on select bridges and culverts located in high-suitability habitat for Species at Risk and road mortality vulnerable species (i.e., amphibians and reptiles). These measures will be further considered during detailed design and implemented during construction at prioritized locations to facilitate safe wildlife passage above or below the Community Access Road and reduce the risk of barriers to movement across the project area during operations.

The type of crossing structure for individual waterbodies may change during detailed design based on site-specific conditions.

2.1.3 Pits and Quarries

Pits and quarries will be developed to provide crushed rock and granular materials for the construction of the Project and temporary access roads. Most of the rock required for construction is expected to come from quarry sites adjacent to the Project. Temporary access roads will be established to connect the various Project components, as required, and will be limited in length to the extent feasible.

All materials will be subject to a geotechnical verification process in order to confirm they possess the desired physical properties for use in construction. The development and operation of all pits and quarries will be subject to the aggregate permitting process under the *Aggregate Resources Act* (Aggregate Resources of Ontario: Site Plan (2020) Standards and Technical Reports and Information [2023]). Permitted pits and quarries will follow the progressive and final rehabilitation requirements outlined in the approved site plans under the Act.

Only material that has been cleared through a geochemical verification process will be used for the permanent and temporary roads to avoid acid rock drainage or metal leaching. Monitoring of runoff will be conducted; further details about this specific type of monitoring will be available in the Surface Water Management Plan of which the Owner/Operator will be responsible to follow all applicable Ontario permitting guidelines.

2.1.4 Temporary Infrastructure for Construction

The temporary infrastructure for the Project includes temporary access roads, staging areas, camps, and debris and / or timber stockpiles. Temporary access roads will be required to access the right-of-way during construction. The purpose of the temporary access roads is to facilitate emergency, equipment, and personnel access and to provide access to and from pits and quarries, staging areas, camps, and debris and / or timber stockpiles. The temporary access roads will be cleared, but not grubbed, to approximately 10 m wide to accommodate equipment movement. The temporary access roads will be limited in length to the extent feasible. Temporary bridges and culverts will be required to cross the various waterbodies along the temporary access roads. Existing access roads will be used where possible; however, access is limited in the area.

Bridges and culverts will be required to cross the various waterbodies along the access roads. Based on initial design and planning, the proposed waterbody crossing structures for the *Environmental Assessment / Impact Statement Report* were initially determined based on bankfull width for each waterbody identified in the crossing list as follows:

- For waterbody crossings with bankfull widths less than 5 m, it was assumed that culverts would be used (requiring in-water work);
- For waterbody crossings with bankfull widths greater than 5 m and less than 30 m, it was assumed that clear span bridges would be used (no in-water work);
- For waterbody crossings greater than 30 m, it was assumed that bridges with piers and abutments would be used (requiring in-water work); and
- For waterbody crossings in flooded / impounded wetlands where wetted widths were greater than bankfull width at the time of the assessment, it was assumed that in-water work would be required.

Temporary access roads leading to temporary quarry areas will also be rehabilitated and surrendered in accordance with the *Aggregate Resources Act*. Temporary quarries not required for maintenance activities will be vegetated in accordance with the Rehabilitation Plan. Access roads to quarries maintained for operations will be blocked to discourage public use.

2.2 Project Activities

The Project is planned to occur in two phases: Construction and Operation and Maintenance. The following Project activities will occur in each phase, including:

- Construction Phase Project activities:
  - Clearing of the right-of-way for the Community Access Road and supporting access roads (e.g., remove and dispose of trees, shrubs, fallen timber, and surface litter; strip organic materials; grub);
  - Blasting rock (e.g., remove rock at quarries and, as required, at specific locations in association with road and bridge construction);
  - Constructing the Community Access Road (e.g., overburden excavation and removal, excavation of granular material at pits, remove unsuitable soil, place and compact rock and granular material, trim and shape the road, stockpiling of mineral soil and leaf litter [organic material], and soil handling and replacement from stockpiles at decommissioning);
  - Constructing bridges and installing culverts (e.g., surface water management and erosion control, dewatering of the watercourses to create ice bridges, alteration of natural drainage systems, and watercourse bank grading to improve approaches if required);
  - Constructing and operating temporary infrastructure (e.g., access roads, construction camps, laydown areas, and staging areas);
  - Decommissioning temporary infrastructure (e.g., remove temporary culverts and bridges and remediate channels); and
  - Mobilizing equipment, supplies, and personnel (e.g., haulage of materials, soil and liquid waste management, fuel storage, hazardous materials handling, sewage and effluent treatment, and water storage and effluent monitoring for temporary construction camps).
- Operation and Maintenance Phase Project activities:
  - Operating the Preferred Route.
  - Maintaining the Preferred Route, including:
    - Excavation at pits, and excavations and / or blasting at quarry sites;
    - Dewatering at pits and quarry sites;
    - Grading road surfaces (e.g., washout repair and correct grade);
    - Conducting erosion control (e.g., apply native seed mix);
    - Conducting dust suppression (e.g., apply environmentally friendly dust products);

- Clearing vegetation on road shoulders (e.g., mow grass and remove brush and small trees);
- Removing snow (e.g., plow);
- Conducting bridge and culvert maintenance (e.g., seasonal inspections debris removal);
- Conducting ditch maintenance (e.g., maintain drainage to design standard by excavating, filling, trimming, and shaping ditches); and
- Conducting road maintenance (e.g., repair settlement, break-up of road surface, slope failures).

3 Information Shared by Indigenous Peoples and Other Interested Persons Which Informed This Report

In the course of completing the description of existing conditions and effects assessment for this Report, information provided by Indigenous Knowledge holders, Indigenous community members, regulators, and public stakeholders was used to develop the approach and assessment conducted for this study. This information and how it informed the development of this Report are described in **Section 3.1**. This section does not detail all the information, comments, or questions received related to the Project and is limited to the information that informed this report. For a full description of all consultation and engagement related to the Community Access Road, refer to the Record of Consultation and Engagement for the *Environmental Assessment / Impact Statement Report*. Information related to the Indigenous Knowledge Program can be found in the *Aboriginal and / or Treaty Rights and Interests Technical Support Document* (Dillon, 2026a).

3.1 Indigenous Knowledge

Indigenous Knowledge refers to Indigenous systems of knowledge as well as cultural practices related to the production of knowledge based on traditional belief systems, relationships to the environment, and community practices. It is the accumulated and living knowledge built upon the historical experiences of Indigenous Peoples living on the land and adapting to social, economic, environmental, spiritual, and political change (Chiefs of Ontario, n.d.). It includes knowledge about the natural environment (e.g., locations of caribou [Oji-Cree translation, *atigwag*] seasonal use and calving areas), the relationships between environmental changes and species or ecosystems, and how potential effects on the environment can be avoided or reduced.

Indigenous land and resource use refers to specific areas and resources used for traditional purposes when Indigenous Peoples learn and practice their Indigenous Knowledge (Garvin & Northern Forestry Centre (Canada), 2001). This includes the areas and sites used for hunting, trapping, fishing, and gathering and the resources harvested, as well as cultural sites, features and practices—sometimes referred to as Traditional Land Use.

In 2019, the Marten Falls First Nation Community Access Road Project Team launched a program to collect Indigenous Knowledge. The Indigenous Knowledge Program is a critical component of the information base upon which the assessments will rely.

The information generated through the Indigenous Knowledge Program has been woven with scientific approaches, and both knowledge systems will be given equal consideration in forming the foundation for existing conditions, predicting potential Project effects, and determining appropriate mitigation and monitoring methods.

The Indigenous Knowledge Program occurs in two concurrent phases:

1. Collecting existing Indigenous Knowledge and information on Indigenous land and resource use to help inform the early stages of the assessments; and
2. Completing Project-specific Indigenous Knowledge and Land and Resource Use studies.

The protection and confidentiality of Indigenous Knowledge and information on Indigenous land and resource use is of the utmost importance to the Project Team. To honour and respect this important information, Indigenous Knowledge Sharing Agreements were established with interested communities prior to the use of community information. The Sharing Agreement outlines how confidential and sensitive information will be woven into the Project's environmental / impact and design processes.

All Indigenous communities and groups identified by the Ministry of the Environment, Conservation and Parks and the Impact Assessment Agency of Canada through the Indigenous Engagement and Partnership Plan have had the opportunity to participate in the Indigenous Knowledge Program. The Indigenous Knowledge Program provides interested Indigenous communities an opportunity to share existing Indigenous Knowledge and information on Indigenous land and resource use and cultural values that may be relevant to the Project and / or complete Project-specific studies to collect and share Indigenous Knowledge and information on Indigenous land and resource use and cultural values. The Indigenous Knowledge Program included opportunities for Indigenous communities and groups to meet with the Proponent to discuss the program, ask questions, and share concerns and interests.

The Proponent strove to respectfully collaborate with Indigenous communities on how Indigenous Knowledge and information on Indigenous land and resource use and cultural values were considered in reporting and how potential impacts on Aboriginal and Treaty Rights and Interests were assessed. Measures to support this included, but were not limited to:

- Engaging Indigenous communities to solicit information on Indigenous Knowledge and Indigenous land and resource use and cultural values to inform existing conditions;
- Providing Indigenous communities with draft sections of the *Environmental Assessment / Impact Statement Report*; to illustrate how Indigenous Knowledge and information on Indigenous land and resource use and cultural values has been integrated, and to confirm it has been presented appropriately; and

- Completing collaborative working sessions with Indigenous communities for the effects assessment on Aboriginal and Treaty Rights and Interests. Further information on how potential effects on Indigenous Rights were assessed is provided in the *Aboriginal and Treaty Rights and Interests Study Plan* (Dillon, 2021).

Information provided by Indigenous Knowledge holders, recognized as such by their Indigenous community, has been obtained through literature review and shared directly by Indigenous nations in support of this Project through face-to-face meetings or receipt of Indigenous Knowledge reports. The information, some of which is confidential, that has been used to inform this reporting is described in **Table 3-1**.

Table 3-1: Indigenous Knowledge

Topic	Indigenous Community	Details	Section Reference
■ Indigenous Knowledge Integration	■ Marten Falls First Nation (Marten Falls First Nation, 2023)	■ Marten Falls First Nation noted a general interest in combining western science hydrology with Indigenous Knowledge.	■ General Indigenous Knowledge and input from Indigenous communities related to surface water and hydrology.
■ Cultural Significance	■ Fort Albany First Nation (Firelight Research Inc., 2024) ■ Nibinamik First Nation (Dillon, 2024b) Weenusk First Nation (MNP LPP, 2024b)	■ Fort Albany First Nation highlighted the importance of fresh water ecosystems, noting that they play a central role in the life of the community – stating that rivers, lakes, and muskeg provide essential habitat, as well as water for drinking, cultural use (e.g., ceremonial / healing), and travel. The community noted that the water cycle throughout the year is reflected in the teachings of the six seasonal cycle and is closely related to Fort Albany First Nation's use of their traditional territory (including the boreal forest of the James Bay ecoregion, coastal areas of James Bay and Hudson Bay, and the Albany River). One community member noted that the different seasons and moons are named in Omushkegowuk/Cree after specific seasonal water cycles, which explain the movement of water at that time of year, and the activities of different animal species based on the changes to water. ■ In addition, Fort Albany First Nation also noted the importance of being able to collect drinking water on the land – such as *scooping a cup of water from the Albany River or lakes on the mainland*. ■ Nibinamik First Nation noted the cultural significance of the various rivers, streams, and lakes throughout their traditional territory including Nibinamik Lake and Neskantagawii siipi. The community noted that, as Anishinaabek, they have their own intimate relationships with the water, and women are the keepers of the water ■ Weenusk First Nation highlighted the importance of the Winisk River, the Shamattawa River, and Shamattawa Lake. The community noted that the Winisk River is the primary source of water within the community's traditional territory. The community noted that the river supports Weenusk's traditional areas, including important resources such as fish, wildlife, and vegetation, as well as influences and supports community members' ability to travel throughout their traditional territory and connect culturally with significant sites and areas. ○ One community member from Weenusk First Nation noting the following about water: "*Water is very important. It is part one of our medicines, because we use water to for ceremonies, like sweat lodge. If we didn't have water, then it would be a big problem*." ■ Weenusk First Nation noted an importance in collaboration between partner communities, as well as consideration of Weenusk Governance and Stewardship practices to prevent downstream impacts within their community as Peawanuck is located furthest downriver from other communities and potential Project-related activities	■ General Indigenous Knowledge and input from Indigenous communities related to surface water and hydrology.
■ Surface Water Quantity ■ Damming and Diversions	■ Marten Falls First Nation (Marten Falls First Nation, 2023) ■ Fort Albany First Nation (Firelight Research Inc., 2024) ■ Kashechewan First Nation (MNP LPP, 2024a)	■ Marten Falls First Nation provided information and concerns about historical and existing conditions related to surface water quantity and previous damming / diversion activities within the Ogoki watersheds. This includes input noting that travel for the community on the Albany River has been impacted by past development including damming and diversion within the watershed including at Rat Rapids, the Root River, Osnaburgh House, and Lake St. Joseph. ■ Additionally, the Marten Falls First Nation has noted that dams have resulted in low water levels in both the Albany River and Ogoki River, making it hard for members to use waterways for harvesting and fishing as they once did. ■ Kashechewan First Nation have shared concerns related to observed changes to flow patterns in the rivers that run through their traditional territory, attributed to the damming and diversion of water upriver from the community. One community member noted that "*the water has declined by 50% in the last 30 years*". Another community noted that when the water is really low, people must sometimes drag their boats to get through the rapids. ■ Kashechewan First Nation have shared concerns related to water levels in surface water features and peatlands resulting from watercourse crossings and road construction. ■ Fort Albany First Nation provided observations related to how surface water and fish habitat have been impacted by damming and water control structures, noting changes to water quality and quantity. The community discussed how the dams at Lake St. Joseph and Big Trout Lake control the water level on the Albany river, resulting in downstream effects in the Fort Albany area and has led to decreased access to preferred hunting locations. Community members provided feedback describing potential damming around the Marten River, observations that they used to travel up the Chemahagan River in the 1970s for moose, but now have difficulties	■ **Section 5.1.2.2** ■ **Section 7.3.1.3**

Topic	Indigenous Community	Details	Section Reference
		doing so, as the river is too dry, and impacts the safety, natural cycle, and timing of river break-ups in the spring due to dam releases causing the ice to break. One community member from Fort Albany First Nation noted, *"It's really dry now, just when I went to Albany recently … in the summertime. That river used to be full of water. Now it's just rocks and boulders. People drive around their trucks now or four-wheelers [in exposed section of the river] Because of lack of water*."	

■ Concerns related to:
  ■ Contamination / Pollution
  ■ Watercourse crossings
  ■ Traffic-related impacts
  ■ Beavers
  ■ Downstream effects
  ■ Barriers and waterflow
  ■ Linear disturbances
■ Mitigation Measures
■ Surface Water Quantity
■ Surface Water Quality
■ Sediment Quality
	■ Aroland First Nation (Shared Value Solutions, 2024)
	■ Marten Falls First Nation (Dillon, 2024a; Marten Falls First Nation, 2023)
	■ Kashechewan First Nation (MNP LPP, 2024a)
	■ Fort Albany First Nation (Firelight Research Inc., 2024)
	■ Weenusk First Nation (MNP LPP, 2024b)
		■ Marten Falls First Nation provided input on concerns related to surface water quality. This includes:
		  ○ Generalized concerns related to surface water contamination / pollution (i.e., dust, oil, chemicals, litter);
		  ○ Concerns related to how the construction of bridges may result in effects on surface water;
		  ○ Concerns related to impacts on water quality due to increased traffic to the area; and
		  ○ Concerns related to beavers building dams around culverts built along the road, impacting water flow.
		■ Marten Falls First Nation also provided several suggestions related to potential mitigation measures specific to surface water quality including:
		  ○ Safe storage and handling areas for fuelling / refuelling; and
		  ○ Implementation of dust and spill control / prevention measures.
		■ Aroland First Nation noted generalized concerns relating to how increased traffic will result in overall impacts on the natural and atmospheric environment.
		■ Aroland First Nation also highlighted concerns related to the potential for accidents along the road, resulting in contamination of the waterways and surrounding environment in the event of a truck overturning, sliding off the road in poor weather, contamination spills, etc. One interview participant spoke of their previous experience with seeing contamination from oil tanks and garbage out on the land, and was concerned that this could happen again if there is an accident on the road close to the water. While they noted the contamination they saw was cleaned up with bales of hay, they also emphasized that doing more to prevent these incidents is necessary.
		■ Kashechewan First Nation have also noted concerns relating to the potential for fuel spillage and associated contamination impacts on surface water features due to previous experiences with development related to Victor Diamond Mine.
		■ Fort Albany First Nation noted the following concerns:
		  ○ Concerns related to fresh water contamination within surface water features, in particular Albany River, which flows northeast and may potentially transmit Project impacts downstream and "down-muskeg" resulting in impacts that may be felt beyond the Project footprint – into Fort Albany First Nation's traditional territory towards the coast.
		  ○ Concerns relating to how the Project might result in impacts on water flow. In particular, relating to how the Project could act as an additional barrier to natural water flow. Fort Albany First Nation also highlight specific concerns related to how the Attawapiskat River, Albany River, Moose River, and Winisk River might be impacted as a result.
		  ○ Concerns relating to how the project may result in water contamination as a result of accidental spills / pollution (e.g., garbage, debris, and waste).
		  ○ The construction and operation of linear infrastructure (e.g., winter roads and transmission lines), as well as associated traffic.
		■ Weenusk First Nation noted concerns relating to the following effects:
		  ○ Downstream contamination within their traditional territory.
		  ○ Impacts on air quality due to emissions of fugitive dust from the movement and operation of construction equipment and vehicles.
		  ○ Lower water levels due to drying.
		  ○ Increased erosion and sedimentation near surface waterbodies in proximity to the Project.
		■ Kashechewan First Nation have noted support for the ongoing monitoring of waterways, as well as continued community engagement throughout the Project life cycle related to follow-up and surface water monitoring programs.
			■ **Informed Section 7.3.1**
			■ **Section 7.3.1.4.1**
			■ **Informed Section 7.3.1.6.1**
			■ **Informed Section 7.3.1.6.2**
			■ **Section 7.3.1.7.1**
			■ **Section 7.3.1.9.1**
			■ **Section 7.3.1.10.1**
			■ **Informed Section 7.3.1.10.2**
			■ **Section 9**

3.2 Indigenous Engagement

The content presented in **Section 3.2** reflects information that was available at the time the *Draft Environmental Assessment / Impact Statement Report* was prepared. No updates have been made to this section for the *Final Environmental Assessment / Impact Statement Report*. For the most up-to-date and comprehensive documentation of engagement, please refer to *Appendix X - Record of Consultation and Engagement* under the *Final Environmental Assessment / Impact Statement Report*, which serves as the source for all community-specific engagement input received during later phases of the Project.

In addition to the Indigenous Knowledge provided by Indigenous Knowledge holders, information was collected from all Indigenous community members with interests in this Project. The information that has been used to inform this report is described in **Table 3-2**.

Table 3-2: Indigenous Engagement

Valued Component	Indigenous Community	Details	Section Reference
■ Waterbodies and watercourses of importance	■ Eabametoong First Nation (Eabametoong First Nation, 2023)	■ During the consultation program, Eabametoong First Nation highlighted a number of waterbodies significant to the history and contemporary resource use of the community including Eabamet Lake, Miminiska Lake, Keezhik Lake, the Albany River, Wabassi River (Oji-Cree translation, *Wabihzii Wih Ziibih*), McIntyre Lake, McIntyre Creek, Gifford Lake, Purchase Lake, Norton Lake, Washi Lake (Oji-Cree translation, *Obaashiwizaagaykaniing*), and Makokibatan Lake. ■ Several of these waterbodies are located within the Makokibatan – Upper Albany River and Misehkow River – Upper Albany River watersheds, which are considered in the surface water quality assessment.	■ **Section 5.1.3** ■ **Table 5-3** ■ **Table 5-4** ■ **Table 5-5**
■ Concerns related to: ■ Surface water quality	■ Marten Falls First Nation (Marten Falls First Nation, 2023)	■ A community member from Marten Falls First Nation noted generalized concerns about the water quality and availability of drinking water in the Albany River.	■ **Section 5.1.4** and **Attachment F** includes an outline of existing surface water and sediment quality conditions within the Local and Regional Study Area.
■ Concerns related to: ○ Surface water quality ○ Downstream effects	■ Métis Nation of Ontario (Métis Nation of Ontario, 2023)	■ Métis Nation of Ontario noted generalized concerns related to potential impacts to surface water quality including quality of wetlands; impacts to downstream watersheds; and potential impacts on waterways due to increased access to the area. ■ Additionally, Métis Nation of Ontario noted the importance of implementing mitigation strategies for spill prevention and response measures.	■ Informed potential effects, mitigation and enhancement measures outlined in **Section 7.3.1**

3.3 Regulator and Public Stakeholder Input

In March 2025, the *Draft Environmental Assessment / Impact Statement Report* was submitted to Regulators, government experts and Indigenous communities for review as part of the Environmental Assessment / Impact Assessment process. All comments received during the review period were carefully evaluated by the Marten Falls First Nation Community Access Road Project Team, and this Report was updated where appropriate.

The content presented in **Section 3.3** reflects information that was available at the time the *Draft Environmental Assessment / Impact Statement Report* was prepared. No updates have been made to this section for the *Final Environmental Assessment / Impact Statement Report*. For the most up-to-date and comprehensive documentation of engagement, please refer to the *Appendix X - Record of Consultation and Engagement*, under the *Final Environmental Assessment / Impact Statement Report*, which serves as the source for all community-specific engagement input received during later phases of the Project.

The Proponent engaged with Regulators and Public Stakeholders with technical knowledge related to the Valued Components to inform aspects of this report. The information and how it informed the development of this report are described in **Table 3-3**.

Table 3-3: Public, Agency, and Other Input

Topic	Provided By	Details	Section Reference
■ Surface Water Study Plan and the Surface Water Field Logistics Plan	■ Impact Assessment Agency of Canada (Impact Assessment Agency of Canada, 2021a) ■ Ministry of the Environment, Conservation and Parks (2022)	■ The Impact Assessment Agency of Canada noted that any edits to the Surface Water Study Plan and the Surface Water Field Logistics Plan methodology as a result of agency comments should be reflected in the Environmental Assessment. ■ Deviations were anticipated to be required as the Project evolved due to challenges encountered in the field, alternative methodologies being developed, comments from regulators, and as updated guidance became available. These deviations are captured within the study methods and assessment scope.	■ **Section 4.1** ■ **Table 4-1**
■ Surface Water Study Plan and the Surface Water Field Logistics Plan	■ Ministry of Natural Resources	■ The Ministry provided feedback on the Surface Water Study Plan and the Surface Water Field Logistics Plan and requested additional information on what was being included in the sampling criteria and how water levels would affect water sampling. ■ Additionally, the importance of incorporating dam information and providing historical context related to flooding due to dam operations was noted.	■ Feedback from the Ministry helped guide the planning of the discipline-specific field programs. ■ **Section 5.1.2.2** outlines information related to Hydropower Generation, as well as feedback from Indigenous communities related to damming and diversion activities. ■ **Section 5.1.3.1** outlines water level fluctuations at dams within 100 km of the Local Study Area.

Topic	Provided By	Details	Section Reference
■ Concerns related to: ■ Increased erosion ■ Use of salt ■ Downstream effects	■ Marten Falls First Nation (Marten Falls First Nation, 2022a; 2022b)	■ Several communities provided feedback / input on the Project during Public Information Centre sessions including: ■ That there may be issues along the river as river levels and ice levels were very high. It was noted that there are locations where the river bank is eroding, which could have the potential to affect the road; ■ Concerns related to the increased erosion during severe weather events (i.e., intense rain showers) that may impact streams or damage the road; ■ Concerns related to the potential impact of salt use on nearby rivers; and ■ Concerns related to downstream impacts (including impacts to water quality and drinking water) from potential mining developments.	■ **Section 7.3.1.9, Section 7.3.1.10** ■ **Section 7.3.1.11**

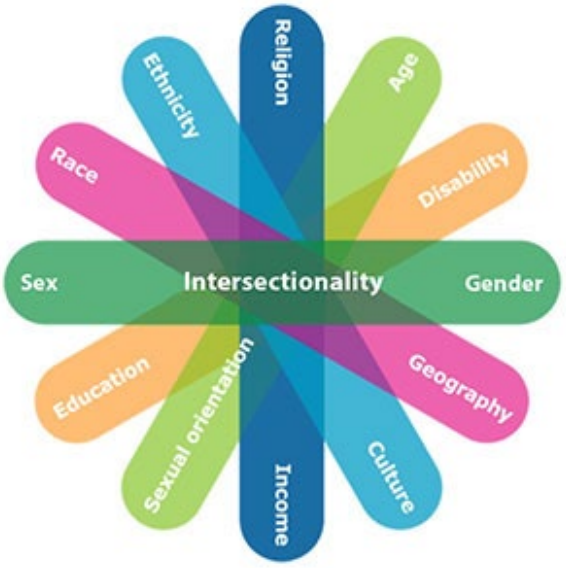
km = kilometre.

3.4 Gender-Based Analysis Plus

The *Impact Assessment Act* (Government of Canada, 2019b) requires Gender-Based Analysis Plus to be applied to Impact Assessments in Canada. Gender-Based Analysis Plus is not a specific set of methods for Impact Assessments but rather an approach that is adapted to the Project and the communities potentially affected and / or engaged.

Gender-Based Analysis Plus is an approach to assess the inequalities and effect of policies, programs, and projects on diverse groups and identities. These identities could include (but are not limited to) gender, sexual orientation, age, race, ethnicity, class, religion, and mental or physical disability (Women and Gender Equality Canada, 2022). These identities can also intersect or overlap; for example, where an individual identifies as being both Indigenous and an Elder or youth. A schematic depiction of Gender-Based Analysis Plus intersecting identity factors are provided in **Figure 3-1**.

Figure 3-1: Gender-Based Analysis Plus Intersecting Identity Factors



Source: (Canadian Institutes of Health Research, 2022)

The Gender-Based Analysis Plus approach involves understanding how certain vulnerable groups such as Indigenous Peoples; women; Elders; youth; and two-spirit, lesbian, gay, bisexual, transgender, queer, questioning, intersex, and asexual persons experience and could be disproportionately affected by a project. Understanding how these groups could be affected by projects allow for more targeted, sensitive, and appropriate enhancement measures, mitigations, monitoring, and follow-up (Impact Assessment Agency of Canada, 2021c).

It is important to understand that vulnerability in Impact Assessment is understood primarily, but not solely, as a structural vulnerability. This means that in many cases it is the systems and power structures that make certain groups more vulnerable (Impact Assessment Agency of Canada, 2021c). For Indigenous Peoples this includes historical and ongoing colonialism, loss of lands and culture, intergenerational trauma, and the residential school system that have resulted in significant social, economic, and health and well-being disparities relative to the non-Indigenous Canadian population (Kim, 2019). Exceptions to this are where vulnerability may be associated with biological sex, pregnancy, or age in relation to environmental determinants of health and exposure to contaminants, for example.

4 Study Methods and Assessment Scope

This section provides a summary of the study methods and assessment scope for the existing conditions and effects assessment for surface water.

4.1 Study and Work Plan Purpose and Objectives

As required by the *Impact Assessment Act* (Government of Canada, 2019b) and referenced in the *Tailored Impact Statement Guidelines* (Impact Assessment Agency of Canada, 2020), a study plan and work plan were developed for each discipline as required. The purpose of the study plan is to explain:

- The existing conditions study methodology that will result in a comprehensive description of the existing environment potentially affected by the Project;
- The process for ensuring efficient and transparent data management and analysis was completed; and
- The discipline-specific effects assessment methodology.

Work plans contain details on how to action the study plans and include information such as location of sampling sites, scheduling, and sequencing.

The *All Season Community Access Road: Surface Water Study Plan* (AECOM Canada ULC, 2021) and *All Season Community Access Road: Surface Water Field Logistics Workplan* (Golder Associates Ltd., 2021), including comments from regulators, can be found in **Attachment A – Draft Study Plan, Work Plan, and Regulator Comments**.

In some instances, through the execution of this study, the approach deviated from what was described in the original Draft Study Plan. These deviations are outlined in **Table 4-1**. Deviations were required as the Project evolved due to challenges encountered in the field, alternative methodologies being developed, comments from regulators, and updated guidance becoming available. General changes, such as changes to section headings, the organization of sections and subsections, and the phrasing and tense have been made throughout and have not been documented in **Table 4-1**.

Table 4-1: Deviations from Draft Study Plan

Section Reference	Description of Change	Rationale
Section 4.2.2 Valued Components and Indicators	The Draft Study Plan previously did not include a "Measure of Change" column in the Valued Components and Indicators Table (now **Table 4-2**).	The measure of change column provides a more detailed expression of the indicator.
Section 4.2.3, Spatial Boundaries	The Draft Study Plan previously used the term *"Local Study Area"* to define the 5 km corridor that is being studied in the Existing Conditions section and within which the footprint of the Project will be further refined. This area has been retitled as the *"Project Study Area."*	This change eliminates confusion between the Project Study Area and the Discipline-Specific Local Study Area.
Section 4.7, Data Management and Analysis	In **Section 4.7.1**, the study plan previously identified that data would be backed up on a "daily basis." This wording has been revised to state that data would be backed up on a "regular basis."	This change brings alignment with the Proponent's various data backup policies.
Section 4.7	In **Section 4.7.2**, wording was updated to note that datasets from all survey sites will be provided upon report finalization. No timeline had been previously identified.	The revision provides added clarity around when the data would be provided.
Section 5.1.1, Watershed and River Systems	The number and location of the expected waterbody crossings for the Project were refined.	The crossing number and locations were updated based on field surveys and reconnaissance.
Section 4.2.3	The Aquatic Study Areas (Construction Disturbance Area, Local Study Area, and Regional Study Area) have been revised and their descriptions updated.	The Aquatic Study Areas required minor revisions to account for shifts to the original route alignment or positioning of temporary infrastructure.
Section 5.2, Surface Water and Sediment Quality	The selected watershed categories for the discipline were revised as follows: small watershed (less than 10 km^2), medium watershed (between 10 and 1,000 km^2), large watershed (greater than 1,000 km^2).	The watershed categories for the field investigated crossings were revised to simplify the analysis of data related to them to allow for easier comparison and interpretation of collected data across different watersheds.

km = kilometre; km^2 = square kilometre.

4.2 Study Scoping

4.2.1 Temporal Boundaries

Project phases, which are temporal boundaries, were developed to establish the timeframes within which potential effects of the Project were considered. As indicated in **Section 2.2**, the Project is planned to occur in two phases:

- **Construction Phase**—The time from start of Construction, including site preparation activities, to the start of Operation and Maintenance of the Community Access Road. Decommissioning of construction works is included in the Construction Phase. The Construction Phase is anticipated to take approximately three to ten years to complete; and
- **Operation and Maintenance Phase**—The Operation and Maintenance Phase starts once construction activities are complete and lasts for the life of the Project. The Operation and Maintenance Phase of the Project is considered to be permanent based on the expected timeline for when major refurbishment of road components (e.g., bridges) is anticipated.

There are currently no plans to decommission the Community Access Road, as there is no expected / known end date for its need. Therefore, future suspension, decommissioning, and eventual abandonment was not considered in this Report. It will be considered if and when a decommissioning or abandonment application is made for the Community Access Road.

In determining the temporal boundaries, in particular the long duration of the Operation and Maintenance Phase, consideration was given to the long-term effects on the well-being of present and future generations.

4.2.2 Valued Components and Indicators

The Impact Assessment Agency of Canada describes **Valued Components** as the environmental, health, social, economic, or additional elements or conditions of the natural and human environment that may be affected by a proposed project and area of concern or value to the public, Indigenous Peoples, federal authorities, and interested parties (Impact Assessment Agency of Canada, 2020). This includes surface water, which is defined as the water that collects at the surface of the ground.

The Valued Components of the surface water discipline were determined through consideration of the following factors:

- Valued Component presence in the study area;
- The extent to which the Valued Component is linked to the interests or exercise of Aboriginal and Treaty Rights of Indigenous Peoples and whether an Indigenous Group has requested the Valued Component;
- The extent to which the effects (real or perceived) of the Project and related activities have the potential to interact with the Valued Component;
- The extent to which the Valued Component may be under cumulative stress from other past, existing, or future undertakings in combination with other human activities and natural processes;
- The extent to which the Valued Component is linked to federal, provincial, territorial, or municipal government priorities (e.g., legislation, programs, policies);
- The possibility that adverse or positive effects on the Valued Component would be of particular concern to Indigenous Groups, the public, or federal, provincial, territorial, municipal, or Indigenous governments; and
- Whether the potential effects of the Project on the Valued Component can be measured and / or monitored or would be better ascertained through the analysis of a proxy Valued Component.

Indicators represent the resource, feature, or attribute related to the Valued Component that, if changed, may demonstrate an effect on the environment. The indicators and rationale for selection and measurement of potential effects, which were also used to assess and evaluate the alternative routes, are provided in **Table 4-2.**

Indicators may be characterized quantitatively or qualitatively. For the *Environmental Assessment / Impact Statement Report*, the indicators for the surface water Valued Component were as follows:

- **Surface Water Quantity**—The amount or abundance and spatial configuration of surface water, with specific consideration of streamflows and / or water levels, drainage patterns, channel hydraulics, and erosion–sedimentation processes;
- **Surface Water Quality**—The physical, chemical, and biological characteristics of surface water, typically defined by suspended solids and chemical constituents present; and
- **Sediment Quality**—The physical and chemical characteristics of sediment.

The indicators for the surface water Valued Component were initially outlined in the *Terms of Reference* (AECOM Canada ULC, 2020) and then refined in the Draft Surface Water Study Plan (AECOM Canada ULC, 2021). A summary of the Valued Components and indicators selected for the assessment of Project effects on surface water and the rationale for their selection are provided in **Table 4-2**.

Table 4-2: Surface Water Valued Components and Indicators

Valued Component	Indicators	Rationale for Selection	Measures of Change
Surface Water Quantity	■ Changes in drainage patterns ■ Changes in flow ■ Changes in water levels ■ Changes in channel hydraulics ■ Changes in channel stability or erosion–sedimentation processes	■ Importance for the protection of aquatic habitat ■ Importance for potable water supplies ■ Importance for areas of Indigenous cultural importance for consumption ■ Directly linked to surface water and sediment quality ■ Directly linked to groundwater quality and quantity; affects groundwater–surface water interactions	■ Potential effects are measured quantitatively and / or qualitatively as a possible change in streamflows, water levels, cross-section hydraulics, erosion, and sedimentation processes in waterbodies as well as overall drainage patterns within the study areas
Surface Water Quality	■ Change in physical parameters of water ■ Change in chemical parameters of water	■ Importance for the protection of aquatic habitat ■ Importance for potable water supplies ■ Importance for areas of Indigenous cultural importance for consumption ■ Directly linked to sediment quality ■ Directly linked to groundwater quality	■ Potential effects are measured quantitatively and / or qualitatively as an increase to concentrations of suspended solids or chemical constituents in receiving waters within the study areas
Sediment Quality	■ Change in physical and chemical characteristics of sediment	■ Importance for the protection of aquatic habitat ■ Directly linked to surface water quality	■ Potential effects are measured quantitatively and / or qualitatively as an increase to concentrations of suspended solids or chemical constituents in the channel bed and bank sediments, including lakes and ponds, within the study areas

4.2.3 Spatial Boundaries

This section includes a summary of the general Project study areas that were defined for the Project and provides a description of the discipline-specific study areas that were designed to capture the geographic extents to which existing surface water conditions could be characterized and direct and indirect effects from the Project on surface water could be assessed.

The spatial boundaries for surface water overlap with the corresponding Local Study Area and Regional Study Area boundaries for fish and fish habitat as described under the *Fish & Fish Habitat Technical Support Document: Existing Conditions and* (WSP, 2026). As such, the surface water and fish and fish habitat study areas have been combined and described as the “Aquatic” study areas.

4.2.3.1 Project Study Areas

General Project study areas were established for the scoping of field programs and to delineate study areas for discipline-specific surveys. These general Project study areas are described in **Table 4-3**.

Table 4-3: Project Study Areas Definition and Description

Study Area	Definition	Description
Construction Disturbance Area	Area of expected direct disturbance	100 m wide Community Access Road right-of-way, temporary work areas, worker camps, pits, quarries, and temporary and permanent access roads
Project Study Area	The area where most of the direct effects of the Project are likely to occur	The area within 2.5 km (total of 5 km) of the centreline of the route alternatives

m = metre; km = kilometre.

4.2.3.2 Aquatic Study Areas

Discipline-specific study areas identify the geographic extents within which potential effects of the Project are likely to occur and were considered in the *Environmental Assessment / Impact Statement Report*. Discipline-specific Local Study Areas and Regional Study Areas were defined for the Project. In defining these areas, the following were considered:

- Location and other characteristics of the discipline relative to the Project;
- The anticipated extent of the potential Project effects;
- Federal, provincial, regional, and local government administrative boundaries;

- Input from Indigenous communities;
- Community knowledge and Indigenous Knowledge;
- Current or traditional land and resource use by Indigenous communities;
- Exercise of Aboriginal and Treaty Rights of Indigenous Peoples, including cultural and spiritual practices; and
- Physical, ecological, technical, social, health, economic, and cultural considerations.

As described in the *Environmental Assessment / Impact Statement Report* and in **Section 6** of this Report, the characterization of existing conditions for the Project was completed on two alternative routes (Alternative 1 and 4). The data collected through the characterization of existing conditions were used to inform the selection of the Preferred Route. The existing conditions of the Local and Regional Study Areas considered the two alternative routes (Alternative 1 and 4). As the residual and cumulative effects assessment was completed on just the selected Preferred Route, the Local and Regional Study Areas for the effects assessment differed from the existing conditions study areas and only considered the one route.

4.2.3.2.1 Existing Conditions Study Areas

The existing conditions spatial boundaries for aquatics (i.e., surface water and fish and fish habitat) are defined by a Local Study Area and a Regional Study Area. These spatial boundaries were applied to each alternative, considering the Project components within the Construction Disturbance Area. The existing condition study areas cover the extent to which readily available information suggests the Project may have noticeable effects on the environment. The size, nature, and location of past, present, and reasonably foreseeable projects will be taken into consideration in the development of the cumulative effects assessment study area(s) and are further discussed in **Section 8**.

The Construction Disturbance Area includes the Project footprint, which encompasses a 100 m wide right-of-way for each Route Alternative (i.e., Alternative 1 and Alternative 4). The right-of-way is only expected to be cleared to a width of 60 m for permanent use with the remaining 40 m to be temporarily cleared to accommodate activities such as the excavation of pits and quarries, construction of temporary laydown areas, and the implementation of debris and / or timber stockpiles. Alternative 1 includes approximately 226 km of new all-season road, while Alternative 4 comprises approximately 194 km in length of new all-season road. The Construction Disturbance Area was designed to capture the potential direct effects of the Project at the immediate local scale (i.e., the area of direct disturbance where fish and / or fish habitat are most likely to be directly affected by Project infrastructure and activities).

Local Study Area

The aquatics existing conditions Local Study Area includes the Construction Disturbance Area and extends 2.5 km from the centreline of the right-of-way for the route alternatives (total 5 km width). Where elements of the Construction Disturbance Area (e.g., pits and quarries) fall outside the 2.5 km extension from centreline, a 500 m buffer was applied (**Figure 4-1**). The aquatics existing conditions Local Study Area was designed to capture the local effects of the Project on surface water and fish and fish habitat environments that may extend beyond the Construction Disturbance Area with the understanding that the spatial extent of this Local Study Area is intended to account for the local area where effects of the Project are likely to be measurable.

Regional Study Area

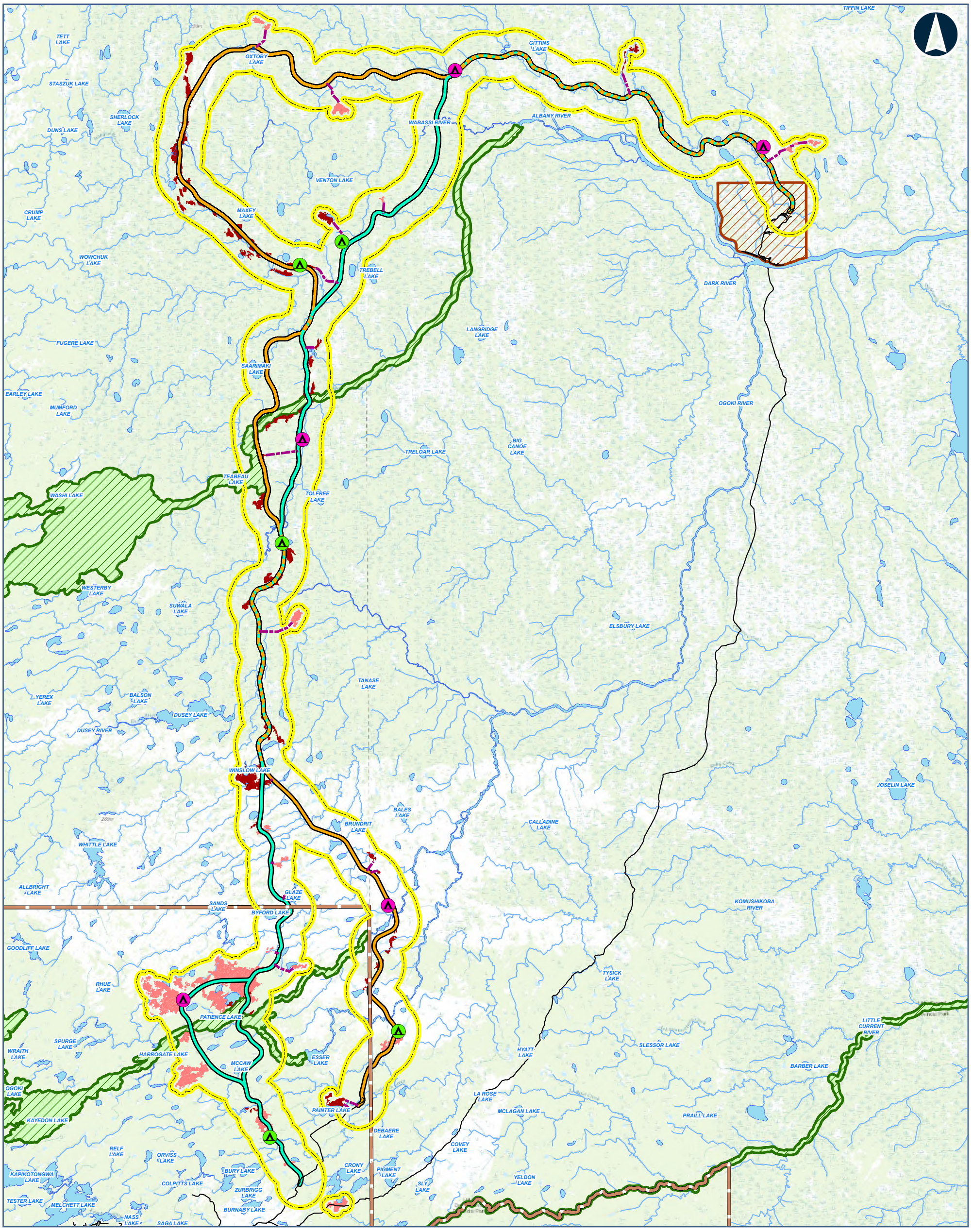
The aquatics Regional Study Area includes the catchment areas (as defined on a tertiary watershed scale) of each waterbody that is crossed by the Project footprint. These include the tertiary watersheds of the Upper Albany – Makokibatan, Lower Ogoki, and Upper Albany – Muswabik. The Regional Study Area was designed to provide a large enough area to assess the cumulative and regional effects on surface water and fish and fish habitat environments.

The existing conditions Construction Disturbance Area and the aquatics existing conditions Local Study Area and Regional Study Area are further described in **Table 4-4** and illustrated in **Figure 4-1** and **Figure 4-2**. Additionally, named waterbodies within and surrounding the aquatics Regional Study Area can be found in **Figure 4-3**.

Table 4-4: Aquatics Existing Conditions Study Areas

Study Area	Area (ha)	Geographic Extent	Rationale
Construction Disturbance Area	12,665	■ Area encompassing the Project footprint including the 100 m wide Community Access Road right-of-way, temporary construction access roads, work areas, worker camps, long-term pits and quarries, and temporary access roads. ■ In the aquatics Study Area, waterbodies crossed by the Community Access Road or temporary access roads were extended to 120 m upstream and downstream of the road centreline to allow for adjustments in the alignment during the design process.	■ Area of direct disturbance that includes the area where fish and fish habitat is most likely to be directly affected by Project infrastructure and activities. ■ A buffer is applied to the Project footprint to allow for uncertainty in the Project footprint including road alignment shifts to avoid sensitive features. ■ The 120 m buffer at water crossings encompass the footprint of the Community Access Road and a 100 m Project footprint.
Local Study Area	170,545	■ Includes the Project footprint and extends approximately 2.5 km from the centreline of Alternative 1 and Alternative 4 (total 5 km width). A 500 m buffer has been applied to areas where the Construction Disturbance Area falls outside of the 2.5 km from the centreline of Alternative 1 and Alternative 4.	■ The area outside of the Construction Disturbance Area with no direct interaction with Project infrastructure, but that has the potential to be subjected to direct or indirect effects (e.g., sedimentation and spills).
Regional Study Area	2,568,527	■ Encompasses the three tertiary watersheds (4GD Upper Albany – Makokibatan, 4GE Lower Ogoki, and 4GF Upper Albany – Muswabik) that are intersected by the centreline of Alternative 1 and Alternative 4. The Regional Study Area was extended to include areas where the Local Study Area falls outside of these tertiary watersheds. ■ Tertiary watersheds are based on the federal “Drainage Area” reporting framework and represent third level subdivisions of Canada into suitably sized areas based on drainage for administrative purposes (Ontario Ministry of Natural Resources and Forestry, 2020b).	■ The area where direct effects outside of the Construction Disturbance Area and Local Study Area are not likely; however, there is potential for broader-scale indirect effects and where cumulative effects may occur.

ha = hectare; m = metre; km = kilometre.



Legend

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- BEDROCK
- SAND AND GRAVEL
- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Aquatics Local Study Area

0 2.25 4.5 9 13.5 18
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:400,000 * when printed 11"x17"
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Figure 4-1

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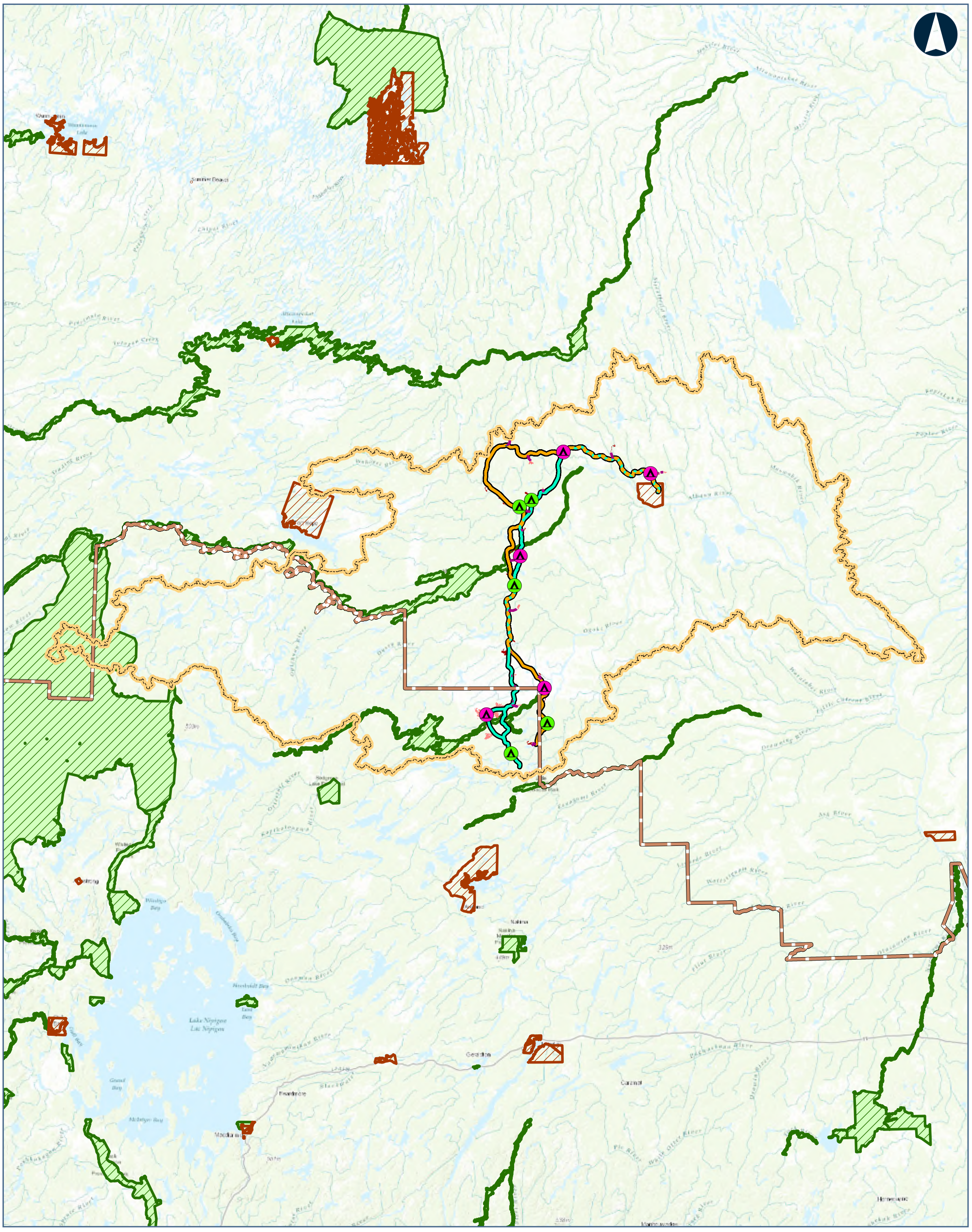

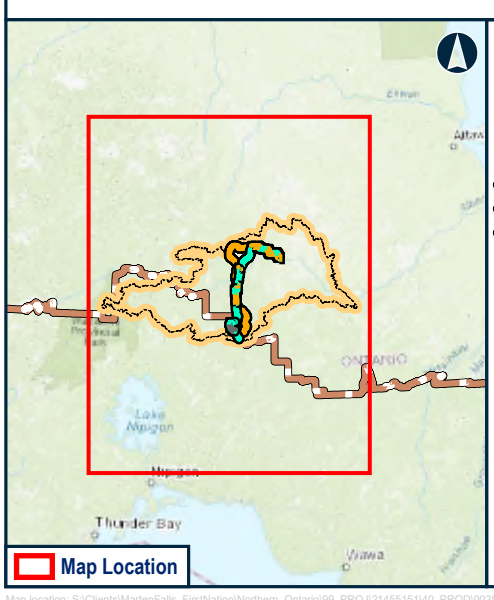

Legend

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- AQUATIC REGIONAL STUDY AREA

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World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Aquatics Regional Study Area

0 5 10 20 30 40
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:1,414,771 * when printed 11"x17"
Rev:0	

Figure 4-2

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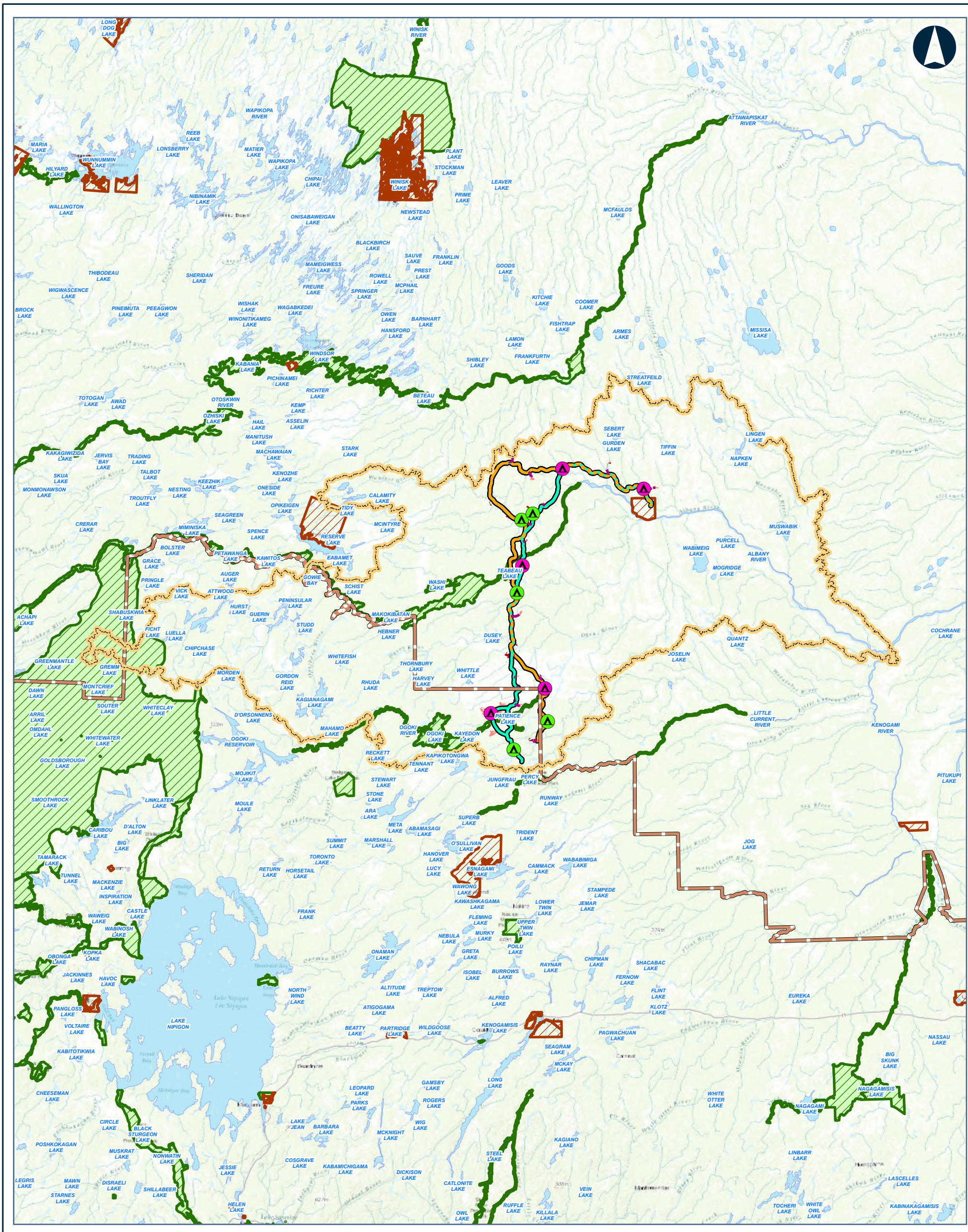

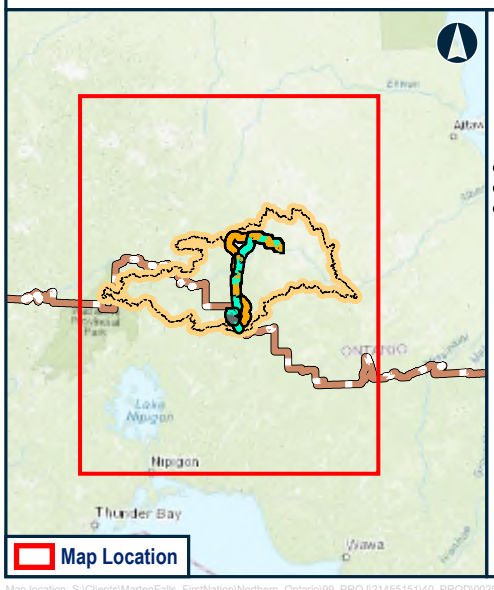

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CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- BEDROCK
- SAND AND GRAVEL
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- FAR NORTH BOUNDARY
- WATERBODY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- AQUATIC REGIONAL STUDY AREA

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World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Named Waterbodies within and surrounding the aquatics regional study area

0 5 10 20 30 40
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure 4-3

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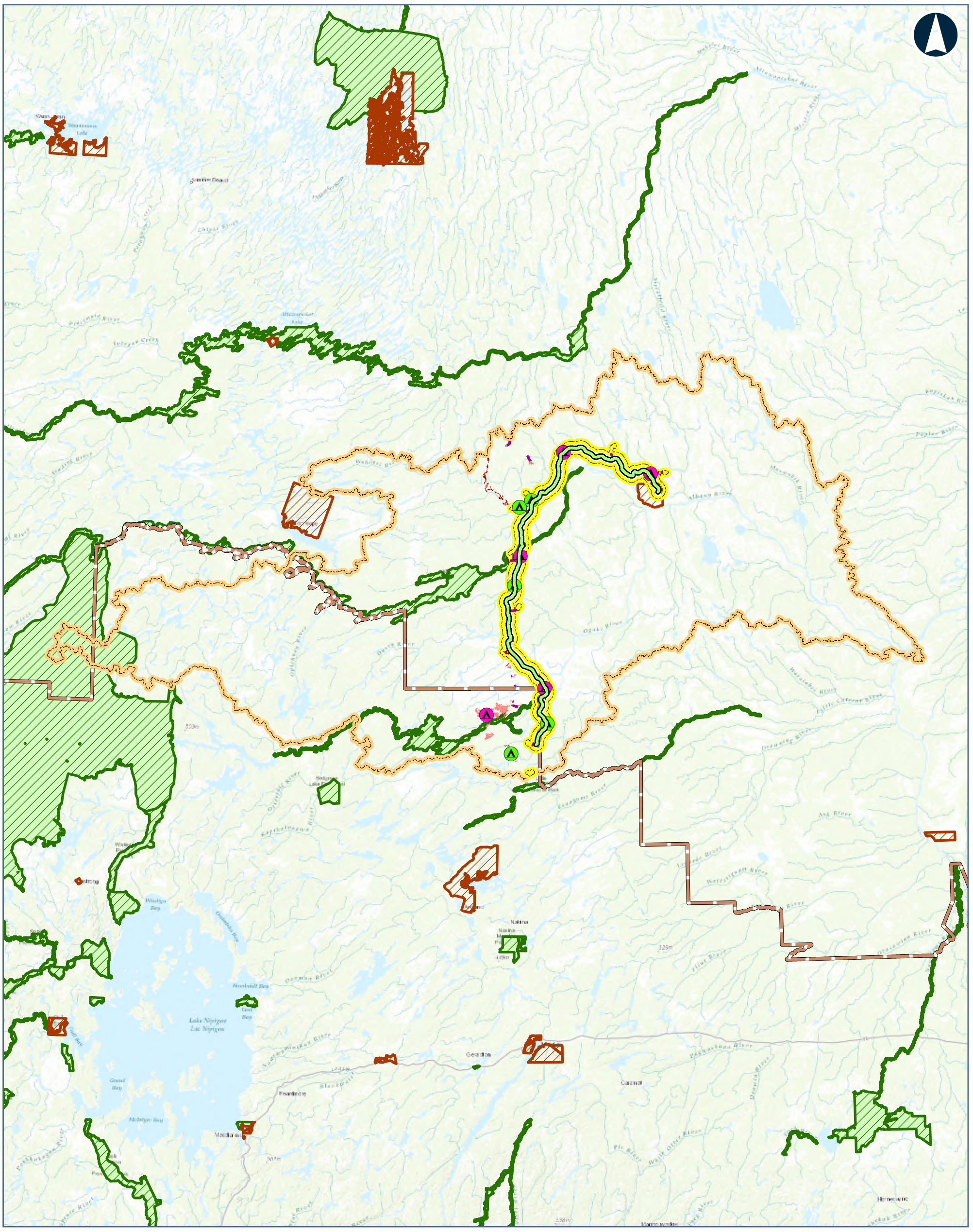
4.2.3.2.2 Effects Assessment Study Areas

The selection of a Preferred Route resulted in refined study areas that represent the same geographic extents of the existing condition study areas; however, they only apply to the Preferred Route. The Construction Disturbance Area for the Preferred Route and the effects assessment Local Study Area and Regional Study Area are described in **Table 4-5** and shown in **Figure 4-4**.

Table 4-5: Aquatics Effects Assessment Study Areas

Study Area	Area Size (ha)	Geographic Extent	Rationale
Construction Disturbance Area	4,700	■ Area encompassing the Project footprint including the 100 m wide Community Access Road right-of-way, temporary construction access roads, work areas, worker camps, long-term pits and quarries, and temporary access roads.	■ Area of direct disturbance that includes the area where surface water is most likely to be directly affected by Project infrastructure and activities. ■ A buffer is applied to the Project footprint to allow for uncertainty in the Project footprint including road alignment shifts to avoid sensitive features.
Local Study Area	97,971	■ Includes the Project footprint and extends approximately 2.5 km from the centreline of Preferred Route (total 5 km width). A 500 m buffer has been applied to areas where the Construction Disturbance Area falls outside of the 2.5 km radius.	■ The area outside of the Construction Disturbance Area with no direct interaction with Project infrastructure but that has the potential to be subjected to direct or indirect effects (e.g., sedimentation and spills).
Regional Study Area	2,568,527	■ Encompasses the three tertiary watersheds (4GD Upper Albany – Makokibatan, 4GE Lower Ogoki, and 4GF Upper Albany – Muswabik) that are intersected by centreline of the Preferred Route. The Regional Study Area was extended to include areas where the Local Study Area falls outside of these tertiary watersheds. Tertiary watersheds are based on the federal “Drainage Area” reporting framework and represent third level subdivisions of Canada into suitably sized areas based on drainage for administrative purposes (Ontario Ministry of Natural Resources and Forestry, 2020b).	■ The area outside of the Construction Disturbance Area and Local Study Area where direct effects are not likely to occur; however, there is a potential for broader-scale indirect effects and cumulative effects.

ha = hectare; m = metre; km = kilometre.



Legend

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- LOCAL STUDY AREA
- REGIONAL STUDY AREA

Data Source:
Base Data: Provided by MNRF 2022; Route Infrastructure - Provided by AECOM 2024. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: World Topographic Map: Esri, © OpenStreetMap contributors, HERE, Garmin, FAO, USGS, NGA, EPA, NPS, AAFC, NRCan
World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surface Water Effects Assessment Local and Regional Study Area

0 5 10 20 30 40
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:1,414,771 * when printed 11"x17"
Rev:0	

Figure 4-4

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0000\21455151-0025-CS-0000.aprx
Date Saved: 2/10/2026 5:56 PM User Name: INRR172702

4.3 Existing Conditions Study Design and Methods

Characterization of the surface water existing environment was completed by undertaking a desktop review, supplemented by field investigations completed specifically for the Project. The desktop review included a review of available existing information, including aerial imagery and light detection and ranging (where available) to develop the waterbody crossing list. Field investigations consisted of aerial reconnaissance and ground-based surveys at a subset of waterbody crossings from 2019 to 2022. The methods used to characterize the surface water existing environment are described in the following sections. Baseline data were compiled for sites on the waterbody crossing list where potential direct effects of the Project at the immediate local scale (i.e., the area of direct disturbance) where receiving waterbodies or watercourses are most likely to be directly affected by Project infrastructure and activities (i.e., new waterbody crossing structures to be installed for the Project).

4.3.1 Desktop Assessment

The desktop assessment consisted of the development of a waterbody crossing list and a review of available existing information. A preliminary list of applicable information sources including federal and provincial guidance was reviewed in development of this approach.

4.3.1.1 Waterbody Crossing List Development

A waterbody crossing list was developed for the Construction Disturbance Area by using geographic information systems to overlay the Project footprint with the Ontario Hydro Network datasets (Ontario Ministry of Natural Resources and Forestry, 2010a; 2010b) to identify potential surface water features crossed by the Project. The initial waterbody crossing list was developed based on the Revision #1 (Rev01) alignment for Alternatives 1 and 4, which was provided in May 2019. Additional potential waterbodies not mapped in the Ontario Hydro Network were identified through manual review of the routes overlaid on aerial imagery. These “unmapped” potential waterbody crossings were then added to the waterbody crossing list. Waterbody crossings were then assigned a site identification code that consisted of a Route Alternative identifier (RA-1 = Alternative 1, RA-4 = Alternative 4, or RA1-4 = overlapped section of both Alternative 1 and Alternative 4), followed by “-WC” (waterbody crossing) and then a two-digit number in sequential order from south to north. The two-digit number is unique for each waterbody crossing (i.e., there is no repetition of numbers). As per **Section 2.1**, the equalization culverts were not considered in the crossing list.

Once light detection and ranging imagery was available, the crossing list was refined by re-examining the unmapped crossings to determine if the digital elevation model showed evidence of a defined channel. Unmapped water features without defined beds or banks, being a criterion for the definition of a waterbody in Ontario (Government of Ontario, 1990a; Stanfield, 2017), were not considered waterbodies for the purposes of this study and were not included in the crossing list.

The crossing list was refined further by incorporating data gathered from the field investigations (i.e., aerial reconnaissance and ground-based surveys) to verify the presence of a waterbody and to characterize the channel morphology and fish habitat.

4.3.2 Review of Available Information Sources

A desktop review of existing information sources was completed to identify information gaps that needed to be addressed through further study. A variety of information sources including federal and provincial guidance was reviewed in development of this approach, including the review and compilation of relevant information from the following sources:

- Aerial imagery (light detection and ranging) provided by Marten Falls First Nation (acquired June 2020);
- Land use / characterization information from the Ministry of Natural Resources and Forestry Land Information Ontario database and the Natural Heritage Information Centre (Government of Ontario, 2015; Ontario Ministry of Natural Resources and Forestry, 2020a), including tertiary watersheds (Ontario Ministry of Natural Resources and Forestry, 2020b), Ontario Hydro Network waterbody and watercourse (1:20K) datasets (Ontario Ministry of Natural Resources and Forestry, 2010a; 2010b), and Ontario Integrated Hydrology Data (Ontario Ministry of Natural Resources and Forestry, 2015a);
- ArcGIS World Imagery (Environmental Systems Research Institute, 2009) as well as topographic imagery (Environmental Systems Research Institute, 2013);
- Geology Terrain Data (1:100K), Northern Ontario Engineering Geology Terrain Study (Ontario Ministry of Northern Development and Mines, 2005);
- Watershed area and return period flow data from the Ontario Watershed Information Tool, developed by the Ministry of Natural Resources and Forestry and powered by Land Information Ontario (Ontario Ministry of Natural Resources and Forestry, 2013);
- Permits to Take Water Data Catalogue, published by the Ministry of Environment and Climate Change in August 2016 and updated quarterly. The dataset utilized in the desktop review was published in April 2022 (Ontario Ministry of the Environment, Conservation and Parks, 2022);

- Various online sources of information on hydropower production in Ontario (Ontario Ministry of Natural Resources and Forestry, 2001; Ontario Power Generation, 2005; Ontario Power Generation Inc., 2019; 2023).
- Archived hydrometric data from Water Survey of Canada datasets (Environment Canada, 2022);
- Archived water quality data from the Ministry of the Environment, Conservation and Parks Provincial (Stream) Water Quality Monitoring Network (Ministry of the Environment Conservation and Parks, 2019);
- Source water protection zones from the *Source Protection Information Atlas* (Ontario Ministry of the Environment, Conservation and Parks, 2017);
- Past surface water investigations (hydrology and water quality) for the Cliffs Chromite Project (Cliffs Ferroalloys, 2013a; 2013b);
- Archived water taking data from the Permits to Take Water Database (Ontario Ministry of the Environment, Conservation and Parks, 2022);
- *National Atlas of Canada*, Natural Resources Canada, Fourth Edition, 1978 (Natural Resources Canada, 1978); and
- *Hydrological Atlas of Canada*, Fisheries and Environment Canada, January 1978 (Fisheries and Environment Canada, 1978).

The review of the identified information sources was used to specifically characterize the following, noting that the results of the field investigations were relied on to further augment this existing environment characterization:

- Watershed and river system characteristics;
- Surface water use;
- Surface water yield and its seasonal distribution (surface water yield is the average outflow from a watershed or catchment through a waterbody over a given time and is calculated by dividing the mean volume of streamflow over a specified period by the surface area of the watershed or catchment); and
- Surface water and sediment quality.

4.3.3 Field Investigations

Field investigations of surface water conditions were completed to obtain site-specific information at the waterbody crossing locations. The results of these field investigations were used to further augment the characterization of existing water quantity and quality conditions for the Project.

The surface water field program was completed in tandem with the corresponding studies for fish and fish habitat assessment. These investigations involved both aerial and ground-based field surveys to characterize existing surface water conditions at waterbody crossings along the route alternatives (i.e., Alternative 1 and 4). The aerial reconnaissance was completed (via helicopter) along the full length of Alternative 1 and 4, while the ground-based surveys were targeted at a subset waterbody crossing locations along both route alternatives.

4.3.3.1 Site Selection

A site selection process was implemented to determine the waterbody crossing locations for detailed assessment. Selection was based on several factors, including:

- Representative sites per tertiary watershed;
- Logistics (i.e., potential helicopter landing within 500 m);
- Health and safety (i.e., were sites safe for field crew access by helicopter or by foot?). Some sites were not accessible within 500 m of helicopter and were not able to have detailed surveys completed;
- Cultural importance; and
- Available background information and previous studies, such as the *Draft Aquatic Ecology Technical Supporting Document for the Integrated Transportation System for the Cliffs Chromite Project* (Golder Associates Ltd., 2013), where sections of the Preferred Route overlap with the alignment of the Cliffs route.

The waterbody crossing locations selected for field assessment were evenly distributed along the length of Alternative 1 and Alternative 4 and among the relevant tertiary watersheds to the extent feasible.

Wherever the route re-alignment resulted in a change of waterbody crossing location, the updated locations were used for the 2022 field programs. All waterbody crossing locations were reviewed against the Rev03 alignment to help ensure site-specific field data had been collected at the most up-to-date crossing location. In some cases, a field survey was completed at both the original Rev01 location and then surveyed again at the updated Rev02 or Rev03 location. The site selection process also considered any revisions to the waterbody crossing list.

4.3.3.2 Aerial Reconnaissance

A total of 164 proposed waterbody crossings were identified by desktop review on Route Alternatives 1 and 4 to establish the initial waterbody crossing list. These crossings were surveyed by aerial reconnaissance on September 5 and 6, 2019, and included the collection of one to two georeferenced photographs at each waterbody crossing as well as documentation of the following:

- Waterbody type (e.g., watercourse, lake / pond, bog or fen terrain, or drainage feature);
- Major habitat types (in accordance with the classification system outlined by O'Neil and Hildebrand [1986]);
- Bankfull width (visual estimate at the crossing location or using less than 2 m, less than 5 m, less than 10 m, and greater than 10 m categories); and
- Bed substrate type using the modified Wentworth scale (Wentworth, 1922).

4.3.3.3 Ground-Based Surveys

The ground-based field surveys were completed at 55 waterbody crossings. The site selection process for the subset of waterbody crossings was based primarily on a "scaled approach," with the objective of selecting a representative number of waterbody crossings under different categories of watershed size (i.e., four categories for watersheds: greater than 500 km^2, between 50 and 500 km^2, between 2 and 50 km^2, and less than 2 km^2). This approach also considered balancing site selection between mapped and unmapped waterbody crossing locations, as well as waterbody crossing locations along Alternative 1 that overlapped with the alignment of the Cliffs Chromite Project route and were previously surveyed during the Cliffs Project. The selected waterbody crossing locations were evenly distributed along the lengths of route Alternative 1 and Alternative 4 and among the relevant tertiary watersheds to the extent possible and practical.

The surface water field investigations were completed during several summer and fall seasonal visits in September 2019, October 2020, September 2021, June 2022, and August 2022 to account for seasonal variability of water quality results. The surveys were targeted at a roughly 200 m reach of the watercourse or drainage feature (100 m upstream and 100 m downstream – centred over the proposed crossing location) and included the following:

- General observations of typical channel patterns and flow conditions as well as documentation of characteristic bed and bank morphology (including any erosion / deposition features), channel substrate, riparian vegetation, and instream controls or barriers;

- A Rapid Geomorphic Assessment in accordance with the Ministry of the Environment, Conservation and Parks (Ontario Ministry of the Environment, 2003) to provide a preliminary assessment of channel stability in the vicinity of the crossing location (based on the presence or absence of various indicators of channel degradation, aggradation, widening, and planform adjustment);
- Measurements of channel geometry along the potential zone of influence (i.e., approximately 50 m upstream and downstream of the proposed crossing locations), noting that these measurements were obtained via a basic topographic survey (using optical level survey equipment) and included bankfull width and depth, wetted width and depth, and side and channel slopes;
- Measurements of streamflow based on the velocity-area method and using a flow meter and wading rod;
- In situ readings of basic water quality parameters, including conductivity, pH, temperature, turbidity, and dissolved oxygen, using a multi-parameter water quality meter;
- Collection of water quality samples using standard grab sampling techniques, noting that the samples were issued to an accredited laboratory for testing of:
    - General chemistry, including pH, electrical conductivity, turbidity, alkalinity, hardness, total suspended solids, and total and dissolved organic carbon.
    - Total metals, anions, and cations.
    - Nutrients and oil and grease.
    - Organic contaminants (i.e., volatile organic compounds and polycyclic aromatic hydrocarbons) and radionuclides for a select set of waterbody crossing locations that were identified as an existing source of potable water.
- Collection of sediment quality samples using standard grab sampling techniques, noting that the samples were issued to an accredited laboratory for analysis of grain size and total metals and nutrients; and
- Collection of photographs of channel setting / conditions.

Additional baseline assessments will be conducted prior to construction. This includes assessments of water quantity, water and sediment quality monitoring of waterbodies that were not previously assessed and/or where monitoring during spring streamflow conditions was not feasible. Surveys will be planned to cover sampling during high and low streamflow conditions, where possible. Refer to **Section 9.1** for details about pre-construction surveys.

4.4 Effects Assessment

The following is a broad overview of the approach for the identification, assessment, and evaluation of the potential effects:

- Review Construction and Operations and Maintenance activities to identify potential interaction(s) that could result in environmental effects;
- Characterize the existing environment for both route alternatives;
- Identify potential environmental effects of the Preferred Route and recommend mitigation measures to avoid or minimize identified effects as well as identify opportunities to enhance benefits to the environment;
- Predict and assess potential environmental effects remaining after taking into consideration the recommended mitigation measures (i.e., residual effects) using direction, magnitude, geographic extent, duration, frequency, reversibility, and likelihood;
- Predict cumulative effects that may result from a combination of the residual effects of the Preferred Route with the effects of other past, present, and reasonably foreseeable projects; and
- Identify a follow-up program for the Preferred Route that includes monitoring to verify the prediction of the effects assessment and effectiveness of the mitigation measures, and a requirement for monitoring of the commitments made in the *Terms of Reference* and *Environmental Assessment / Impact Statement Report* (AECOM Canada ULC, 2020).

The following sections provide discipline-specific input and considerations as they pertain to the methodology for effects assessment. For detailed descriptions of the methodology used to inform this study, refer to the *Environmental Assessment / Impact Statement Report*. Refer to **Section 6** for details related to the Preferred Route. Refer to **Section 4.2.3.2.2** for a description of the revised study areas which have been used for the effects assessment.

4.4.1 Project–Environment Interactions

Considering the Project components and activities presented in **Section 2.1**, interactions were identified between the Project components and activities to the existing conditions of surface water. These interactions support the identification of potential effects, both direct and indirect, that may result in changes to surface water. The likely Project–environment interactions were identified based on professional judgment, activities planned to occur, and as described in the *Marten Falls Community Access Road Project Tailored Impact Statement Guidelines* (Impact Assessment Agency of Canada, 2020). **Table 4-6** provides the preliminary analysis of Project–environment interactions for surface water that was presented in the Surface Water Study Plan.

The analysis of Project–environment interactions for surface water that are likely to have a potential effect is provided in **Section 7.2**.

Table 4-6: Project–Environment Interactions

Project Phases	Project Activities	Interaction with Surface Water
Construction Phase	Clearing of the right-of-way for the Community Access Road and supporting access roads (e.g., remove and dispose of trees, shrubs, fallen timber, and surface litter; strip organic materials; grub)	X
	Blasting rock (e.g., remove rock at quarries and, as required, at specific locations in association with road and bridge construction)	X
	Constructing the Community Access Road (e.g., remove unsuitable soil, place and compact rock and granular material, trim and shape the road)	X
	Constructing bridges and install culverts	X
	Construction and operation of temporary infrastructure (e.g., access roads, construction camps, laydown areas, and staging areas)	X
	Decommissioning temporary infrastructure (e.g., remove temporary culverts and bridges and remediate channels)	X
Operation and Maintenance Phase	Operate the Community Access Road and permanent access roads	X
	Maintain[(a)] the Community Access Road and permanent access roads, including bridges and culverts	X

Notes:
(a) Includes general maintenance (e.g., grading, erosion control, quarrying, pits and quarries), seasonal maintenance (e.g., snow clearing and bridge and culvert maintenance), and special maintenance (e.g., slope failures and road settlement / break up).
X = Interaction

4.4.2 Assessing Residual Effects

4.4.2.1 Potential Effects

Following the identification of the Project–environment interactions, a comparative analysis of the existing conditions for the Preferred Route was conducted to determine the potential effects of the Project. The potential effects are described as either direct or indirect.

A **direct effect** is an immediate change to an environmental component caused by a Project activity at the same time and place as the activity. An **indirect effect** occurs when a change resulting from a Project activity leads to subsequent changes in other environmental component, which may occur later in time or at a different location but are reasonably foreseeable. **Residual effects** are the effects that remain after the application of mitigation measures. **Discipline interactions** occur when a change to one Valued Component resulting from a Project activity causes a change to another Valued Component.

Surface water may be indirectly affected by changes to other environmental disciplines. The atmospheric environment can affect water quality by aerial deposition of pollutants from Project activities directly to surface waterbodies or to the terrestrial environment where pollutants can be transported to waterbodies with runoff. Changes to physiography, geology, terrain and soils, and vegetation can alter flow patterns and the interaction of water with soils and vegetation, thereby affecting hydrology and water quality. Changes to groundwater that affect the quality or quantity of groundwater can affect surface water in areas with prominent groundwater–surface water interactions (e.g., springs [Oji-Cree translation, *mokijiwanibiik*] and groundwater-dominated baseflow periods at permanent watercourses). Land and resource use that may be affected by the Project, such as expansion of industry (e.g., forestry, extraction, recreation, and tourism) can affect surface water due to water consumptive use and potential for pollution associated with those industries.

Table 4-7 provides a preliminary identification of how changes to other environmental disciplines may result in indirect effects on surface water. The degree of risk for discipline interactions to surface water as a result to changes to another discipline varies depending on activity.

Table 4-7: Potential Indirect Interactions Between Surface Water and Other Disciplines

Indirect Interactions with Surface Water								Disciplines and Associated Valued Components								
	Aboriginal and Treaty Rights and Interests	Atmospheric Environment	Climate Change	Acoustic and Vibration Environment	Physiography, Geology, Terrain and Soils	Surface Water	Groundwater and Geochemistry	Vegetation	Peatlands	Wildlife	Fish and Fish Habitat	Social	Economy	Land and Resource Use	Human Health and Community Safety	Visual Aesthetics	Archaeological and Cultural Heritage
Indirect effects on surface water as a result of changes in other disciplines	-	X	X	-	X		X	X	X	-	-	-	-	-	-	-	-

X = Potential pathway for indirect effect as a result of the Project.
- = No pathway for indirect effect is anticipated as a result of the Project.

4.4.2.2 Mitigation and Enhancement Measures

Following the identification of potential effects, the effects assessment has explored technically and economically feasible mitigation measures to avoid or minimize the identified negative effects. The recommended enhancement measures are anticipated to increase positive effects beyond those that are already inherent to the design. These measures consist of industry-standard practices, federal and provincial standard specifications, regulator-mandated measures, Indigenous and community recommendations, and recommendations from environmental professionals based on expertise, scientific publications, experience, and judgment.

It is important that mitigation and enhancement measures are achievable, measurable, verifiable, and monitored for compliance and effectiveness during all temporal phases as part of the Project follow-up monitoring plan. Recommended environmental monitoring will verify the potential environmental effects predicted, evaluate the effectiveness of mitigation and enhancement measures, and identify the process the Proponent will follow if mitigation and enhancement measures are not effective.

The *Tailored Impact Statement Guidelines* (Impact Assessment Agency of Canada, 2020) Section 20 requirements and *Terms of Reference* Requirements (AECOM, 2020) for mitigation and enhancement measures related to surface water are provided in **Table 4-8**. The applicability of these requirements has been evaluated and will be adapted to the needs of the site, environment, and Project activities.

Table 4-8: Tailored Impact Statement Guidelines Section 20 Requirements and Terms of Reference Requirements

***Tailored Impact Statement Guidelines* Section 20 Requirement**	**Section Addressed in**
A description of the Sediment and Erosion Control Plan, including the proposed mitigation measures and their effectiveness on the contaminants of concern affecting surface water	■ An Environmental Protection Plan and Sediment and Erosion Control Plan will be developed once the detailed construction design has advanced. ■ General mitigation measures are provided in **Section 7.3.1.**
Identification of measures to avoid the deposit of substances harmful to fish or migratory birds in water	■ **Section 7.3.1**
Identification of measures to prevent surface water **conditions** at water crossings (e.g., culverts) from negatively affecting fresh water fish movement (e.g., due to flow, debris, or “perching”)	■ **Section 7.3.1**

Terms of Reference Requirement	Section Addressed In
Construction and operation of the Project will require permanent infrastructure crossings of watercourses along the CAR and temporary crossings along construction access roads. Watercourse crossings may include bridges, culverts, fords, corduroy, swamp mats, ice and snow crossings, which may result in changes to surface water quality and quantity. Equalization culverts will also be installed at locations where it is determined that spring-melt or storm runoff needs to pass from one side of the CAR to the other.	■ **Section 7.3.1**
It is anticipated that effects to surface water will be primarily related to sediment and erosion, potential introduction of contaminants from accidental releases and from materials uses during road maintenance (e.g., road salt and dust suppressants), use of quarry, borrow and aggregate materials having acid rock drainage or metal leaching potential. Changes to surface water quality and quantity may cause indirect effects to other environmental disciplines such as fish and fish habitat, and wetlands.	■ **Section 7.3.1**
Activities during construction, such as vegetation clearing, grading, excavation, equipment and machinery use, and stockpiling of materials may result in sedimentation into nearby waterbodies due to the creation of exposed and unstable soils. Erosion into surface water may result in changes to concentrations of sediment, baseflows and water temperatures. These activities may also affect surface water quality through the introduction of contaminants from blasting activities and equipment used during construction, and from maintenance activities (e.g., salt, sand and dust suppressant application) and accidental releases from vehicles during the operation of the CAR.	■ **Section 7.3.1**
Placement of stockpiles, soil compaction and impervious surfaces may change surface drainage patterns as well, which may result in effects to surface water quantity and quality. The placement of temporary and permanent structures in watercourses has the potential to change stream dynamics and morphology, and cause erosion and sediment issues.	■ **Section 7.3.1**
The Project will consider MNRF and DFO recommended practices outlined in Ministry of Natural Resources and Forestry / Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings (MNRF / DFO 2016) and Environmental Guidelines for Access Roads and Water Crossings (MRNF 1990).	■ **Section 7.3.1**

4.4.2.3 Predicting Residual Effects

Following the identification of direct and indirect effects and identification of mitigation and enhancement measures, residual effects are predicted. Once predicted, residual effects are characterized by residual effects characteristics, which are described in **Table 4-8**. Any predicted residual effects are also carried forward into the cumulative effects assessment, which is described in **Section 4.4.3**.

4.4.2.4 Characterization of Predicted Residual Effects

Predicted residual effects, if identified, will be described in terms of the effects assessment characteristics presented in **Table 4-9**. These effect characteristics are described in detail in the *Environmental Assessment / Impact Statement Report*. The section that follows outlines how these characteristics were applied as well as any discipline-specific characteristics, if applicable.

Table 4-9: Residual Effects Characteristics

Effects Characteristic	Definition	Description
Context	■ Ecological context ■ Socio-economic context	■ See description in **Section 4.4.2.5**
Direction	■ Direction of change from existing conditions	■ Positive: net gain or positive effect ■ Neutral: no change to existing condition ■ Negative: net loss or adverse effect
Magnitude	■ Magnitude is the expected change from existing conditions	■ Negligible, low, medium, high ■ See description in **Section 4.4.2.5**
Geographic Extent	■ The spatial area that the effect is expected to occur	■ Construction Development Area: effect is confined within the direct physical disturbance of the Project ■ Local: effect extends into the Local Study Area ■ Regional: effect extends into the Regional Study Area ■ Beyond Regional: effect extends beyond the Regional Study Area
Duration	■ The period of time that the effect is expected to occur	■ Short term: effect ends before the end of Construction ■ Medium term: effect occurs during Construction and ends soon after Operation and maintenance begins, after the activity causing the effect ends ■ Long term: effect occurs during Construction and persists into Operation and Maintenance and / or the effect is considered permanent or the likelihood of reversibility is low or uncertain
Frequency	■ How often the effect is expected to occur	■ Infrequent: The effect is expected to occur rarely ■ Frequent: The effect is expected to occur intermittently ■ Continuous: the effect is expected to occur continuously
Reversibility	■ The ability to return to existing conditions	■ Reversible: the effect is not permanent ■ Irreversible: the effect is permanent
Likelihood	■ Probability that the effect will occur	■ Unlikely: the effect is not likely to occur ■ Possible: the effect may occur but is not likely ■ Probable: the effect is likely to occur ■ Certain: the effect will occur

Effects Characteristic	Definition	Description
Uncertainty	■ Social context ■ Ecological context ■ Timing of effect in relation to sensitive activities	■ See description below in Discipline Specific Characteristics in **Section 4.4.2.5**.
Direct / Indirect	■ Nature of the pathway through which the effect occurs.	■ Direct effects are typically immediate and spatially aligned with the activity. Indirect effects may be delayed or spatially removed but are causally linked and predictable.

4.4.2.5 Discipline-Specific Characteristics

In addition to the residual effects characteristics described in **Table 4-9,** characterization of the following discipline-specific characteristics are required to characterize residual effects and to determine the significance of those effects from the Project on surface water.

4.4.2.5.1 Ecological and Social Context

The social context within which the Project's potential effects may occur was taken into account when considering the effects criteria. Effects criteria consider the physical characteristics of an effect (e.g., magnitude, geographical extent, timing, and duration) as well as the context-specific value characteristics (e.g., environmental, health, social, and economic conditions). Context is considered one of the most critical factors when evaluating effects, and the effects assessment has considered potential or existing effects or pressures on social, economic, and health conditions affecting the sensitivity or resilience of a Valued Component.

Context for surface water considers existing trophic status, resilience, adaptive capacity, current status and trends, applicable legislation, and mitigation measures. The current and future sensitivity and resilience of the surface water Valued Component to change caused by the Project are considered and included Indigenous Knowledge, where it was available. The ecological context of the effect includes a discussion of the environmental consequences of the predicted effect. Consideration of ecological context includes timing when it is important in the evaluation of the effect, such as when the effect could occur during a species life cycle window.

4.4.2.5.2 Magnitude

Magnitude refers to the amount of change in a measurable parameter relative to the existing conditions of a Valued Component with and without the Project in place or to other standards or guidelines. When evaluating the magnitude of effects this study considers both the proportion of the Valued Component affected within identified spatial boundaries and the relative effect.

For magnitude, environmental discipline-specific definitions were developed as part of the study plan and are provided in **Table 4-10** and **Table 4-11**. These definitions informed the reasoned narrative about magnitude in discussions. Magnitude of effects are Project-related and excludes variations due to climate change. For hydrology, the magnitude of anticipated effects will be based on the proportion of the catchment area for a given waterbody that is expected to be disturbed or influenced by Project activities. This approach considers drainage area as a proxy or analog for streamflow and, to a lesser extent, the potential for sediment erosion and transport. More specifically, the rationale for an effects magnitude of "Low" (identified in **Table 4-10** and **Table 4-11**) reflects the level of reliability of typical flow monitoring instrumentation (i.e., ±15%), coupled with observations and inferences from the literature that suggest minimal changes (if any) in streamflow and channel stability as a result of land disturbance if less than approximately 20% of the contributing drainage area is disturbed or influenced.

For surface water and sediment quality, the magnitude of anticipated effects will also consider the following federal and provincial water and sediment quality guidelines and objectives:

- *Canadian Water Quality Guidelines for the Protection of Aquatic Life, Provincial Water Quality Objectives, Guidelines for Canadian Drinking Water Quality* and *Ontario Drinking Water Quality Standards* as may be applicable for surface water quality parameters; and
- *Provincial Sediment Quality Guidelines* and *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life* as may be applicable for sediment quality parameters.

For parameters with multiple guidelines or objectives, the most stringent guideline or objective will be relied on for the assessment.

Table 4-10: Magnitude Definition for Surface Water Quantity (Hydrology)

Magnitude Level	Definition[(a)]	Rationale
Negligible	■ There is little to no variation predicted in indicator parameters, meaning that, where applicable for a given waterbody, the proportion of the catchment area disturbed or influenced by a specific Project activity is <5%. As such, indicator parameters are expected to remain within the range of natural variation.	■ No discernable changes to hydrology and therefore no anticipated changes to aquatic life or potable sources of water.
Low	■ There is a small variation predicted in indicator parameters, meaning that, where applicable for a given waterbody, the proportion of the catchment area disturbed or influenced by a specific Project activity is between 5% and 20%. As such, the indicator parameters are expected to vary to within the upper or lower limits of, or just outside, the range of natural variation.	■ Changes to hydrology are discernable, but it is anticipated that surface water quantity conditions remain protective of aquatic life and potable sources of water.
Medium	■ There is a moderate variation predicted indicator parameters, meaning that, where applicable for a given waterbody, the proportion of the catchment area disturbed or influenced by a specific Project activity is between 20% and 50%. As such, the indicator parameters are expected to vary outside the range of natural variation.	■ Changes to hydrology are discernable and / or statistically significant, but it is anticipated that surface water quantity conditions remain protective of aquatic life and potable sources of water.
High	■ There is a large variation predicted in indicator parameters, meaning that, where applicable for a given waterbody, the proportion of the catchment area disturbed or influenced by a specific Project activity is greater than 50%. As such, indicator parameters are expected to vary outside the range of natural variation.	■ Changes to hydrology are discernable and / or statistically significant and may impair aquatic life or potable sources of water.

Notes:
(a) The relative (percent) change may be modified as appropriate for specific parameters of interest to consider measurement / monitoring instrumentation error, laboratory detection limits, accepted practice or findings in the scientific literature, and professional judgment.
< = less than; % = percent.

Table 4-11: Magnitude Definition for Surface Water and Sediment Quality

Magnitude Level	Definition[(a)]	Rationale
Negligible	■ There is little to no variation predicted in indicator parameters and, as such, the indicator parameters are expected to remain within the range of natural variation.	■ No changes to surface water and or sediment quality are discernable and therefore no changes to aquatic life or potable sources of water are anticipated.
Low	■ There is a small variation predicted in the indicator parameters such that the indicator parameters are expected to vary within or just outside the range of natural variation (i.e., by less than 20% outside the range of natural variation), but they remain below applicable guideline / objective or threshold values (assuming that indicator parameters satisfy the relevant guideline / objective or threshold values under existing conditions).	■ Changes to surface water and / or sediment quality are discernable but are anticipated to remain protective of aquatic life and potable sources of water.
Medium	■ There is a modest variation predicted in the indicator parameters such that indicator parameters are expected to vary outside the range of natural variation (i.e., by 20% to 50%), but remain below the applicable guideline / objective or threshold values (assuming that indicator parameters satisfy the relevant guideline / objective or threshold values under existing conditions).	■ Changes to surface water and / or sediment quality are readily discernable and, where applicable, of potentially statistical significance, but are anticipated to remain protective of aquatic life and potable sources of water.
High	■ There is a large variation predicted in the indicator parameters such that indicator parameters are expected to vary outside the range of natural variation (i.e., by more than 50%) and / or exceed applicable guideline / objective or threshold values.	■ Changes to surface water and / or sediment quality are readily discernable and / or could potentially impair aquatic life or potable sources of water.

Notes:
(a) The relative (percent) change may be modified as appropriate for specific parameters of interest to consider measurement / monitoring instrumentation error, laboratory detection limits, accepted practice or findings in the scientific literature, and professional judgment.
% = percent.

4.4.2.6 Determination of Significance

A conclusion on significance of residual effects was made using the characteristics described in **Section 4.4.2.4** as well as by professional judgment.

The assessment of significance of residual effects of the Project was informed by the interaction between the residual effects characteristics, with magnitude, duration, and geographic extent being the most important factors, along with consideration of context. Consideration was also given to the concerns of Indigenous communities, interested agencies, groups, and individuals raised during engagement.

Using the overall residual effects characteristics provided in **Table 4-9**, each of the potential residual effects was assigned a significance level as a means of ranking the potential effects on the surface water quantity, surface water quality, and sediment quality. The significance levels are defined as:

- **Significant**—Residual effects were considered to be significant if the majority of the residual effects characteristics were assessed as high in magnitude and long-term or permanent in duration, at any geographic extent, or they represented a management concern; and
- **Not Significant**—Residual effects were considered not significant if they demonstrated any other combination.

Considering the significance for each residual effect along with the context, an overall significance determination was completed for the surface water Valued Component.

4.4.2.7 Prediction Confidence and Uncertainty

Prediction confidence refers to the degrees of certainty in the predicted residual effects and associated determination of significance. All Impact Assessments involve some level of uncertainty, often over many geographic, biophysical, and social dimensions, and observed results may deviate, to some degree, from predictions made in the assessment. Therefore, the residual effects predictions vary in their level of certainty, which could be related to a number of factors, such as Project design and components, existing conditions, spatial and temporal scope, Valued Component response, effectiveness of mitigation measures, overall scope of factors considered, and natural and human-induced influences on the biophysical and human environment.

Transparency in describing sources of uncertainty is critical to understanding the confidence that can be attributed to the analysis of effects and is important to decision-making. Efforts to address uncertainties have been focused on those uncertainties that are most meaningful to decision-making, such as how the biophysical and human environment will respond to changes and the efficacy of mitigation measures. Each of the potential residual effects was assigned a confidence level as a means of ranking the potential effects on surface water.

The levels of uncertainty are defined as:

- **Low**—Uncertainty levels were considered to be low if the baseline data for almost all of the study area and the ecology of the Value Component are well known generating statistically and ecologically robust habitat models and effects predictions, the Project-related effects are clearly understood, and the level of certainty associated with the effectiveness of proposed mitigations is high;
- **Moderate**—Uncertainty was considered to be moderate if there were baseline data for much of the study area and the ecological knowledge of the Valued Component is adequate to generate habitat models with confident assumptions and predictions supported by literature, the Project-related effects are mostly understood, and the level of certainty associated with the effectiveness of proposed mitigations is moderate to high; and
- **High**—Uncertainty considered to be high if there were no baseline data available and the ecology of the Valued Component is poorly understood, habitat models are based on assumptions with little to no field data or scientific literature, the Project-related effects are poorly understood, and the level of certainty associated with the effectiveness of proposed mitigations is low or unknown.

Discussion is provided on how uncertainty was addressed to increase the level of confidence so that residual effects will not be worse than predicted.

4.4.3 Assessing Cumulative Effects

The Impact Assessment Agency of Canada defines **Cumulative Effects** as “changes to the environment, health, social and economic conditions, as a result of the Project’s residual environmental, health, social and economic effects combined with the existence of other past, present and reasonably foreseeable physical activities, as well as within activities of the Project itself from multiple emissions and discharges (e.g., simultaneous operations) to understand synergistic or additive effects” (Impact Assessment Agency of Canada, 2020). Cumulative effects may result if:

- The implementation of the Project has the potential to cause direct residual adverse effects on the Valued Components, taking into account the application of technically and economically feasible mitigation measures; and
- The same Valued Component may be affected by other past, present, and future physical activities.

A cumulative effect on an environmental, health, social, or economic component may be important even if the Project's effects on this component by themselves are minor. The method for assessment of cumulative effects is consistent with the *Tailored Impact Statement Guidelines*, *Operational Policy Statement: Assessing Cumulative Environmental Effects* under the *Canadian Environmental Assessment Act*, 2012 (Canadian Environmental Assessment Agency, 2013) and the *Interim Technical Guidance for Assessing Cumulative Environmental Effects* under the *Canada Environmental Assessment Act*, 2012 (Canadian Environmental Assessment Agency, 2018). The identification and assessment of cumulative effects will be undertaken as follows:

- Identify and assess the residual effects of the Project;
- Define the spatial and temporal boundaries for cumulative effects based on the residual effects predicted;
- Identify other past, present, and reasonably foreseeable activities with effects likely to overlap in type of effect (i.e., Valued Component), temporally, and spatially with the predicted residual effects of the Project; and
- Predict potential cumulative effects and identify additional mitigation.

4.4.3.1 Cumulative Effects Scoping

4.4.3.1.1 Valued Components with Residual Effects

The cumulative effects assessment builds on the results of the residual effects assessment described in **Section 4.4.2** and considers the incremental changes that were predicted to have a likely residual adverse effect on a Valued Component. The Valued Components that did not have a residual effect predicted or for which the residual adverse effect was both of negligible magnitude and was possible, albeit rare, to occur were not carried forward into the cumulative effects assessment. Select residual effects on Valued Components identified were brought into the cumulative effects assessment, detailed in **Section 8**. The rationale for the exclusion of Valued Components from the cumulative effects assessment was provided.

4.4.3.1.2 Temporal and Spatial Boundaries

Temporal boundaries, as described in **Section 4.2.1**, correspond to the duration that the likely residual adverse effects of the Project are predicted to occur. *The Tailored Impact Statement Guidelines* (Impact Assessment Agency of Canada, 2020) indicate the cumulative effects assessment should look at potential effects throughout the life cycle of the Project, including decommissioning and abandonment; however, there are currently no plans to decommission the Project. Therefore, this assessment is limited to identifying and assessing cumulative effects during the Project Construction and Operation and Maintenance Phases.

Spatial boundaries, which are the study area(s) within which the geographic extent of cumulative effects will be studied, may vary by the residual effects of each Valued Component selected. For example, the geographic extent of residual effects on the migration patterns of wildlife Valued Components may differ from the geographic extent of habitat loss to the same Valued Components as a result of the Project. The spatial boundaries used to assess cumulative effects are described in **Section 8.1.2**.

4.4.3.1.3 Identification of Past, Present, and Reasonably Foreseeable Developments

Activities that were considered in the cumulative effects assessment included other past and existing anthropogenic (i.e., human-made) developments and future activities that are reasonably foreseeable. For an activity to be considered foreseeable and included in the cumulative effects assessment, sufficient information about the activity must have been available to make a reasonable assessment of its potential effects (i.e., in the planning / approvals / design stage). This included induced development that is certain or reasonably foreseeable and activities with additive effects, where appropriate (Canadian Environmental Assessment Agency, 2018). Reasonably foreseeable activities that were not considered are those for which formal plans have not been publicly disclosed, and information is not available. For a potential future project to be considered in the cumulative effects assessment, preliminary information such as activity description, activity size, footprint, project components, and anticipated timelines are needed to evaluate if the Project and the potential future project will overlap. The full list of past, present, and reasonably foreseeable developments considered in the cumulative effects assessment is presented in the *Environmental Assessment / Impact Statement Report*.

To determine which past, present, and reasonably foreseeable developments and their activities should be considered in the surface water cumulative effects assessment, the following questions were answered. If effects of the activities of the projects are expected to overlap in type, time, and space with the residual effects of surface water Valued Components, it was assumed that those activities would act cumulatively and be assessed for cumulative effects with the Project.

- Do the Project's activities overlap in the type of effects (e.g., effects on fish habitat quality)?
- Do the Project's activities overlap in the timing of effects (i.e., do they overlap with the cumulative effect temporal boundaries with the identified residual effects)?
- Do the Project's activities overlap in the location of effects (i.e., do they overlap with the cumulative effect spatial boundaries)?

4.4.3.2 Cumulative Effects Assessment

Following the scoping of the cumulative effects assessment, cumulative effects were assessed for applicable surface water Valued Components. Cumulative effects on each Valued Component were identified by reviewing the likely residual effects of the Project with and without the other activities. Effects of past activities (i.e., activities that have been carried out) were used to contextualize the current state of the Valued Component.

Mitigation measures that are technically and economically feasible to eliminate or reduce adverse cumulative effects were described. A qualitative assessment of the effectiveness of the measures was provided, taking into consideration all applicable reasonably foreseeable developments to provide a regional context. Cumulative effects were characterized using the same effects characteristics presented in **Table 4-9.**

4.5 Identify Monitoring Programs and Future Commitments

Effects monitoring programs are recommended to verify the prediction of the effects assessment and the effectiveness of the mitigation and enhancement measures presented in this report. Commitments made in this Report are also presented to support compliance monitoring to evaluate whether the Project has been constructed, implemented, and operated in accordance with the commitments made. Refer to **Section 9** for details about proposed monitoring programs and future commitments.

4.6 Predicting Future Conditions

The methods for future predictions of surface water and sediment quality, and surface water quantity are described below.

4.6.1 Surface Water and Sediment Quality

Qualitative methods were used to assess potential effects of the Project to surface water and sediment quality based on an understanding of existing surface water and sediment quality, likely parameters / contaminants of potential concern associated with different Project activities, and consideration of mitigation measures inherent to the Project design.

4.6.2 Surface Water Quantity (Hydrology)

Project-related effects on surface water quantity (hydrology) were assessed, where possible, based on the proportion of the catchment area for a given waterbody that is expected to be disturbed or influenced by Project activities. This approach considers drainage area as a proxy or analog for streamflow and, to a lesser extent, the potential for sediment erosion and transport. Mitigation measures may be designed to offset negative effects.

4.7 Data Management and Analysis

Data management including quality assurance / quality control has been employed to minimize potential for data entry and analysis errors, prepare datasets for analysis, and limit sensitive data distribution in accordance to established agreements.

4.7.1 Field Surveys

To maintain consistency and for quality assurance / quality control of the data collected, standardized datasheets (either digital or paper) paired with mapping software have been used in the field. Field studies have followed technical protocols that outlined specific work instructions and have been developed to follow federally and provincially acceptable methods. Completeness and accuracy of field data were verified daily during field verification and field photos and coordinate information has been backed up regularly.

4.7.2 Geographic Information Systems

Where existing conditions data are available in Geographic Information Systems format, this information will be provided to the Impact Assessment Agency of Canada as electronic geospatial data file(s) compliant with the International Organization for Standardization 19115 standard. This will support the Government of Canada's commitment to Open Science and Data and will facilitate the sharing of information with the public through the Canadian Impact Assessment Registry Internet Site and the Government's Open Science and Data Platform. The Impact Assessment Agency of Canada intends to make the geospatial data files available to the public under the terms of the Open Government Licence – Canada as applicable with exclusion of sensitive species at risk and Indigenous Knowledge.

Complete datasets from all survey sites will be provided upon finalization of this Report. They will be in the form of complete and quality assured relational databases, with precisely georeferenced site information, precise observation / visit information, and observations and measurements in un-summarized form. Databases and Geographic Information Systems files will be accompanied by detailed metadata that meets International Organization for Standardization 19115 standards. Documentation and digital files will be provided for all results of analyses that allow for a clear understanding of the methods and a replication of the results. All geographic data, along with accompanying metadata, pertaining to species at risk will be provided to Natural Heritage Information Centre and the Ministry of the Environment, Conservation and Parks – Species at Risk Branch.

4.7.3 Data Analysis

Data were collected to gather surface water quantity and sediment quality information at each proposed waterbody crossing. Information was collected from data acquired in the field at each waterbody crossing and supplemented by additional literature review.

Results of the desktop assessment and field investigations were then used to describe the surface water throughout the study area. Surface water data were compiled by waterbody crossing to provide an overall summary by Construction Disturbance Area, Local Study Area, and Regional Study Area.

5 Existing Conditions

The existing conditions for Alternative 1 and Alternative 4 are described based on a combination of information obtained through engagement and consultation, desktop assessment, field investigation, and modelling. This section provides a description of existing environmental conditions for surface water. For the purpose of this Report, "existing environmental conditions" are defined as those present at the time of assessment within the study areas (i.e., from 2019 to 2022). The characterization of the existing environment serves as the baseline condition for which the environmental effects of the Project will be predicted.

5.1 Desktop Analysis

This section provides an overall summary of the existing surface water environment based on the results of the desktop analysis for the existing conditions Construction Disturbance Area (i.e., the Project footprint, which encompasses a 100 m wide right-of-way for each Route Alternative), the existing conditions Local Study Area, and the existing conditions Regional Study Area.

5.1.1 Watershed and River Systems

The aquatics existing conditions Regional Study Area is located in the Upper Albany secondary watershed within the Hudson Bay primary watershed and is composed of the following three tertiary watersheds: 4GD-Upper Albany – Makokibatan, 4GE-Lower Ogoki, and 4GF-Upper Albany – Muswabik. The number and two letters that precede the watershed names are used to identify the primary, secondary, and tertiary watersheds based on the naming convention from the Ministry of Natural Resources and Forestry (Ontario Ministry of Natural Resources and Forestry, 2020b):

1. **First Character**—"4" represents the southwestern Hudson Bay primary watershed;
2. **Second Character**—"G" represents the Upper Albany secondary watershed; and
3. **Third Character**—"D" through "F" represents the tertiary watershed identifiers.

These watersheds generally drain either east towards the Albany River or northeast towards Hudson Bay and are located within the area managed by the Ministry of Natural Resources. As such, construction activities adjacent to or within the watersheds, such as temporary and permanent crossing structures, will require approval from the Ministry of Natural Resources via *Ontario Regulation 239/13* under the *Public Lands Act* (Government of Ontario, 1990h) administered by the Ministry of Natural Resources for waterbody crossings on public land or *Ontario Regulation 454/96* under the *Lakes and Rivers*

Improvements Act (Government of Ontario, 1990f) (administered by Ministry of Natural Resources for waterbody crossings on private or public land).

The main characteristics of the watersheds in each tertiary watershed are summarized in the following sections and include descriptions of drainage area, surficial geology, land cover, catchment length, catchment shape factor, topographic relief, and catchment slope. The definitions for each of these items follow.

- **Drainage area** is the geographical area drained by a river and its tributaries where surface water from rainfall or snowmelt converges to a single point at a lower elevation, usually where the water joins another waterbody;
- **Surficial geology** refers to the unconsolidated sediment overlying bedrock within the river's catchment, which is indicative of the soil cover and its drainage properties;
- **Land cover** refers to the surface cover on the ground (whether urban infrastructure, vegetation, water, bare soil, or other) that affects hydrologic processes by intercepting precipitation, altering water infiltration into the soil, affecting energy budgets and evaporation, and influencing water and sediment conveyance;
- **Catchment length** is defined as the distance measured along the longest flow path from the catchment divide to the mouth of the river system. The length of a catchment influences the flow through its outlet (Oji-Cree translation, *kojijiing*). For the same rainfall, a longer flow path may generate a lower instantaneous outlet flow than a shorter flow path;
- **Catchment shape factor** "represents how the surface runoff flows are collected through the drainage network" (Guo, 2009). Shape factor is calculated as the square of the catchment length divided by the catchment area. The shape of a catchment influences the flow through its outlet. For the same rainfall, a longer shape may generate a lower instantaneous outlet flow than that from a fan-shaped catchment;
- **Topographic relief** describes the difference in elevation from the lowest point to the highest point within the catchment. The relief of a catchment influences the flow through its outlet. For the same rainfall, a high relief may generate a higher instantaneous outlet flow than a low relief; and
- **Catchment slope** represents the rate of change of elevation along the catchment length. Similar to topographic relief, a steep slope may generate a higher instantaneous outlet flow than a shallower slope for the same rainfall.

5.1.1.1 4GD – Upper Albany – Makokibatan Tertiary Watershed

The Upper Albany - Makokibatan watershed is situated in the west end of the aquatics existing conditions Regional Study Area (**Figure 4-2**), noting that mainstem and associated tributary streams of the Upper Albany - Makokibatan watershed drain to the mainstem of the Albany River and, in turn, discharge to James Bay. The Project crosses a total of 46 watercourses, 2 lakes / ponds, and 50 undefined waterbodies in this watershed.

The tertiary watershed of the Upper Albany - Makokibatan includes a total catchment area of 22,739 km^2. Apart from the Albany River, there are three other river systems larger than 1,000 km^2 in the watershed: the Attwood River (with a catchment of approximately 2,420 km^2 and catchment length of 206 km), the Opichuan River (with a catchment of approximately 1,130 km^2 and catchment length of 122 km), and Gourlie Creek (Oji-Cree translation, *Onagwa'ihgan Ziibih*) (with a catchment area of approximately 1,020 km^2 and catchment length of 143 km) (Ministry of Natural Resources, 2011; Ministry of Natural Resources and Forestry, 2022). The following named lakes are located in the aquatics existing conditions Local Study Area (5 km buffer from route centreline) position of the Upper Albany - Makokibatan watershed:

- Oxtoby Lake;
- Saarimaki Lake; and
- Teabeau Lake.

The surficial geology underlying the watershed of the Upper Albany – Makokibatan is primarily a mix of till, bedrock, and organic deposits (Ministry of Northern Development and Mines, 2006). The watershed consists of largely treed and swamp land cover (accounting for more than 50% of the catchment area) (Ministry of Natural Resources and Forestry, 2022).

The length of the mainstem channel of the Albany River from Gowie Bay to the confluence of the Ogoki River and Albany River is approximately 250 km. The shape factor for the catchment is 24.7, suggesting a relatively elongated catchment (i.e., longer distance from headwaters to outlet). Topographic relief in the Upper Albany - Makokibatan watershed varies from approximately 150 to 393 m, with a mean elevation of 311 m, while the mean slope of the catchment is roughly 0.041% (Ministry of Natural Resources and Forestry, 2022).

5.1.1.2 4GE – Lower Ogoki Tertiary Watershed

The Lower Ogoki watershed is situated in the south end of the aquatics existing conditions Regional Study Area (**Figure 4-2**), noting that the mainstem and associated tributary streams in the Lower Ogoki watershed drain from the Ogoki River at a point approximately 50 km upstream from Ogoki Lake to the confluence with the Albany River and, in turn, discharge to James Bay. The Project crosses 36 watercourses, 4 lakes / ponds, and 23 undefined waterbodies in this watershed.

The Lower Ogoki watershed includes a total catchment area of approximately 8,640 km^2. Apart from the Ogoki River, there are two other river systems larger than 1,000 km^2 in the watershed: Colpitts Creek (with a catchment of approximately 1,050 km^2 and catchment length of 197 km) and the Dusey River (with a catchment of approximately 2,310 km^2 and catchment length of 210 km) (Ministry of Natural Resources, 2011; Ministry of Natural Resources and Forestry, 2022). The following named lakes are located in the aquatics existing conditions Local Study Area (2.5 km buffer from route centreline) of the Lower Ogoki watershed:

- Byford Lake;
- Glaze Lake;
- McCaw Lake;
- Patience Lake (Oji-Cree translation, *Bakihda'hawgan*); and
- Winslow Lake.

The surficial geology underlying the watershed of Lower Ogoki is primarily a mix of till, bedrock, and organic deposits (Ministry of Northern Development and Mines, 2006). The watershed consists largely of bog, fen, and swamp land cover (accounting for more than 51% of the catchment area) (Ministry of Natural Resources and Forestry, 2022).

The length of the mainstem channel of the Ogoki River from a point approximately 50 km upstream from Ogoki Lake to the confluence with the Albany River is approximately 322 km. The shape factor for the catchment is 20.2, suggesting a relatively elongated catchment (i.e., longer distance from headwaters to outlet). Topographic relief in the Lower Ogoki watershed varies from approximately 146 to 298 m, with a mean elevation of 256 m, while the mean slope of the catchment is roughly 0.045% (Ministry of Natural Resources and Forestry, 2022).

5.1.1.3 4GF – Upper Albany – Muswabik Tertiary Watershed

The Upper Albany – Muswabik watershed is situated in the northeast end of the aquatics existing conditions Regional Study Area (**Figure 4-2**). The mainstem and associated tributary streams in the Upper Albany – Muswabik watershed drain to the mainstem of the Albany River and, in turn, discharge to James Bay. The Project crosses three defined watercourses in the watershed.

The watershed of the Upper Albany – Muswabik includes a total catchment area of 39,034 km^2. Apart from the Albany River, there are three other river systems larger than 1,000 km^2 in the watershed: one unnamed watercourse (with a catchment of approximately 1,380 km^2 and catchment length of 161 km), the Muswabik River (with a catchment of approximately 2,050 km^2 and catchment length of 209 km), and Ruby Creek

(with a catchment of approximately 1,010 km^2 and catchment length of 154 km) (Ministry of Natural Resources, 2011; Ministry of Natural Resources and Forestry, 2022).

The surficial geology underlying the watershed of the Upper Albany – Muswabik is primarily organic deposits (Ministry of Northern Development and Mines, 2006). The watershed largely consists of bog, fen, and swamp land cover (accounting for more than 84% of the catchment area) (Ministry of Natural Resources and Forestry, 2022).

The length of the mainstem channel of the Albany River from the confluence of the Ogoki River and Albany River to the confluence of the Albany River and Kenogami River is approximately 478 km. The shape factor for the catchment is 22.5, suggesting a relatively elongated catchment (i.e., longer distance from headwaters to outlet). Topographic relief in the Upper Albany – Muswabik watershed varies from approximately 71 to 146 m, while the mean slope of the catchment is roughly 0.041% (Ministry of Natural Resources and Forestry, 2022).

5.1.1.4 Watershed Waterbody Crossings by Tertiary Watershed

A summary of the proposed waterbody crossings by tertiary watershed are presented in **Table 5-1**.

Table 5-1: Summary of Waterbody Crossings by Tertiary Watershed

Tertiary Watershed	Number of Waterbody Crossings					
	Waterbody Type				Flow Regime	
	Watercourse	Lake / Pond	Undefined	Total	Unknown	Permanent
4GD-Upper Albany – Makokibatan	46	2	50	96	50	48
4GE-Lower Ogoki	36	4	23	64	23	40
4GF-Upper Albany – Muswabik	3	N/A	N/A	3	N/A	3
Total	**85**	**6**	**73**	**163**	**73**	**91**

N/A = not applicable.

A total of 91 defined waterbody crossing locations (85 watercourses and 6 lakes) were described in the existing environment characterization and of these:

- 40 waterbody crossings are on Alternative 1;
- 38 waterbody crossings are on Alternative 4; and
- 13 waterbody crossings overlap both Alternative 1 and 4.

There are three sections of the Alternative 1 and 4 that overlap. Therefore, Alternative 1 has 53 total waterbody crossings (40 on Alternative 1 alone, plus the 13 that overlap), and Alternative 4 has 51 total waterbody crossings (38 on Alternative 4 alone, plus the 13 that overlap).

Nine waterbody crossings are on named, large permanent rivers, including the Albany, Wabassi, Dusey, and Ogoki rivers. The documented surface water characteristics for each of the defined waterbody crossings are provided in **Attachment B – Surface Water Characteristics of Defined Waterbody Crossings**.

A total of 73 unmapped water features without defined bed or banks (a criterion for the definition of a waterbody in Ontario (Government of Ontario, 1990a; Stanfield, 2017) were not considered waterbodies and therefore not included in the crossing list. The list of 73 undefined water features with supporting data (e.g., aerial photographs, light detection and ranging screengrabs) is provided in **Attachment C – Surface Water Characteristics of Undefined Waterbody Crossings**.

5.1.1.5 Cliffs Chromite Waterbody Crossings

As part of the Cliffs Chromite Project, a proposed Community Access Road north of Painter Lake Road was to be centred within a new approximately 100 m wide right-of-way, with a cleared width of approximately 60 m. From its start point near the junction of Anaconda Road and Highway 643, the Community Access Road would have covered a distance of approximately 338 km and crossed three major rivers: the Ogoki River, the Albany River, and the Attawapiskat River (from south to north). A comparison of the waterbody crossings for the Marten Falls First Nation Community Access Road and the Cliffs Access Road crossings is provided in **Attachment D – Hydrological, Hydraulic, and Geomorphic Characteristics of Project Watercourse Crossings**. Additional information, including a Cliffs Chromite Project crossing location figure, water and sediment quality, and waterbody crossing characteristics are detailed in **Attachment E – Cliffs Chromite Project Information**. Attachment E also includes Cliffs Chromite Project-related information, such as the following characterization of waterbody crossings for the Cliffs Chromite Project:

- 69 waterbody crossings were identified in total along the proposed Cliffs Access Road, of which 54 were new Cliffs-identified crossings and 14 were on existing crossings routes;
- 40 of the proposed Community Access Road waterbody crossings were at perennial watercourses; and
- 29 of the proposed Community Access Road waterbody crossings were at intermittent / ephemeral watercourses.

5.1.2 Surface Water Use

5.1.2.1 Active Permits to Take Water

The Ministry of the Environment, Conservation and Park's Permit to Take Water data catalogue (Ontario Ministry of the Environment, Conservation and Parks, 2022) was accessed on January 31, 2023 (Permit to Take Water records, updated April 29, 2022) to identify active permits to take water, within the aquatics existing conditions Local Study Area. The results of this review showed that there are no active Permit to Take Water sources within the existing conditions Local Study Area or existing conditions Regional Study Area; however, it is expected that communities within the existing conditions Regional Study Area use surface water sources for domestic and recreational purposes.

5.1.2.2 Hydropower Generation

Based on a review of publicly available hydropower mapping (Ontario Ministry of Natural Resources and Forestry, 2001), Ontario Power Generation (2005; 2019; 2023) reports, and Water Survey of Canada Hydrometric (Environment Canada, 2022), there are no known hydropower generating stations within the boundaries of the existing conditions Local Study Area or existing conditions Regional Study Area. Specifically, no active generating dams are located within the boundaries when viewing Water Survey of Canada mapping datasets or Ontario Power Generation hydroelectric power generating stations listings. The closest known hydropower facility to the Project is the Ontario Power Generation-operated Pine Portage station. This facility is located approximately 195 km southwest of the existing conditions Local Study Area and has a capacity of 142 megawatts.

There is a water control dam (Waboose Diversion Dam) on the Ogoki River located at Waboose Falls. This dam is outside of the existing conditions Regional Study Area, but it does affect river flows within the existing conditions Regional Study Area. The dam is managed under the Nipigon River System Water Management Plan by Ontario Power Generation and is designed to divert a portion of flow of the Nipigon River (Ontario Power Generation, 2005; Ontario Power Generation Inc., 2023). The dam does not impound water, instead diverts flow into an artificial watercourse and is regulated by specific flow constraints. For example, when the Lake Nipigon water level is above 260.45 m, the flow is reduced to zero and any required discharge is passed at the Waboose Diversion Dam for efficient water management. The Waboose Diversion Dam is almost always fully closed, with only leakage between the hydraulic control structures flowing north (Ontario Power Generation, 2005). During periods of high-water elevations on Lake Nipigon, some or all the flow from the Ogoki basin may be redirected north through the Waboose Dam to the Albany River and northward into James Bay.

Information provided by Marten Falls First Nation notes that historically, past development, including damming and diversion within the watershed has resulted in low water levels in the Albany and Ogoki Rivers, making it harder for community members to utilize waterways for travel. This includes past development activities at Rat Rapids, the Root River, Osnaburgh House, and Lake St. Joseph (Marten Falls First Nation, 2023). Members of Kashechewan First Nation community have also shared similar concerns related to observed changes to flow patterns in the rivers that run through their traditional territory, attributed to the damming and diversion of water upriver. One community member noted that "*the water has declined by 50% in the last 30 years*". Another community member from Kashechewan noted that sometimes, when the water is really low, people must sometimes drag their boats to get through the rapids (MNP LPP, 2024a)
(MNP LPP, 2024a).

Fort Albany First Nation also provided observations related to how surface water and fish habitat have been impacted by damming and water control structures, noting changes to water quality and quantity. The community discussed how the dams at Lake St. Joseph and Big Trout Lake control the water level on the Albany River, resulting in downstream effects in the Fort Albany area and has led to decreased access to preferred hunting locations. Community members provided feedback describing potential damming around the Marten River, observations that they used to travel up the Chemahagan River in the 1970s for moose, but now have difficulties doing so, as the river is too dry, and impacts the safety, natural cycle, and timing of river break-ups in the spring due to dam releases causing the ice to break. One community member from Fort Albany First Nation noted

> *"It's really dry now, just when I went to Albany recently … in the summertime. That river used to be full of water. Now it's just rocks and boulders. People drive around their trucks now or four-wheelers [in exposed sections of the river] Because of lack of water*." (Firelight Research Inc., 2024).

5.1.2.3 Ice Cover Conditions

Ice cover conditions within the Local Study Area are consequential as communities surrounding the area may rely on ice roads for transportation and recreation during winter periods. In particular, ice roads, which form over frozen lakes and rivers, can be essential for delivering supplies such as fuel, food, and construction materials, and ice formation can be essential for traditional activities like hunting, fishing, and trapping. Without reliable ice cover, communities can face higher costs and logistical challenges within the winter periods.

Future freeze / thaw timing cycles and ice conditions within the northern Ontario region are expected to be affected by climate change forecasts (ClimateData.ca, 2024). Studies indicate that increasing air temperatures and decreasing snow cover within the northern Ontario region will lead to fewer frozen days and more transitional days within the winter period where the ground repeatedly freezes and thaws (Hori, Gough, Butler, & Tsuji,

2017). This can result in earlier thaws and later freezes, disrupting traditional seasonal patterns.

Projections for ice cover suggest a general reduction in the extent and duration of ice cover on lakes within northern Ontario. Warmer temperatures will likely lead to thinner ice and shorter ice seasons. This can affect local ecosystems, winter transportation routes, and recreational activities (Hori, Cheng, Gough, Jien, & Tsuji, 2018).

In a warmer climate, due to the effects of climate change, the role of ice may change significantly. Given that ice dynamics can affect many ecosystem features, there will be negative and positive consequences of less ice in northern Ontario (Dove-Thompson, Lewis, Gray, Chu, & Dunlop, 2011). There are several negative effects of climate change on ice dynamics in lake ecosystems. This includes, but is not limited to, increased evaporation rates where the shortening of the ice-in season will affect evaporation rates (Allan, Palmer, & Poff, 2005). In the Great Lakes system, the greatest losses due to evaporation generally occur in late autumn and winter when cold, dry air passes over the warmer lakes (Mortsch, Alden, & Scheraga, 2003). There is also potential loss of shoreline protection as ice protects the shoreline and prevents erosion during winter storm events. That said, a reduction in the ice-in periods around lakes will render shorelines more susceptible to extreme storm events (Mortsch, Alden, & Scheraga, 2003). Additionally, the increased duration of the ice-free season and increased water temperatures within the lakes may lead to increased oxygen consumption in the deeper waters when algae decompose, which may limit the amount of oxygen available for select species inhabiting deeper waters (Wrona, et al., 2006).

That said, there can also be positive effects of a shorter ice-in period in the northern Ontario region, including an increased potential for over-winter survival of fish species as a shorter ice-in seasons means a reduced risk of low dissolved oxygen conditions, which can increase the chances of over-winter survival of fish eggs (Mortsch, Alden, & Scheraga, 2003). A shorter ice-in season may also mean that fewer atmospheric airborne particulates may be stored in the snow and ice pack leading to less deposition of toxic material that is flushed into a lake during the spring thaw cycle (Dove-Thompson, Lewis, Gray, Chu, & Dunlop, 2011).

5.1.3 Surface Water Quantity

5.1.3.1 Water Survey of Canada Stations

Flow regimes in the three tertiary watersheds within the existing conditions Regional Study Area are largely driven by local snow melt, with individual precipitation events reporting only minimal responses. Spring freshet typically occur in mid-April to early May with flow remaining high until early summer, where flow decrease until early fall when they typically increase in response to regular precipitation events.

Flows typically decrease again in mid-fall as waterbodies begin to freeze with most annual low flows occurring in winter before the spring melt. Mean annual precipitation and mean annual flows for the Project were estimated using data retrieved from the Ontario Watershed Information Tool (Ontario Ministry of Natural Resources and Forestry, 2013). The results of the analysis are summarized for each of the relevant tertiary watersheds in **Table 5-2**.

Table 5-2: Mean Annual Precipitation, Surface Water Yields, and Runoff Coefficients for the Existing Conditions Regional Study Area

Tertiary Watershed	Number of Watercourses Crossed by the Right-of-Way	Total Catchment Area[(a)] (km^2)	Mean Annual Precipitation[(b)] (mm)	Mean Annual Surface Water Yield[(c)] (mm)	Mean Annual Runoff Coefficient[(d)]
4GD-Upper Albany – Makokibatan	46	22,739	687	297	0.43
4GE-Lower Ogoki	36	8,640	698	297	0.43
4GF-Upper Albany – Muswabik	3	39,034	681	310	0.46

Notes:
(a) Total catchment areas represent the total surface area of the tertiary watershed, with consideration of the following:
- Calculated as the sum of the catchment areas of the river systems crossed by the Project within the tertiary watershed; and
- Catchment areas for the Albany River include the diverted areas downstream from the Lake St. Joseph dam.

(b) Calculated as the area-weighted average of the mean annual precipitation for the catchments crossed by the Project.
(c) Calculated as the area-weighted average of the mean annual surface water yields in the catchments crossed by the Project. For each catchment, mean annual surface water yield in mm was calculated from the mean annual flow in m^3/s and the catchment area in km^2.
(d) Calculated as the ratio of mean annual surface water yield to mean annual precipitation.
km^2 = square kilometre; m^3/s = cubic metres per second; mm = millimetre.

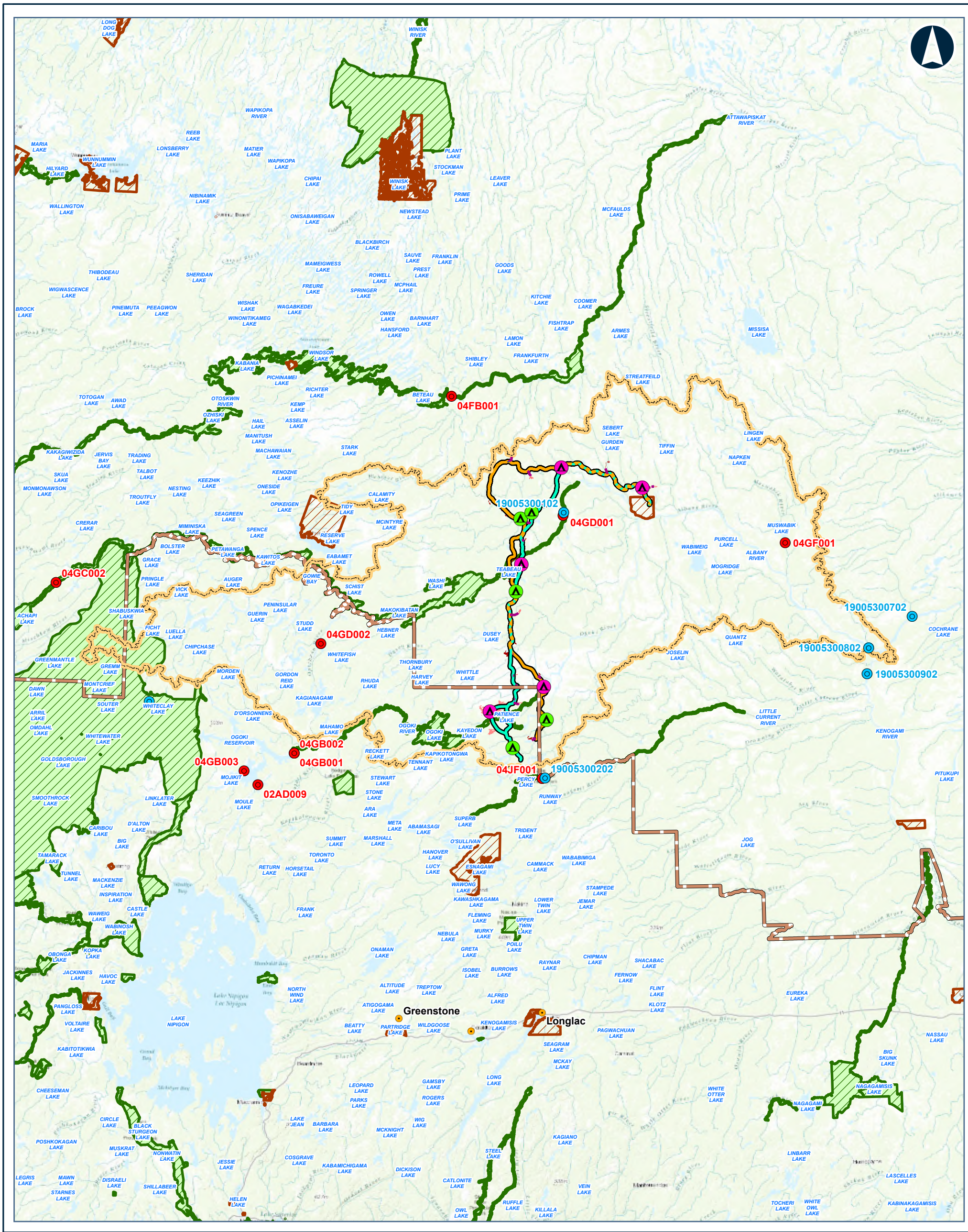
Based on the results in **Table 5-2**, mean annual surface water yield in the tertiary watersheds varies from 297 to 310 mm, representing between 43% and 46% of mean annual precipitation. Surface water yield was shown to generally increase from west to east, corresponding to the comparatively higher mean annual precipitation. These findings are consistent with information provided in published hydrological atlases (Fisheries and Environment Canada, 1978; Natural Resources Canada, 1978).

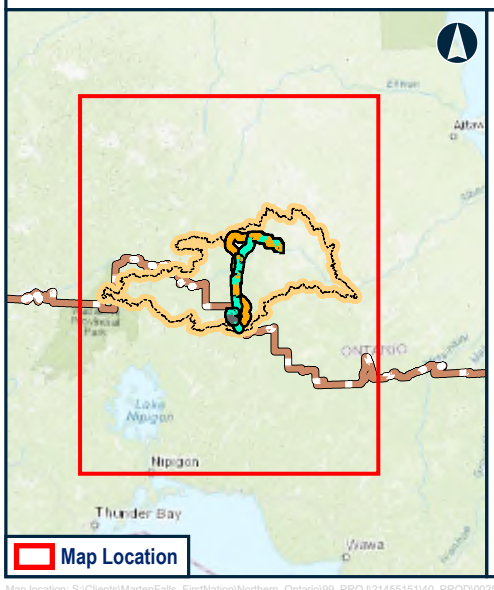
Water Survey of Canada operates or has operated ten hydrometric stations that are located within or in close proximity to the existing conditions Regional Study Area (Environment Canada, 2022). These hydrometric stations are presented in **Table 5-3**, as well as in **Figure 5-1**, noting that streamflow records are available at eight of the stations, while lake levels are available at the other two stations.

Table 5-3: Water Survey of Canada Hydrometric Gauges within Approximately 100 Kilometres of the Aquatics Existing Conditions Local Study Area

Tertiary Watershed	Station ID	Station Name	Zone	Easting (m)	Northing (m)	Catchment Area (km²)	Data Type	Regulation Type[(a)]	Available Record
4GD-Upper Albany – Makokibatan	04GD001	Albany River above Nottick Island	16	541714.1	5721104.6	32,400	Flow, Level	Regulated	1966-2021
4JF-Little Current	04JF001	Little Current River at Percy Lake	16	533084.1	5611935.5	5,300	Flow, Level	Natural	1968-2021
4FB-Upper Attawapiskat	04FB001	Attawapiskat River below Attawapiskat Lake	16	495436.7	5770616.7	24,200	Flow, Level	Natural	1965-2020
4GF-Upper Albany – Muswabik	04GF001	Muswabik River at Outlet Muswabik Lake	16	633878.7	5709785.8	1,890	Flow, Level	Natural	1970-1995
4GD-Upper Albany – Makokibatan	04GD002	Lake Opichuan River at Kellow Lake	16	441260.6	5667919.8	1,170	Flow	Natural	1968-1977
4GB-Upper Ogoki	04GB002	Waboose Lake Reservoir at Waboose Dam	16	430160.1	5622491.8	N/A	Level	Regulated	1943-1994
4GB-Upper Ogoki	04GB001	Ogoki River at Waboose Falls Dam	16	430160.1	5622491.8	13,600	Flow	Regulated	1941-1994
2AD-Upper Ogoki	02AD009	Ogoki River Diversion to Lake Nipigon	16	415150.4	5609334.2	N/A	Flow	Regulated	1943-1994
4GB-Upper Ogoki	04GB003	Mojikit Lake Reservoir at Mojikit Lake	16	409358.2	5615148.2	N/A	Level	Regulated	1943-1994
4GC-Upper Albany – Misehkow	04GC002	Albany River below Achapi Lake	16	331383.5	5693376.3	16,300	Flow, Level	Regulated	1970-2020

Notes:
(a) Regulation type indicates whether streamflow and water levels at the gauge follow a natural regime (uninfluenced by humans) or a regulated (controlled) regime.
km^2 = square kilometre; m = metre; N/A = not applicable.





Legend

- PROVINCIAL (STREAM) WATER QUALITY MONITORING NETWORK (PWQMN) SITE
- WATER SURVEY OF CANADA (WSC) HYDROMETRIC GAUGE
- TOWN/COMMUNITY

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- AQUATIC REGIONAL STUDY AREA

Data Source:
Base Data: Provided by MNRF 2022; Route Infrastructure - Provided by AECOM 2024. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: World Topographic Map: Esri, © OpenStreetMap contributors, HERE, Garmin, FAO, USGS, NGA, EPA, NPS, AAFC, NRCan
World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Location of WSC Hydrometric and PWQMN Stations

0 5 10 20 30 40
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:1,500,000 * when printed 11"x17"
Rev:0	

Figure 5-1

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0000\21455151-0025-CS-0000.aprx
Date Saved: 2/10/2026 5:56 PM User Name: INRR172702

Flow records from the identified Water Survey of Canada hydrometric stations were reviewed to assess the mean annual surface water yield as a monthly distribution at stations where streamflow is gauged, and the monthly fluctuation in lake levels at stations where water levels are gauged. The results are summarized in **Table 5-4**.

Table 5-4: Mean Annual Surface Water Yields at Water Survey of Canada Stream Gauging Stations

Tertiary Watershed	Location in Relation to Existing Conditions Regional Study Area	Station ID	Station Name	Regulation Type	Catchment Area (km^2)	Mean Annual Surface Water Yield[a] (mm)	Mean Annual Flow in m^3/s ($L/s/km^2$)
4GD-Upper Albany – Makokibatan	Within existing conditions Regional Study Area Limits	04GD001	Albany River above Nottick Island	Regulated	32,400	219	225 (7)
4JF-Little Current	Outside of existing conditions Regional Study Area Limits	04JF001	Little Current River at Percy Lake	Natural	5,300	304	5 (10)
4FB-Upper Attawapiskat	Outside of existing conditions Regional Study Area Limits	04FB001	Attawapiskat River below Attawapiskat Lake	Natural	24,200	319	245 (10)
4GF-Upper Albany – Muswabik	Within existing conditions Regional Study Area Limits	04GF001	Muswabik River at Outlet Muswabik Lake	Natural	1,890	250	15 (8)
4GD-Upper Albany – Makokibatan	Within existing conditions Regional Study Area Limits	04GD002	Lake Opichuan River at Kellow Lake	Natural	1,170	384	14 (12)
4GB-Upper Ogoki	Outside of existing conditions Regional Study Area Limits	04GB002	Waboose Lake Reservoir at Waboose Dam	Regulated	N/A	N/A[b]	N/A[b]
4GB-Upper Ogoki	Outside of existing conditions Regional Study Area Limits	04GB001	Ogoki River at Waboose Falls Dam	Regulated	13,600	N/A[c]	N/A[c]

Tertiary Watershed	Location in Relation to Existing Conditions Regional Study Area	Station ID	Station Name	Regulation Type	Catchment Area (km^2)	Mean Annual Surface Water Yield[(a)] (mm)	Mean Annual Flow in m^3/s ($L/s/km^2$)
2AD-Upper Ogoki	Outside of existing conditions Regional Study Area Limits	02AD009	Ogoki River Diversion to Lake Nipigon	Regulated	N/A	N/A[(b)]	N/A[(b)]
4GB-Upper Ogoki	Outside of existing conditions Regional Study Area Limits	04GB003	Mojikit Lake Reservoir at Mojikit Lake	Regulated	N/A	N/A[(b)]	N/A[(b)]
4GC-Upper Albany – Misehkow	Outside of existing conditions Regional Study Area Limits	04GC002	Albany River below Achapi Lake	Regulated	16,300	115	60 (4)

Notes:

(a) Calculated from the mean annual flow in m^3/s and the catchment area in km^2.

(b) Water Survey of Canada station is located in, or adjacent to, a reservoir or dam. As a result, the catchment size contributing to the station was not provided within the Water Survey of Canada dataset for the selected stations. Additionally, it was not possible to use the Ontario Watershed Information Tool to derive a catchment area estimate.

(c) Gauge station includes incomplete flow records. Calculations would not be able to provide an accurate representation of the mean annual surface water yield and flow for selected station.

km^2 = square kilometre; m^3/s = cubic metres per second; $L/s/km^2$ = litres per second per square kilometre;
mm = millimetre; N/A = not applicable.

The flow records at the identified hydrometric stations were further evaluated to assess the long-term average seasonal mean flows, low flows (7Q20 the minimum 7-day average flow with recurrence interval of 20 years – i.e., a 5% chance of occurring in any one year) and high flows (25-, 50-, and 100-year flows with recurrence interval of 25, 50 and 100 years, respectively). Daily flow records were analysed to determine yearly 7-day minimum flows (based on 7-day moving average of daily flows) and high flows. High and low flow analysis was completed using RMC-BestFit software developed collaboratively by the U.S. Army Corps of Engineers' Risk Management Center and Engineer Research and Development Center's Coastal and Hydraulics Laboratory. Note that the continuous flow records for all years of record were not available at all stations. For this preliminary low and high flow analysis, only the years with complete flow data were considered. Years with incomplete or missing flow data were excluded and the data were analysed as a single record and fitted to Log-Pearson Type III distribution. These results are provided in **Table 5-5**.

Table 5-5: Seasonal Surface Water Flows at Water Survey of Canada Stream Gauging Stations

Tertiary Watershed	Station ID	Station Name	Regulation Type	Catchment Area (km^2)	Average Seasonal Mean Flow (m^3/s)[a]				Low Flows (m^3/s)[c]	High Flows (m^3/s)[d]		
					Fall (September–October)	Winter (November-April)	Spring (May-June)	Summer (July-August)	7Q20	25-Year	50-Year	100-Year
4GD-Upper Albany – Makokibatan	04GD001	Albany River above Nottick Island	Regulated	32,400	255	127	436	292	31	1043	1147	1252
4JF-Little Current	04JF001	Little Current River at Percy Lake	Natural	5,300	51	27	117	64	6.8	322	356	388
4FB-Upper Attawapiskat	04FB001	Attawapiskat River below Attawapiskat Lake	Natural	24,200	282	120	527	301	29	1509	1657	1796
4GF-Upper Albany – Muswabik	04GF001	Muswabik River at Outlet Muswabik Lake	Natural	1,890	18	5	41	15	0.13[h]	156	172	188
4GD-Upper Albany – Makokibatan	04GD002	Lake Opichuan River at Kellow Lake	Natural	1,170	14	8	15	14	N/A[e]	N/A[e]	N/A[e]	N/A[e]
4GB-Upper Ogoki	04GB002	Waboose Lake Reservoir at Waboose Dam	Regulated	N/A	N/A[b][f]	N/A[b][f]	N/A[b][f]	N/A[b][f]	N/A[f]	N/A[f]	N/A[f]	N/A[f]
4GB-Upper Ogoki	04GB001	Ogoki River at Waboose Falls Dam	Regulated	13,600	N/A[g]	N/A[g]	N/A[g]	N/A[g]	N/A[e]	N/A[e]	N/A[e]	N/A[e]
2AD-Upper Ogoki	02AD009	Ogoki River Diversion to Lake Nipigon	Regulated	N/A	N/A[b]	N/A[b]	N/A[b]	N/A[b]	N/A[b]	N/A[b]	N/A[b]	N/A[b]
4GB-Upper Ogoki	04GB003	Mojikit Lake Reservoir at Mojikit Lake	Regulated	N/A	N/A[b][f]	N/A[b][f]	N/A[b][f]	N/A[b][f]	N/A[f]	N/A[f]	N/A[f]	N/A[f]
4GC-Upper Albany – Misehkow	04GC002	Albany River below Achapi Lake	Regulated	16,300	74	36	81	99	7.8	743	1249	2093

Notes:
(a) Calculated from the mean annual flow in m^3/s and the catchment area in km^2.
(b) Water Survey of Canada station is located in, or adjacent to, a reservoir or dam. As a result, the catchment size contributing to the station was not provided within the Water Survey of Canada dataset for the selected stations. Additionally, it was not possible to use the Ontario Watershed Information Tool to derive a catchment area estimate.
(c) Low flows (7Q20 - the minimum 7-day average flow with recurrence interval of 20 years – i.e., a 5% chance of occurring in any one year) is based on the minimum 7-days moving average daily flows of each year of the record and fitted to Log-Pearson Type III distribution.
(d) Peak flows (25-, 50-, and 100-year flows with recurrence interval of 25, 50 and 100 years, respectively) are based on the daily peak flows of the year and fitted to Log-Pearson Type III distribution.
(e) Insufficient flow record and/or incomplete yearly flow data to conduct low and high flow analysis.
(f) Flow data is not available for this station.
(g) Gauge station includes incomplete flow records. Calculations would not be able to provide an accurate representation of the average mean seasonal flow for selected station.
(h) Value is based on Pearson Type III distribution. Low flow data did not fit to Log-Pearson Type III distribution.
m^3/s = cubic metres per second; km^2 = square kilometre; N/A = not applicable.

With reference to **Figure 5-2** and **Figure 5-3**, a review of the monthly streamflow and lake level results demonstrated that mean flows / water levels are highest during the spring (due to the spring freshet - snowmelt) and lowest in the winter, noting that average seasonal yields in the region ranged from 5 cubic metres per second (m^3/s) in the winter (Station 04GF001) to 527 m^3/s in the spring (Stations 04FB001). In addition, the following trends were observed:

- Stations with natural flows (**Figure 5-2**) generally included two periods of the year with comparatively high flow: a primary peak in May and a secondary peak in October;
- Stations with regulated flows (**Figure 5-4**) generally included one or two periods of the year with comparatively high flow: a primary peak in each case in June or July and a secondary peak in just one case in October (specific to Station 04GD001 [Albany River above Nottick Island]);
- Stations with natural flows and regulated flows were characterized by the lowest monthly yields for the year in either February or March for all stations (when most precipitation in the watershed is deposited / stored as snow);
- Stations with natural flows (**Figure 5-2**) experienced the bulk of the annual yield in May and June alone, accounting for 29% (at Station 04GD002) to 52% (Station 04GF001) of the annual total; similarly, stations with regulated flows (**Figure 5-4**) supported the same type of condition, accounting for 27% (Station 04GC002) to 39% (Station 04GD001) of the annual total; and
- Stations with regulated flows on lakes (**Figure 5-3**) included mean monthly lake levels that varied from -0.5 to 0.6 m (relative to the average annual level), noting that instances of especially minimal fluctuation in monthly water levels at Station 04GB002 (Waboose Lake Reservoir at Waboose Dam) and Station 04GB003 (Mojikit Lake Reservoir at Mojikit Lake) reflected dam / reservoir operation activities (i.e., draw down and refilling of the reservoir to maintain flows from the lake during seasonal variation).

Figure 5-2: Mean Monthly Surface Water Yields at Water Survey of Canada Stream Gauging Stations with Natural Flows

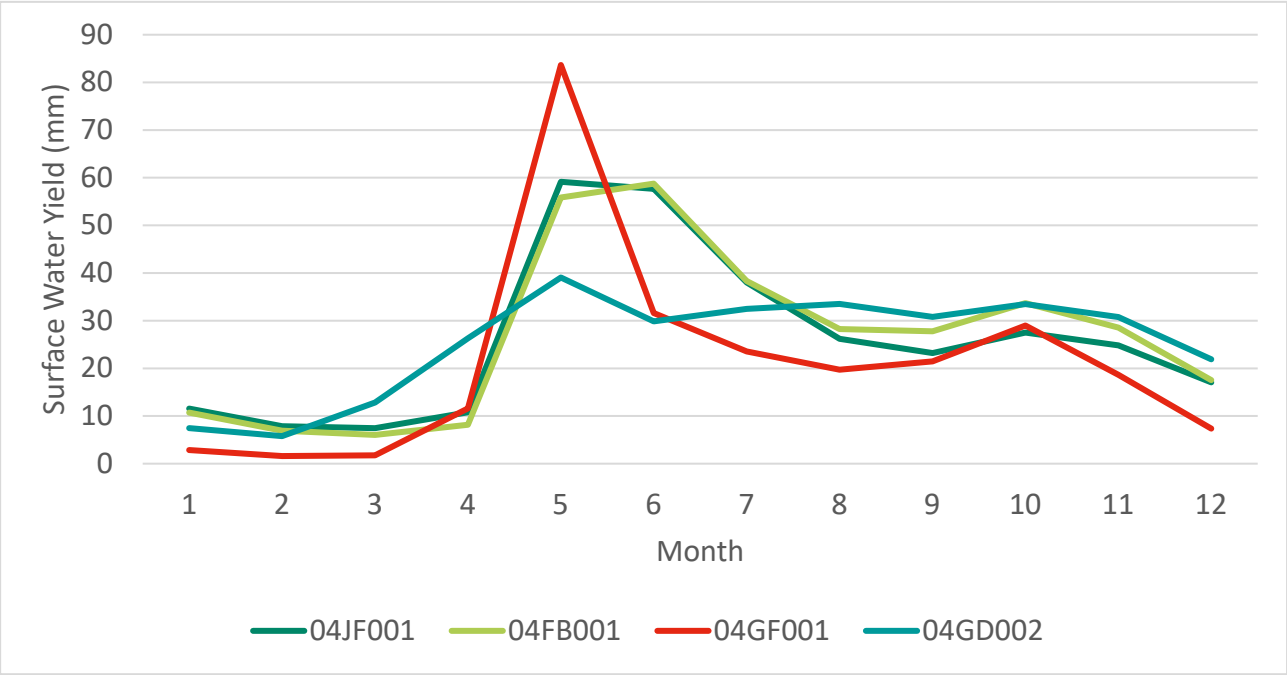


Figure 5-3: Mean Monthly Lake Levels at Water Survey of Canada Water Level Gauging Stations

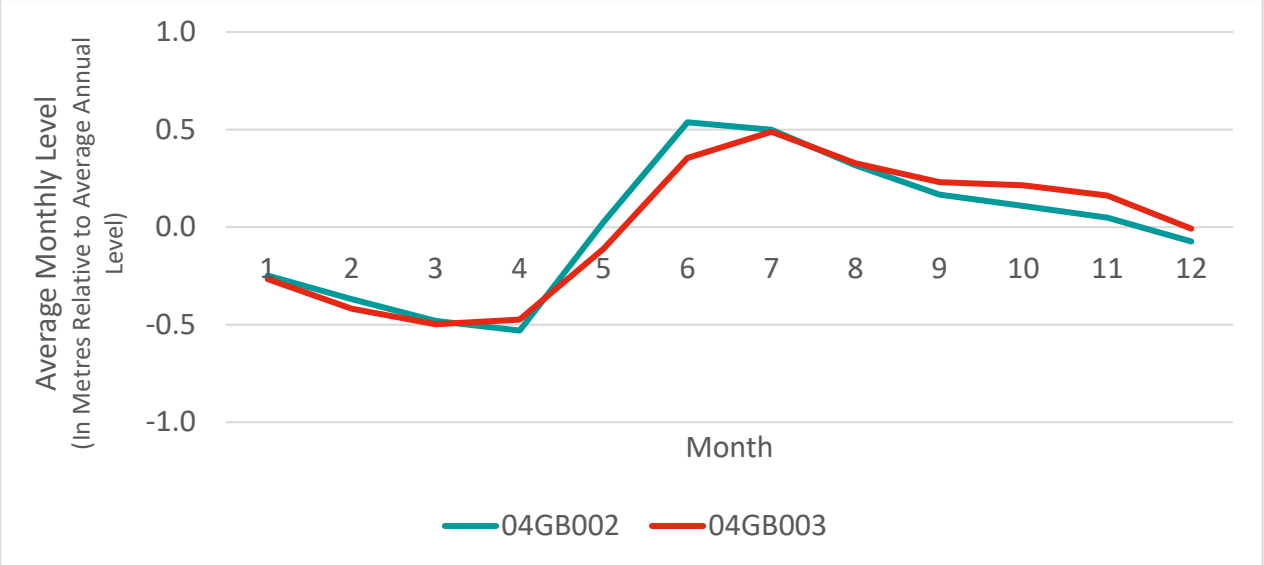
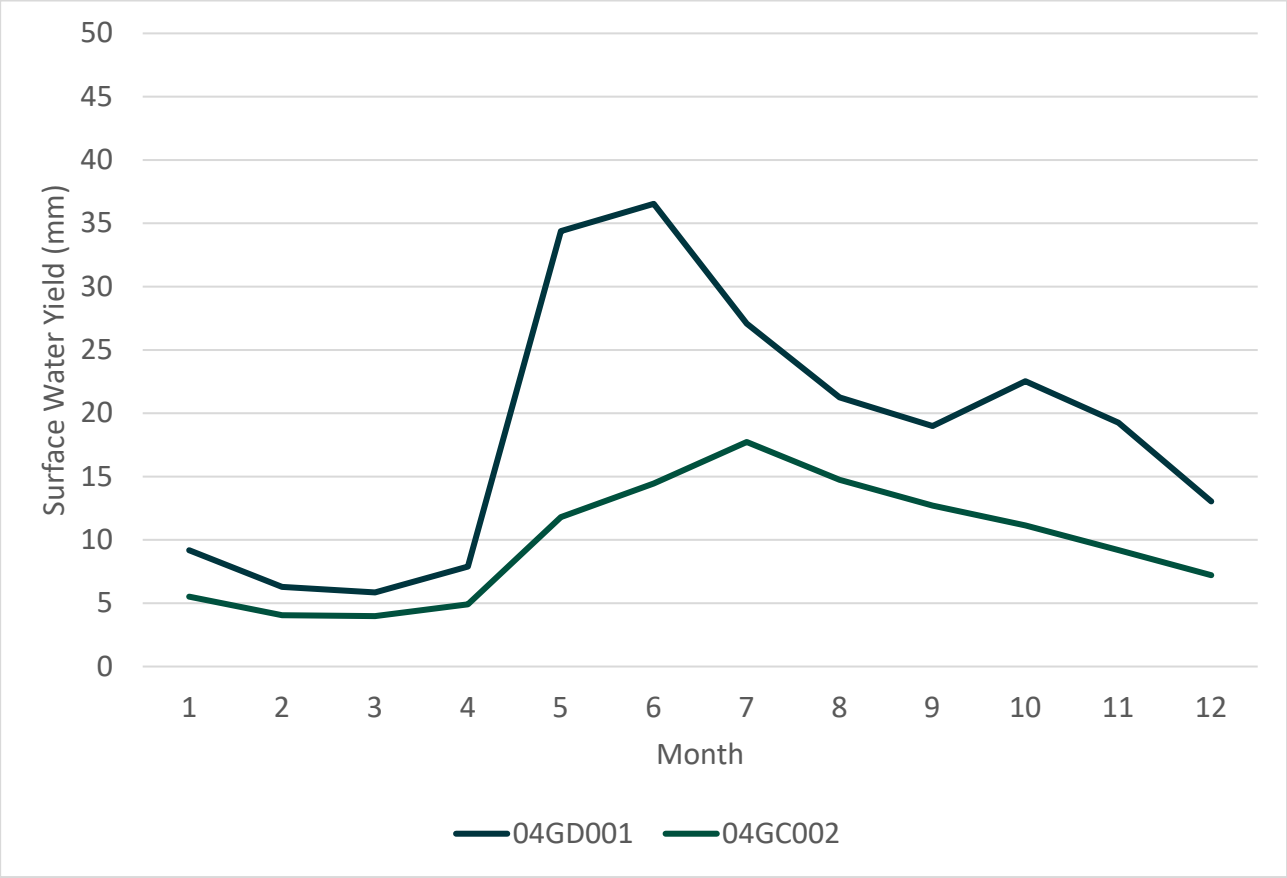


Figure 5-4: Mean Monthly Surface Water Yields at Water Survey of Canada Stream Gauging Stations with Regulated Flows



5.1.3.2 Water Quantity Results from Cliff Chromite Project

The Cliffs Chromite Project (Cliffs Ferroalloys, 2013a; 2013b) included site-specific field studies at the planned waterbody crossing locations along the Project route (described as the Community Access Road and intended to link the proposed mine site at the time with the main transportation grid via new and existing roads). These field studies included spot flow measurements at 67 of the proposed watercourse crossings over a wide range of catchment sizes (refer to **Figures 2.2.2-1A** through **2.2.2-1J** in **Attachment E**), noting that flow measurements were obtained in the fall of 2011 (a period of relatively low flow) and / or summer of 2012 (a period of mostly moderate flow). A summary of the results are as follows:

- The measured flow rates at select watercourse crossings in the fall of 2011 ranged from 6 to 233 litres per second (L/s); and
- The measured flow rates at select watercourse crossings in the summer of 2012 ranged from 4 to 2,206 L/s.

As expected, the measured flow rates were shown to be well-correlated to catchment size (i.e., flows increased with each incremental change in watershed area) and characteristic runoff conditions (i.e., flow rates were generally higher under wet weather conditions versus dry weather conditions).

5.1.4 Surface Water and Sediment Quality

A review of the Ministry of Environment, Conservation and Parks (2019) Provincial Water Quality Monitoring Network data catalogue on May 23, 2023, identified six water quality monitoring stations that are located within and surrounding the existing conditions Regional Study Area (as shown in **Figure 5-1**). These six stations are non-active; three stations were monitored in 1983 on two events, and three stations were monitored in 2009 on a single event. Details for each of the selected Provincial Water Quality Monitoring Network stations are presented in **Table 5-6**, while a summary of the historical water quality monitoring data is presented in **Table 5-7**, with detailed water quality results presented in **Table F-1** within **Attachment F – Surface Water Quality Within and Surrounding the Regional Study Area**.

In addition to the review of the Ministry of the Environment, Conservation and Park's water quality monitoring stations, water, and sediment quality records from the Cliffs Chromite Project (Cliffs Ferroalloys, 2013a; 2013b) were relied on to further characterize water and sediment quality conditions on a local and regional scale. This included water quality monitoring at 43 waterbody crossing stations and sediment quality monitoring at 38 waterbody crossing locations (as shown in **Figure 2.2.2-1** in **Attachment E**). Details of the Cliffs water and sediment quality monitoring results are also presented in **Attachment E**.

Water quality parameters are compared to standards, objectives, and guidelines from the *Ontario Ministry of Environment and Energy - Provincial Water Quality Objectives* (Ministry of Environment and Energy, 1994), *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines* (Ontario Ministry of the Environment, 2003), and the *Canadian Water Quality Guidelines (Freshwater) for the Protection of Aquatic Life* (Canadian Council of Ministers of the Environment, 1999b). The sediment quality parameters are compared to *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life* (Canadian Council of Ministers of the Environment, 1999a), and *Ontario Provincial Sediment Quality Guidelines* (Ministry of Environment and Energy, 1993).

5.1.4.1 Within the Existing Conditions Regional Study Area

5.1.4.1.1 Upper Albany – Makokibatan Watershed – Station 19005300102: Albany River near Nottick Island Station

The available water quality records at Provincial Water Quality Monitoring Network station 19005300102 were limited to a single sampling event (obtained in May 1983) for select metals (e.g., total aluminum, cadmium, copper, iron, and lead). All parameters met applicable water quality standards, objectives, and guidelines except for concentrations of cadmium and iron (i.e., 0.0005 and 0.31 milligrams per litre [mg/L], respectively), which exceeded the Provincial Water Quality Objectives.

5.1.4.1.2 Upper Albany – Muswabik Watershed – Station 19005300802: Albany River near Hill Island

The available water quality records at Provincial Water Quality Monitoring Network station 19005300802 were limited to a single sampling event (obtained in July 2009) for temperature, pH, alkalinity, conductivity, chloride, nitrate, nitrite, dissolved oxygen, and select metals (e.g., total aluminum, cadmium, copper, iron, and lead). All parameters met applicable water quality standards, objectives, and guidelines.

5.1.4.2 Outside of the Existing Conditions Regional Study Area

5.1.4.2.1 Little Current Watershed – Station 19005300202: Little Current River

The available water quality records at Provincial Water Quality Monitoring Network station 19005300202 included two sampling events in 1983: one in May and another in August. The samples were analyzed for pH, alkalinity, conductivity, chloride, phosphorus, nitrate, nitrite, sulphate, turbidity, and select metals (e.g., total aluminum, cadmium, copper, iron, and lead). General chemistry for the sampling events included pH of 7.8, alkalinity of 66 mg/L, and turbidity of 1.4 nephelometric turbidity units. The water quality results (presented as mean values for the two sampling events) met applicable water quality standards, objectives, and guidelines except for concentrations of cadmium (i.e., 0.0005 mg/L), which exceeded the Provincial Water Quality Objective of 0.0002 mg/L.

5.1.4.2.2 Upper Ogoki Watershed - Station 19005300402: Ogoki River

The available water quality records at Provincial Water Quality Monitoring Network station 19005300402 included two sampling events in 1983: one in May and another in September. The samples were tested for pH, alkalinity, conductivity, chloride, phosphorous, nitrate, nitrite, sulphate, turbidity, and select metals (e.g., total aluminum, cadmium, copper, iron, and lead). General chemistry for the sampling events included pH of 7.1, alkalinity of 16 mg/L, and turbidity of 0.45 nephelometric turbidity units. The water quality results (presented as mean values for the two sampling events) met applicable water quality standards, objectives and guidelines except for concentrations of cadmium (i.e., 0.0006 mg/L), which exceeded the Provincial Water Quality Objective of 0.0002 mg/L.

5.1.4.2.3 Albany - Mouth Watershed - Station 19005300702: Albany River at Comb Island

The available water quality records at Provincial Water Quality Monitoring Network station 19005300702 were limited to a single sampling event (obtained in July 2009) for temperature, pH, alkalinity, conductivity, chloride, nitrate, nitrite, dissolved oxygen, and select metals (e.g., total aluminum, cadmium, copper, iron, and lead). General chemistry for the sampling events included pH of 7.8 and alkalinity of 41 mg/L. All parameters met applicable water quality standards, objectives, and guidelines except for concentrations of cadmium (i.e., 0.0010 mg/L), which exceeded the Provincial Water Quality Objective of 0.0002 mg/L.

5.1.4.2.4 Lower Kenogami Watershed - Station 19005300902: Kenogami River at Coltman Island

The available water quality records at Provincial Water Quality Monitoring Network station 19005300902 were limited to a single sampling event (obtained in July 2009) for temperature, pH, alkalinity, conductivity, chloride, nitrate, nitrite, dissolved oxygen, and select metals (e.g., total aluminum, cadmium, copper, iron, and lead). All parameters met applicable water quality standards, objectives, and guidelines.

5.1.4.3 Water and Sediment Quality Monitoring for Cliffs Chromite Project

With reference to **Figure 2.2.2-1** in **Attachment E**, monitoring data for the Cliffs Chromite Project were available from 2011 and 2012 and included water quality data at 43 waterbody crossing locations and sediment quality data at 38 waterbody crossing locations, noting the following:

- With some exceptions, water and sediment quality results at each waterbody crossing location included two rounds of sampling (one in summer and another in fall); and
- Water and sediment quality monitoring locations were sited along the then-proposed Community Access Road route as well as the area of a proposed Cavell Transload Facility (Cliffs, 2013a) and, in the case of the sampling locations along the Community Access Road (with the Anaconda Road / Painter Lake Road section at the south end of the road alignment representing the existing portion of road), included a total of 8 locations at “Major Water Crossings” (permanent crossings greater than 40 m in width) and 30 locations at “Minor Water Crossings” (permanent crossings less than 40 m in width).

The key results from the Cliffs water quality monitoring program were extracted from the Cliffs Water and Sediment Quality Technical Supporting Document Part 2 (Cliffs Ferroalloys, 2013b) and are tabulated in the following bullet points, noting that the detailed results are presented in **Attachment E**:

- Measured field pH values were shown to be slightly acidic to alkaline, noting that 10% of the measurements did not meet the *Ontario Drinking Water Standards*, Objectives and Guidelines and *Provincial Water Quality Objective* criteria range (6.5 to 8.5), while 5% did not meet the Canadian Council of Ministers of the Environment criteria (i.e., *Water Quality Guidelines for the Protection of Aquatic Life*) range (6.5 to 9). Most of the recorded pH values that did not meet criteria were collected in the fall of 2011. Measurements that were below criteria were generally closer to the Mine Site, whereas measurements above criteria were along Anaconda Road / Painter Lake Road and at the Cavell Transload Facility. Generally, samples from Anaconda Road / Painter Lake Road and near the proposed Cavell Transload Facility area were more alkaline than samples from the major and minor water crossings along the new portion of the (Cliffs) Community Access Road;

- Total iron concentrations were greater than the Ontario Drinking Water Quality Standards (*Canadian Water Quality Guidelines for the Protection of Aquatic Life*), and Provincial Water Quality Objective criteria (all with values of 0.3 mg/L) in 30% of the samples, with a calculated average of 0.27 mg/L. Generally, total iron concentrations were greater in the summer samples collected from the minor water crossings than in the remaining samples. Total iron concentrations were also higher along the new portion of the proposed Community Access Road as compared to the existing Anaconda Road / Painter Lake Road section, and near the proposed Cavell Transload Facility area;

- Total aluminum concentrations were greater than the *Ontario Drinking Water Quality Standards*, Canadian Council of Ministers of the Environment and *Provincial Water Quality Objective* criteria in 13%, 18%, and 26% of the samples, respectively, with a calculated average of 0.055 mg/L. Generally, total aluminum concentrations were slightly lower at the major and minor water crossings as compared to the samples collected near the proposed Cavell Transload Facility area;

- Total manganese concentrations were greater than the *Ontario Drinking Water Quality Standards* criterion (0.05 mg/L) in 19% of all samples, with a calculated average of 0.06 mg/L. Generally, total manganese concentrations were greater at the minor water crossings in the summer than in the remaining samples;

- Dissolved organic carbon concentrations were greater than the *Ontario Drinking Water Quality Standards* criterion (5 mg/L) in 96% of the samples, with a calculated average of 12.5 mg/L. Generally, dissolved organic carbon concentrations were lower at the Cavell Transload Facility as compared to the major and minor water crossings;

- Hardness concentrations were below the lower *Ontario Drinking Water Quality Standards* criterion (80 mg/L [as calcium carbonate]) and above the upper *Ontario Drinking Water Quality Standards* criterion (100 mg/L [as calcium carbonate] in 68% and 10% of samples, respectively, with a calculated average of 69.6 mg/L [as calcium carbonate]). Generally, hardness varied over a larger range of values in the minor and major water crossings as compared to the area near the proposed Cavell Transload Facility;

- Alkalinity concentrations were below the lower *Ontario Drinking Water Quality Standards* criterion (30 mg/L [as calcium carbonate]) in 6% of the samples, with a calculated average of 63 mg/L as calcium carbonate. Generally, alkalinity varied over a larger range of values in the minor and major water crossings as compared to the proposed Cavell Transload Facility area;
- Phenol concentrations were greater than the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (0.004 mg/L) and *Provincial Water Quality Objective* (0.005 mg/L) criteria in 13% and 10% of the samples, respectively, with a calculated average of 0.0023 mg/L. Phenol concentrations were greater in the fall of 2011 along Anaconda Road / Painter Lake Road and at the proposed Cavell Transload Facility area than in the remaining samples;
- Dissolved oxygen measured in the field concentrations were below the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (greater than 5.5 mg/L) and *Provincial Water Quality Objective* (greater than 4 mg/L) criteria in 11% and 6% of the samples, respectively, with a calculated average of 8.1 mg/L. Generally, dissolved oxygen concentrations were lower in the summer samples than the fall samples. Dissolved oxygen concentrations were also lower along the proposed Community Access Road as compared to the Anaconda Road / Painter Lake Road segment and near the proposed Cavell Transload Facility area;
- Phosphorus concentrations were greater than the *Provincial Water Quality Objective* criterion (0.03 mg/L for rivers and streams, 0.02 mg/L for lakes) in 8% of the samples, with a calculated average of 0.012 mg/L. Average total phosphorus concentrations in surface water correspond to mesotrophic type water (i.e., a moderate amount of plant nutrients, such as nitrogen or phosphorus are available) as defined by the Canadian Council of Ministers of the Environment guidelines. There were no substantial seasonal or geographical trends in phosphorus concentrations;
- Total cadmium, cobalt, hexavalent chromium, copper, lead, selenium, zinc, nitrite, E. coli, turbidity, and polycyclic aromatic hydrocarbon concentrations were greater than their respective criteria on one to three occurrences;
- Hexavalent chromium concentrations were generally below the detection limit (of 0.001 mg/L), except for two occurrences (0.001 mg/L near the proposed Cavell Transload Facility area and 0.0011 mg/L along the proposed Community Access Road), which were at and slightly greater than the Canadian Council of Ministers of the Environment and *Provincial Water Quality Objective* criteria and detection limit of 0.001 mg/L. Total chromium concentrations were mostly below the detection limit, with the exception of five detected concentrations along the Community Access Road (existing and new portions) and at the proposed Cavell Transload Facility area. All total chromium concentrations were below the *Ontario Drinking Water Quality Standards*; and

- Mercury and methylmercury concentrations were generally detectable, but values were below their respective criteria (*Ontario Drinking Water Quality Standards* 0.001 mg/L, Canadian Council of Ministers of the Environment 0.000026 mg/L, and *Provincial Water Quality Objective* 0.0002 mg/L for total mercury; and Canadian Council of Ministers of the Environment 0.000004 mg/L for methylmercury) in all samples. The maximum acceptable concentration of mercury (including methylmercury) for human consumption in drinking water has been established at 0.001 mg/L, as indicated by Health Canada (1979). This maximum acceptable concentration is based on epidemiological studies and includes a safety factor (i.e., 10x) to prevent neurological symptoms associated with a mercury ingestion.

The key results from the sediment quality monitoring program were extracted from the *Cliffs Water and Sediment Quality Technical Supporting Document Part 2* (Cliffs Ferroalloys, 2013b) and are tabulated in the following bullet points, noting that the detailed results are presented in **Attachment E**:

- Sediment substrate along Anaconda Road, Painter Lake Road, and the proposed new portion of the (Cliffs) road alignment south of the Ogoki River was shown to be predominantly composed of sand, noting that the overburden geology in these areas is generally bedrock or glaciomarine deposits. Substrate north of the Ogoki River to the Mine Site demonstrated variable conditions, interchanging between silt, silt loam, sandy loam, and sand (Schaetzl & Anderson, 2005) and generally corresponding with the organic, till, and glaciofluvial deposits that dominate the overburden geology;
- Total organic carbon was greater than the *Ontario Provincial Sediment Quality Guidelines* lowest effect level (1%) and severe effect level (10%) criteria in 68% and 6% of the samples, respectively, with a calculated average of 4% for all samples collected. The *Ontario Provincial Sediment Quality Guidelines* acknowledge that in areas of high natural organic matter content, such as wetlands, the local background levels would serve as the practical lower limit (Fletcher, Welsh, & Fletcher, 2008);
- The majority of metal concentrations were approximately twice those in sediment samples collected from the major and minor water crossings than those collected near the proposed Cavell Transload Facility sampling area. That said, metal concentrations were variable along the Community Access Road alignment and described as follows*:*
    - Chromium concentrations were greater than the Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* (37.3 milligrams per kilogram [mg/kg]) and *Ontario Provincial Sediment Quality Guidelines* lowest effect level (26 mg/kg) criteria in 3% and 30% of the samples, respectively, with calculated average concentrations of 23.7 mg/kg at the major and minor water crossings and 13.2 mg/kg at the proposed Cavell Transload Facility area.
    - Manganese concentrations were greater than the *Ontario Provincial Sediment Quality Guidelines* lowest effect level (460 mg/kg) and *Ontario Provincial Sediment Quality Guidelines* severe effect level (1,100 mg/kg) criteria in 27% and 7% of the

samples, respectively, with calculated average concentrations of 524 mg/kg at the major and minor water crossings and 125 mg/kg at the proposed Cavell Transload Facility area.

- Nickel concentrations were greater than the *Ontario Provincial Sediment Quality Guidelines* lowest effect level criterion (16 mg/kg) in 16% of the samples, with calculated average concentrations of 12.6 mg/kg at the major and minor water crossings and 7.0 mg/kg at the proposed Cavell Transload Facility area.
- Iron concentrations were greater than the *Ontario Provincial Sediment Quality Guidelines* lowest effect level criterion (20,000 mg/kg) in 14% of the samples, with calculated average concentrations of 14,872 mg/kg at the major and minor water crossings and 7,657 mg/kg at the proposed Cavell Transload Facility area.
- Copper concentrations were greater than the Canadian Council of Ministers of the Environment probable effect level (197 mg/kg); *Ontario Provincial Sediment Quality Guidelines* severe effect level (110 mg/kg); Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* (35.7 mg/kg); and *Ontario Provincial Sediment Quality Guidelines* lowest effect level (16 mg/kg) criteria in 3%, 5%, 5%, and 9% of the samples, respectively. The calculated average copper concentrations were 9.5 mg/kg at the major and minor water crossings and 39 mg/kg at the proposed Cavell Transload Facility area.
- Arsenic, cadmium, lead, and zinc concentrations were greater than their respective criteria on one to three occurrences.

- Polycyclic aromatic hydrocarbon concentrations were mostly below their respective detection limits. However, four sample locations had at least one polycyclic aromatic hydrocarbon concentration that was greater than at least one criterion;
- 2-Methylnaphthalene was greater than Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* criterion (0.0202 mg/kg) observed at WC42 (Attawapiskat River). 2-Methylnaphthalene is a natural component of crude oil and coal and is found in pyrolysis and combustion products such as cigarette and wood smoke, emissions from combustion engines, asphalt, coal tar residues, and used oils (Agency for Toxic Substances and Disease Registry, 1995) (Hazardous Substances Data Bank, 2013);
- Acenaphthene (Canadian Council of Ministers of the Environment probable effect level and *Interim Sediment Quality Guideline* criteria of 0.0889 and 0.00671 mg/kg, respectively); fluorene (Canadian Council of Ministers of the Environment probable effect level and *Interim Sediment Quality Guideline* , *Ontario Provincial Sediment Quality Guidelines* lowest effect level and severe effect level criteria of 0.33 and 0.144 mg/kg, and 0.00019 and 0.096 mg/kg, respectively); 2-Methylnaphthalene (Canadian Council of Ministers of the Environment probable effect level and *Interim Sediment Quality Guideline* criteria of 0.201 and 0.0202 mg/kg, respectively); naphthalene (Canadian Council of Ministers of the Environment probable effect level and *Interim Sediment Quality Guideline* criteria 0.391 and 0.0346 mg/kg, respectively);

and phenanthrene criteria (Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* and *Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.0419 and 0.00056 mg/kg, respectively); and all present in coal tar (Hazardous Substances Data Bank, 2013), were greater than at least one of their respective criteria, observed at AWC2 (located approximately 12 km north of the Cavell Transload Facility);

- Fluoranthene (*Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00075 mg/kg and severe effect level criteria of 0.0055 mg/kg based on sample total organic carbon) and pyrene (Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* criteria of 0.053 mg/kg, *Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00049 mg/kg and *Ontario Provincial Sediment Quality Guidelines* severe effect level criteria of 0.0046 mg/kg based on sample total organic carbon), both present in coal tar (Hazardous Substances Data Bank, 2013), were greater than at least one of their respective criteria, observed at a sample location adjacent to the Cavell Transload Facility (i.e., sample labelled TRSLD #1, which is located at the crossing of Canadian National's transcontinental rail line and the Kawashkagama River); and

- These polycyclic aromatic hydrocarbons may be associated with creosote treatment of the rail lines (Brooks, 2004) and benz(a)anthracene (Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* criteria of 0.0317 mg/kg, *Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00032 mg/kg and *Ontario Provincial Sediment Quality Guidelines* severe effect level criteria of 0.014 mg/kg, based on sample total organic carbon); benzo(a)pyrene (Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* criteria of 0.0319 mg/kg, *Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00024 mg/kg and *Ontario Provincial Sediment Quality Guidelines* severe effect level criteria of 0.013 mg/kg, based on sample total organic carbon); benzo(b)fluoranthene (*Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00017 mg/kg and severe effect level criteria of 0.003 mg/kg, based on sample total organic carbon); benzo(g,h,i)perylene (*Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00037 mg/kg and severe effect level criteria of 0.014 mg/kg, based on sample total organic carbon); chrysene (Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* criteria of 0.0571 mg/kg, *Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00034 mg/kg and *Ontario Provincial Sediment Quality Guidelines* severe effect level criteria of 0.0044 mg/kg, based on sample total organic carbon); fluoranthene (*Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00075 mg/kg and severe effect level criteria of 0.0097 mg/kg based on sample total organic carbon, and Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* criterion of 0.111 mg/kg); indeno(1,2,3-cd)pyrene (*Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.0002 mg/kg and severe effect level criteria of 0.003 mg/kg, based on sample total organic carbon); phenanthrene (*Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00056 mg/kg and severe effect level criteria of 0.009 mg/kg, based on

sample total organic carbon); and pyrene (Canadian Council of Ministers of the Environment *Interim Sediment Quality Guideline* criteria of 0.053 mg/kg, *Ontario Provincial Sediment Quality Guidelines* lowest effect level criteria of 0.00049 mg/kg and *Ontario Provincial Sediment Quality Guidelines* severe effect level criteria of 0.0081 mg/kg based on sample total organic carbon) (all typically resulting from incomplete combustion of organic matter, including of fossil fuels; HSDB 2013) were greater than at least one of their respective criteria, at a sample location adjacent to the Cavell Transload Facility (i.e., sample labelled TRSLD #5, which is located on Wawong Lake approximately 1 km north of the Cavell Transload Facility and the Aroland First Nation community).

Table 5-6: Provincial Water Quality Monitoring Network Stations Within and Surrounding the Existing Conditions Regional Study Area

Station ID	Tertiary Watershed	Station Name	Latitude °N	Longitude °W	Available Record	No. of Samples	Location	Status
19005300102	**Upper Albany – Makokibatan**	Albany River near Nottick Island Station	-86.3929	51.65119	1983	1	Nottick Island	Inactive
19005300202	**Little Current**	Little Current River	-86.515	50.66097	1983	2	Percy Lake	Inactive
19005300402	**Upper Ogoki**	Ogoki River	-88.85	50.93178	1983	2	Upstream of Whiteclay Lake	Inactive
19005300702	**Albany – Mouth**	Albany River at Comb Island	-84.3277	51.23392	2009	1	Comb Island	Inactive
19005300802	**Upper Albany – Muswabik**	Albany River near Hill Island	-84.5915	51.12277	2009	1	Hill Island	Inactive
19005300902	**Lower Kenogami**	Kenogami River at Coltman Island	-84.3621	51.133	2009	1	Coltman Island	Inactive

° = degree; N = north; W = west.

Table 5-7: Surface Water Quality Within and Surrounding the Existing Conditions Regional Study Area

Parameter	Units	Guideline	Albany River near Nottick Island Station	Little Current River	Ogoki River	Albany River at Comb Island	Albany River at Hill Island	Kenogami River at Coltman Island
		Value or Range	Station ID 19005300102	Station ID 19005300202	Station ID 19005300402	Station ID 19005300702	Station ID 19005300802	Station ID 19005300902
			Value	Mean[a]	Mean[a]	Value	Value	Value
Temperature	°C	N/A[b]	N/A	N/A	N/A	19.2	20.0	20.0
pH	N/A	6.5-8.5[c]	N/A	7.80	7.1	7.80	7.78	7.77
Alkalinity	mg (as $CaCO_3$)/L	30-500[d]	N/A	66	**16**	41	40	47
Conductivity (25°C)	µS/cm	N/A[b]	N/A	132	40	78	78	94
Chloride	mg/L	120[m]	N/A	0.2	0.3	0.4	0.4	0.7
Phosphorus	mg/L	Variable[c][f]	N/A	0.0190	0.009	N/A	N/A	N/A
Nitrate	mg/L	3.0[m][h]	N/A	0.01	N/A	0.01	0.01	0.01
Nitrite	mg/L	0.060[m][h]	N/A	0.003	N/A	0.003	0.003	0.005
Sulphate	mg/L	500[e]	N/A	1.8	2.5	N/A	N/A	N/A
Turbidity	Nephelometric turbidity units	5[g][j]	N/A	1.4	0.5	N/A	N/A	N/A
Dissolved oxygen	mg/L	Variable [m][n]	N/A	N/A	N/A	9.26	9.50	9.47
Total hardness	mg/L	N/A[b]	N/A	75	16	43	43	53
Total aluminum[k]	mg/L	0.075 [c][o]	0.0600	0.0580	0.0300	0.0705	0.0678	**0.1040**
Total cadmium[k]	mg/L	0.0002[c]	**0.0005**	**0.0005**	**0.0006**	**0.0010**	0.0001	-0.0001
Total copper[k]	mg/L	0.005[c]	0.0010	0.0015	0.0020	0.0005	0.0008	0.0008
Total iron[k]	mg/L	0.3[c][i]	**0.310**	0.155	0.094	0.187	0.191	0.244
Total lead[k]	mg/L	Variable[c][l]	0.0030	**0.0035**	**0.005**	-0.0044	-0.0034	0.0010
Total mercury[k]	µg/L	0.026[m]	0.010	**0.04**	**0.028**	N/A	N/A	N/A

Notes:
Bold values indicate exceedances of applicable guidelines, standards, and objectives.
(a) Based on the arithmetic mean of the data presented in the Provincial (Stream) Water Quality Monitoring Network dataset for select stations.
(b) No applicable guideline, standard, or objective value available for select parameter.
(c) *Ontario Ministry of Environment and Energy – Provincial Water Quality Objectives* (Ministry of Energy and Environment, 1999).
(d) *Operational guideline detailed in the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines* (Ontario Ministry of the Environment, 2003).
(e) Aesthetic object detailed in the *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines* (Ontario Ministry of the Environment, 2003).
(f) *Interim Provincial Water Quality Objectives* identify that the following phosphorus concentrations should be considered as general guidelines and should be supplemented by site-specific studies, including the following: 1) To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L; 2) A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less. This should apply to all lakes naturally below this value; and 3) Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 µg/L.
(g) Maximum Acceptable Concentration detailed in the *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines* (Ontario Ministry of the Environment, 2003).
(h) Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen).
(i) *Canadian Water Quality Guideline, Water Quality (Freshwater) for the Protection of Aquatic Life* (Canadian Council of Ministers of the Environment, 1999a).
(j) Applicable for all waters at the point of consumption.
(k) Values reported for unfiltered samples.
(l) *Interim Provincial Water Quality Objectives* for total lead are dependent on hardness. Hardness at the Ogoki River station (ID #19005300402) was 16 mg/L and therefore the lead *Interim Provincial Water Quality Objective* is 0.001 mg/L. Average hardness at the remaining stations is between 43 and 75 mg/L, except for the Albany River at Nottick Island station (ID #19005300102), which was not assessed for hardness and therefore the lead *Interim Provincial Water Quality Objective* is 0.003 mg/L for these select stations.
(m) Long-term concentration value presented in the *Canadian Water Quality Guideline, Water Quality (Freshwater) for the Protection of Aquatic Life* (Canadian Council of Ministers of the Environment, 1999a).
(n) *Water Quality (Freshwater) Guidelines for the Protection of Aquatic Life* sources identifies the lowest acceptable dissolved oxygen concentration for the following conditions: 1) For warm water biota (i.e., salmonid fish communities), early life stages = 6.0 mg/L; 2) For warm water biota, other life stages = 5.5 mg/L; 3) For cold water biota (i.e., centrarchid fish communities), early life stages = 9.5 mg/L; 4) For cold water biota, other life stages = 6.5 mg/L.
(o) *Interim Provincial Water Quality Objectives* identify that the following aluminum concentrations should be considered as general guidelines and should be supplemented by site-specific studies, including the following: 1) At pH 4.5 to 5.5 the *Interim Provincial Water Quality Objective* is 15 µg/L based on inorganic monomeric aluminum measured in clay-free samples; 2) At pH >5.5 to 6.5, no condition should be permitted which would increase the acid soluble inorganic aluminum concentration in clay-free samples to more than 10% above natural background concentrations for waters representative of that geological area of the province that are unaffected by human-made inputs; and 3) At pH >6.5 to 9.0, the *Interim Provincial Water Quality Objective* is 75 µg/L based on total aluminum measured in clay-free samples. Note that pH values of <6.5 and >8.5 are outside the range considered acceptable by the *Interim Provincial Water Quality Objectives* for pH.
mg/L = milligrams per litre; mg (as $CaCO_3$)/L = milligrams as calcium carbonate per litre; N/A = not applicable; µg/L = micrograms per litre; µS/cm = microsiemens per centimetre; > = greater than; < = less than; °C = degree Celsius.

5.1.5 Summary of Desktop Analysis

The key findings of the desktop analysis of existing surface water conditions included the following:

- **Watershed and river system characteristics**—The Project was shown to cross three tertiary watersheds (4GD-Upper Albany – Makokibatan, 4GE-Lower Ogoki, and 4GF-Upper Albany – Muswabik) that comprised 91 defined waterbody crossing locations. These waterbodies included catchment areas that ranged from approximately less than 1 to 18,350 km² and generally drained to the east or north (ultimately discharging to James Bay). The surficial geology of the watersheds was dominated by organic deposits with instances of glaciolacustrine deposits, glaciofluvial deposits, till, and bedrock, while land cover in the catchments was characterized by mostly treed and moderate relief (ranging on average from 215 to 260 m);
- **Surface water use**—There were no active Permits to Take Water within or near the aquatics existing conditions Local Study Area or existing conditions Regional Study Area (based on Ministry of the Environment, Conservation and Parks) at the time of the desktop review. Similarly, no active hydropower generating stations were shown to be located within the existing conditions Local Study Area or existing conditions Regional Study Area (according to publicly available mapping, Ontario Power Generation reports, and hydro network datasets). It is expected that local communities rely on surface water sources for potable and recreational purposes;
- **Surface water yield and seasonal distribution**—Surface water flows and water levels from the available hydrometric monitoring records at locations within and slightly outside of the existing conditions Regional Study Area were shown to be largely controlled by snowmelt- and rainfall-generated runoff patterns. The spring and fall hydrographs for these stations were typically characterized by high flows in response to the annual snowmelt event in April-May and rainfall-generated runoff in October-November, while hydrographs during the summer and winter months were marked by mostly low to moderate flows (due to comparatively dry or frozen conditions). Mean annual surface water yields varied from 122 to 384 mm based on data from Ontario Watershed Information Tool and Water Survey of Canada; and
- **Surface water and sediment quality**—Surface water and sediment quality results from the available monitoring records at locations within and slightly outside of the existing conditions Regional Study Area (including the available water quality monitoring results from the Provincial Water Quality Monitoring Network Stations and samples collected as part of the Cliffs Chromite Project) were shown to generally satisfy the relevant guideline values, noting that the concentrations of some metals (e.g., aluminum at the Kenogami River at Coltman Island station, cadmium at the Ogoki River and Albany River at Comb Island stations, iron at the Albany River near Nottick Island station, and lead and mercury at the Little Current River and Ogoki River stations for water and chromium, manganese, and nickel for sediment samples collected for the Cliffs Chromite Project) were elevated likely due to natural background conditions at certain locations, while the concentrations of several other parameters (including

methylmercury, polycyclic aromatic hydrocarbons / hydrocarbons, and hexavalent chromium) were at or below laboratory detection limits. Turbidity ranged from 0.49 to 7.50 nephelometric turbidity units, while pH generally demonstrated slightly acidic to alkaline conditions.

5.2 Field Investigation

The surface water quantity and quality results from the field investigations are described here and include a summary of site-specific observations and measurements from a total of 55 potential waterbody crossing locations (i.e., the subset of potential waterbody crossings that were visited / assessed as part of the ground-based field surveys). The detailed results (including hydrological, hydraulic, and geomorphic characteristics) from the field surveys are presented in **Attachment D**, water quality sample results are presented in **Tables F-2** through **F5** within **Attachment F**, sediment quality results are presented in **Attachment F**, and detailed field data sheets are presented in **Attachment H – Field Data Sheets** and include, where applicable, concurrent results from the Cliffs Chromite Project (where survey locations from the Marten Falls Community Access Road route alternatives overlapped with survey locations from the Cliffs Chromite Project). In addition, photographs of each of the surveyed waterbody crossings are provided on the field data sheets in **Attachment H**, while the completed Rapid Geomorphic Assessment forms for these same crossing locations are presented in **Attachment I – Rapid Geomorphic Assessments**. In instances where waterbody crossing locations were surveyed in multiple seasons or years, an additional Rapid Geomorphic Assessment form was completed at the same crossing location.

In general, the expected waterbody crossing locations ranged from first to fourth order stream systems, with catchment areas that varied from approximately less than 1 km^2 to greater than 18,000 km^2 and land cover that is characterized primarily by forested and / or fen / bog terrain. A first to fourth order stream system classifies streams based on the hierarchy of their tributaries. First-order streams are the smallest, with no tributaries flowing into them. When two first-order streams merge, they form a second-order stream. When two second-order streams join, they create a third-order stream, and two third-order streams form a fourth-order stream. Of the 55 potential waterbody crossing locations that were visited between 2020 and 2022 as part of the ground-based field surveys (including multiple visits at a majority of the 55 locations), 50 were deemed as watercourses and 5 as lakes / ponds. Thirteen of the waterbodies had small watersheds (less than 10 km^2), 34 had medium watersheds (between 10 and 1,000 km^2), and 8 had large watersheds (greater than 1,000 km^2). The waterbody types and catchment sizes were used to organize and structure the summary of the surface water quantity and quality results.

Where applicable, the seasonal or inter-annual variations in surface water quantity and quality parameters (in instances where crossing locations were revisited over multiple seasons or years) are also presented, with the understanding that the runoff conditions at the time of each field survey event were generally as follows:

- September 2019 – Moderate flow conditions;
- October 2020 – Moderate flow conditions;
- September 2021 – Moderate flow conditions;
- June 2022 – Moderate to high flow conditions; and
- August 2022 – Low flow conditions.

5.2.1 Surface Water Hydrology

A summary of the key surface water quantity results follows.

- Measured bankfull geometry at the watercourse locations included the following ranges by catchment size, noting that the channel conditions at these watercourse crossing locations were generally moderately to well defined:
    - **Small Watersheds**—Bankfull widths of less than 1 to 9 m and bankfull depths of 0.3 to 1.7 m.
    - **Medium Watersheds**— Bankfull widths of 2.3 to approximately 40 m and bankfull depths of 0.5 to 3 m.
    - **Large Watersheds**—Bankfull widths of 43 to approximately 210 m and bankfull depths of 2 m or greater, noting that the measurement of a maximum channel depth at some of the crossing locations was not possible due to safety reasons.
- Measured wetted geometry at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
    - **Small Watersheds**—Wetted widths and wetted depths of 1 to 6 m and 0.2 and 1.2 m, respectively, under moderate to high flows (in spring or fall) and corresponding wetted geometry of 1.2 to 1.5 m and 0.2 to 0.9 m, respectively, under summer low flows.
    - **Medium Watersheds**—Wetted widths and wetted depths of 2.3 to 43 m and 0.4 to 2 m, respectively, under moderate to high flows (in spring or fall) and corresponding wetted geometry of 3.5 to 90 m and 0.3 to 1.7 m, respectively, under summer low flows.
    - **Large Watersheds**—Wetted widths of 31 to 200 m under moderate to high flows (in spring or fall) and wetted widths of 32 to 60 m under summer low flows, noting that

the measurement of wetted depths at most of the crossing locations was not possible due to safety reasons.

- Measured spot flow measurements at select watercourse locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—Spot flow measurements of 2 to 90 L/s under moderate to high flows (in spring or fall) and 1 to 51 L/s under summer low flows.
  - **Medium Watersheds**—Spot flow measurements of 19.8 to 7,639 L/s under moderate to high flows (in spring or fall) and 6 to 669 L/s under summer low flows.
  - **Large Watersheds**—A single spot flow measurement of 1,098 L/s under moderate to high flows (in spring or fall), noting that spot flow measurements at most of the crossing locations was not possible due to safety reasons.

Note that continuous flows at each waterbody crossing were not recorded during field investigations. Characteristic daily data hydrographs at small, medium, and large watersheds can be obtaining using flow records at Water Survey of Canada gauge stations in the vicinity of the Project Local Study Area. **Section 5.1.3.1** provides details about Water Survey of Canada stations within Approximately 100 Kilometres of the Aquatics Existing Conditions Local Study Area. **Figure 5-5** and **Figure 6-6** present prorated daily hydrographs at crossings located in Albany River and Ogoki River watershed with small, medium and large watersheds using data at Albany River above Nottick Island station (04GD001) and Little Current River at Percy Lake (04JF001) respectively.

Figure 5-5: Prorated Hydrographs at Crossings located in Albany River Watershed with Small, Medium, and Large Watersheds

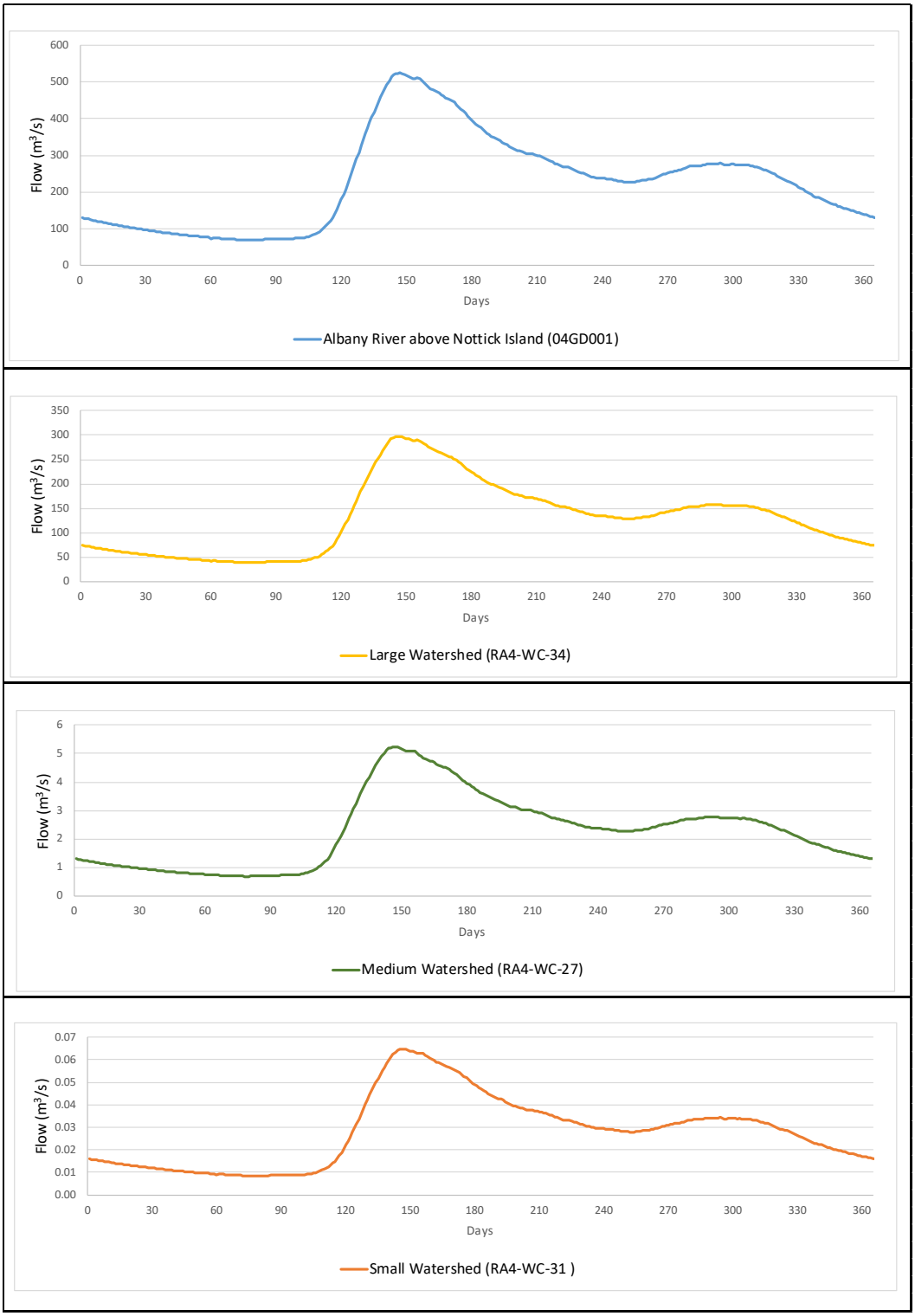
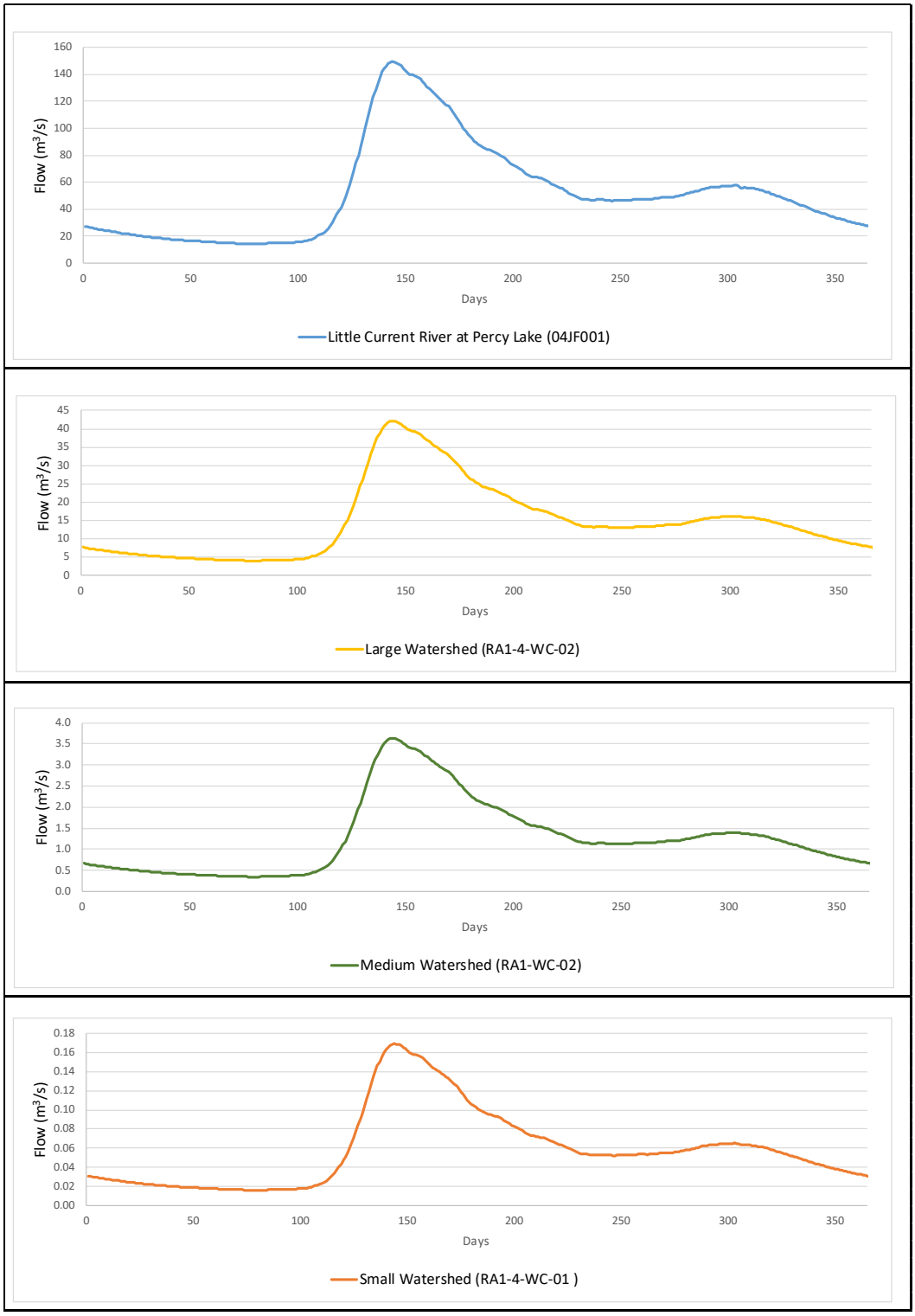


Figure 5-6: Prorated Hydrographs at Crossings located in Ogoki River Watershed with Small, Medium, and Large Watersheds



- Rapid Geomorphic Assessments scores at select watercourse locations included the following results by catchment scale, noting that, with few exceptions, the channels at the watercourse crossing locations included limited evidence of erosion–sedimentation processes (i.e., the bed and banks of the channels were generally stable with, in some instances, examples of minor bank erosion, bed aggradation, and planform adjustment):
    - **Small Watersheds**—Stable conditions at six crossing locations and transitional or stressed conditions at four locations.
    - **Medium Watersheds**—Stable conditions at 18 crossing locations and transitional or stressed conditions at 11 locations.
    - **Large Watersheds**—Stable conditions at all six crossing locations.
- Observed channel sinuosity at the watercourse locations included the following observations by catchment scale, noting that the relative descriptors of “low sinuosity” and “moderate to high sinuosity” correspond to sinuosity values of less than 1.2 and 1.2 to 2.0, respectively:
    - **Small Watersheds**—Low sinuosity at 15 crossing locations and moderate to high sinuosity at 3 crossing locations.
    - **Medium Watersheds**—Low sinuosity at 26 crossing locations and moderate to high sinuosity at 17 crossing locations.
    - **Large Watersheds**—Low sinuosity at nine crossing locations and moderate to high sinuosity at 2 crossing locations.
- Observed channel slopes at the watercourse locations included generally “low” channel slopes (identified here as slopes that vary between 0.2% to 2.0%) for all catchment scales.

Overall, the results of the surface water hydrology aspects of the field investigations demonstrated that the watercourses at the waterbody crossing locations were generally characterized by moderately to well-defined channels (with bankfull geometry ranging from less than 1 to 9 m, 2.3 to 40 m, and 43 to 210 m at small, medium and large watersheds, respectively) that cut across broad tracts of bog and fen terrain. These channels included mostly low sinuosity, low channel slopes (0.2% to 2.0%), and limited evidence of erosion–sedimentation processes (i.e., the bed and banks of the channels were generally stable with, in some instances, examples of minor bank erosion, bed aggradation, and planform adjustment). As expected, the observed bankfull and wetted geometry of the channels, as well as the measured flow rates on a seasonal scale, were well-correlated to catchment size (i.e., channel geometry and flows increased with each incremental change in watershed area). In addition, a review of the results from the current field investigations with the associated results from Cliffs Chromite Project, presented in **Attachment E**, showed that, where concurrent results / observations were available at crossing locations, the physical conditions at the watercourses remained largely consistent.

5.2.2 Surface Water and Sediment Quality

The key surface water quality results of field investigations are outlined in the following bullet points below, with detailed results found in **Attachment F**:

- Lab-tested total suspended solids at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—2 to 20 mg/L under moderate to high flows (in spring or fall) and 1 to 3 mg/L under summer low flows.
  - **Medium Watersheds**—1 to 27 mg/L under moderate to high flows (in spring or fall) and 1 to 4 mg/L under summer low flows.
  - **Large Watersheds**—2 to 4 mg/L under moderate to high flows (in spring or fall) and 1 to 3 mg/L under summer low flows.
- Field measured turbidity values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—0 to 9.12 nephelometric turbidity units under moderate to high flows (in spring or fall) and 0 to 5.40 nephelometric turbidity units under summer low flows.
  - **Medium Watersheds**—0 to 27.91 nephelometric turbidity units under moderate to high flows (in spring or fall) and 0 to 7.3 nephelometric turbidity units under summer low flows (of note a measured turbidity value of 88 nephelometric turbidity units at one crossing under summer low flows was deemed to be an outlier).
  - **Large Watersheds**—0 to 33.10 nephelometric turbidity units under moderate to high flows (in spring or fall) and 0 to 0.6 nephelometric turbidity units under summer low flows.
- Field measured pH values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—6.72 to 7.90 under moderate to high flows (in spring or fall) and 6.35 to 7.88 under summer low flows.
  - **Medium Watersheds**—6.45 to 7.63 under moderate to high flows (in spring or fall) and 6.66 to 7.54 under summer low flows.
  - **Large Watersheds**—7.29 to 7.68 under moderate to high flows (in spring or fall) and 7.53 to 7.65 under summer low flows.

- Field measured dissolved oxygen values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—7.07 to 12.15 mg/L under moderate to high flows (in spring or fall) and 4.01 to 10.51 mg/L under summer low flows.
  - **Medium Watersheds**—2.48 to 14.47 mg/L under moderate to high flows (in spring or fall) and 3.24 to 10.73 mg/L under summer low flows.
  - **Large Watersheds**—7.89 to 14.6 mg/L under moderate to high flows (in spring or fall) and 8.34 to 9.45 mg/L under summer low flows.
- Lab-tested alkalinity values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—5.1 to 120 mg/L as calcium carbonate under moderate to high flows (in spring or fall) and 4 to 140 mg/L as calcium carbonate under summer low flows.
  - **Medium Watersheds**—7.8 to 54 mg/L as calcium carbonate under moderate to high flows (in spring or fall) and 9.7 to 58 mg/L as calcium carbonate under summer low flows.
  - **Large Watersheds**—24 to 55 mg/L as calcium carbonate under moderate to high flows (in spring or fall) and 36 to 41 mg/L as calcium carbonate under summer low flows.
- Lab-tested total aluminum values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—9.90 to 150 micrograms per litre (µg/L) under moderate to high flows (in spring or fall) and 12 to 180 µg/L under summer low flows.
  - **Medium Watersheds**—20 to 250 µg/L under moderate to high flows (in spring or fall) and 33 to 150 µg/L under summer low flows.
  - **Large Watersheds**—25 to 120 µg/L under moderate to high flows (in spring or fall) and 29 to 40 µg/L under summer low flows.
- Lab-tested total iron concentrations at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale, noting that iron concentrations at 19 of the crossing locations were shown to be elevated relative to Ontario Drinking Water Standards, Provincial Water Quality Objective, and / or Canadian Council of the Ministers of the Environment (five of which included elevated values under multiple sampling events):
  - **Small Watersheds**—110 to 360 µg/L under moderate to high flows (in spring or fall) and 170 to 580 µg/L under summer low flows.

- **Medium Watersheds**—100 to 900 µg/L under moderate to high flows (in spring or fall) and 150 to 1,200 µg/L under summer low flows.
- **Large Watersheds**—100 to 310 µg/L under moderate to high flows (in spring or fall) and 120 to 300 µg/L under summer low flows.

- Lab-tested total manganese concentrations at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale noting that manganese concentrations at seven of the crossing locations were shown to be elevated relative to Ontario Drinking Water Standards and / or Canadian Council of the Ministers of the Environment (two of which included elevated values under multiple sampling events):
  - **Small Watersheds**—2.50 to 65 µg/L under moderate to high flows (in spring or fall) and 5 to 100 µg/L under summer low flows.
  - **Medium Watersheds**—2.60 to 92 µg/L under moderate to high flows (in spring or fall) and 6.90 to 270 µg/L under summer low flows.
  - **Large Watersheds**—8.50 to 35 µg/L under moderate to high flows (in spring or fall) and 20 to 38 µg/L under summer low flows.
- Lab-tested total phosphorus values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
  - **Small Watersheds**—0.005 to 0.068 µg/L under moderate to high flows (in spring or fall) and 0.006 to 0.078 µg/L under summer low flows.
  - **Medium Watersheds**—0.006 to 0.031 µg/L under moderate to high flows (in spring or fall) and 0.004 to 0.023 µg/L under summer low flows.
  - **Large Watersheds**—0.010 to 0.016 µg/L under moderate to high flows (in spring or fall) and 0.008 to 0.012 µg/L under summer low flows.
- Lab-tested concentrations of total cadmium, chromium, cobalt, copper, lead, nickel, and zinc at the combined watercourse and lake locations were all at or below laboratory detection limits and hence satisfied all relevant water quality criteria, with the exception of the observed copper concentrations at one crossing location (value of 2.4 µg/L at a large watershed);
- Lab-tested concentrations of total calcium (with an observed range of 2,700 to 37,000 µg/L), total magnesium (370 to 6,200 µg/L), and total potassium (290 to 410 µg/L) at the combined watercourse and lake locations were in general shown to be naturally abundant and characteristically under low flow conditions at the smaller watershed size, noting that Ontario Drinking Water Standards, Provincial Water Quality Objectives, and Canadian Council for the Ministers of the Environment guidelines do not exist for these identified parameters;

- Lab-tested concentrations of the radionuclide parameters (i.e., lead-210, radium-226, polonium-210, and thorium-230 – sampled / tested at five watercourse crossing locations) were all at or below laboratory detection limits and hence satisfied all relevant water quality criteria;
- Lab-tested total methylmercury values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
    - **Small Watersheds**—less than 0.05 ng/L under summer low flows (no water quality results were available under moderate to high flows).
    - **Medium Watersheds**—less than 0.05 to 0.08 ng/L under summer low flows (no water quality results were available under moderate to high flows). Values that were above detection were also above the Canadian Council of Ministers of the Environment guideline for long-term protection of aquatic life (0.004 µg/L).
    - **Large Watersheds**—less than 0.05 ng/L under summer low flows (no water quality results were available under moderate to high flows).
- Lab-tested dissolved organic carbon values at the combined watercourse and lake locations included the following ranges by catchment scale and seasonal / inter-annual scale:
    - **Small Watersheds**—13 to 33 mg/L under moderate to high flows (in spring or fall) and 14 to 42 mg/L under summer low flows.
    - **Medium Watersheds**—16 to 37 mg/L under moderate to high flows (in spring or fall) and 19 to 30 mg/L under summer low flows.
    - **Large Watersheds**—13 to 24 mg/L under moderate to high flows (in spring or fall) and 15 to 21 mg/L under summer low flows.

The key sediment quality results of field investigations are summarized below and detailed in **Attachment G – Sediment Quality Data**, noting that, from the observed results of the physical testing (i.e., grain size distribution and water content), the sampled material throughout the watercourses and lakes in the existing conditions study area was generally characterized as fine to coarse sand:

- Lab-tested total Kjeldahl nitrogen concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that observed total Kjeldahl nitrogen concentrations at 29 of the crossing locations were shown to be elevated relative to lowest effect levels for Provincial Sediment Quality Guidelines, while 20 of these same samples were shown to be elevated relative to severe effect levels for Provincial Sediment Quality Guidelines:
    - **Small Watersheds**—479 to 19,900 micrograms per gram (µg/g).
    - **Medium Watersheds**—344 to 17,000 µg/g.

- **Large Watersheds**—139 to 3,310 µg/g.

- Lab-tested acid extractable arsenic concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed concentrations at all of the sampled crossing locations were shown to be below the Canadian Council of Ministers of the Environment and Provincial Sediment Quality Guidelines:
  - **Small Watersheds**—less than 1.00 to 3.90 µg/L.
  - **Medium Watersheds**—less than 1.00 to 5.80 µg/L.
  - **Large Watersheds**—less than 1.00 to 1.30 µg/L.
- Lab-tested acid extractable cadmium concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed cadmium concentrations at three of the crossing locations (all located within medium watershed areas) were shown to be elevated relative to lowest effect levels for *Provincial Sediment Quality Guidelines* (i.e., 0.6 µg/L):
  - **Small Watersheds**—less than 0.10 to 0.40 µg/L.
  - **Medium Watersheds**—less than 0.10 to 1.10 µg/L.
  - **Large Watersheds**—less than 0.10 to 0.15 µg/L.
- Lab-tested acid extractable chromium measurements at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed chromium concentrations at ten of the crossing locations (located within small and medium watershed areas) were shown to be elevated relative to lowest effect levels for *Provincial Sediment Quality Guidelines* (i.e., 26 µg/L):
  - **Small Watersheds**—7.30 to 58 µg/L.
  - **Medium Watersheds**—12 to 48 µg/L.
  - **Large Watersheds**—13 to 17 µg/L.
- Lab-tested acid extractable copper concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed copper concentrations at two of the crossing locations (located within a small and medium watershed areas) were shown to be elevated relative to lowest effect levels for *Provincial Sediment Quality Guidelines* (i.e., 16 µg/L):
  - **Small Watersheds**—0.99 to 19 µg/L.
  - **Medium Watersheds**—1.40 to 17 µg/L.
  - **Large Watersheds**—3.00 to 4.40 µg/L.

- Lab-tested acid extractable lead concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed concentrations at all of the sampled crossing locations were shown to be below the Canadian Council of the Ministers of the Environment and *Provincial Sediment Quality Guidelines*:
  - **Small Watersheds**—less than 3.30 to 13 µg/L.
  - **Medium Watersheds**—less than 2.60 to 13 µg/L.
  - **Large Watersheds**—less than 2.00 to 4.40 µg/L.
- Lab-tested acid extractable manganese concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed manganese concentrations at seven of the crossing locations (located within small and medium watershed areas) were shown to be elevated relative to lowest effect levels for *Provincial Sediment Quality Guidelines* (i.e., 460 µg/L):
  - **Small Watersheds**—66 to 1,300 µg/L.
  - **Medium Watersheds**—150 to 1,100 µg/L.
  - **Large Watersheds**—89 to 170 µg/L.
- Lab-tested acid extractable mercury concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that, with the exception of one crossing location, the observed mercury concentrations at all crossings were shown to satisfy the *Canadian Council of the Ministers of the Environment Interim Sediment Quality Guideline* (0.17 µg/L):
  - **Small Watersheds**—less than 0.05 to 0.11 µg/L.
  - **Medium Watersheds**—less than 0.05 to 0.18 µg/L.
  - **Large Watersheds**—less than 0.05 µg/L.
- Lab-tested acid extractable nickel concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed nickel concentrations at seven of the crossing locations (located within small and medium watershed areas) were shown to be elevated relative to lowest effect levels for *Provincial Sediment Quality Guidelines* (i.e., 16 µg/L):
  - **Small Watersheds**—4.20 to 35 µg/L.
  - **Medium Watersheds**—6.50 to 25 µg/L.
  - **Large Watersheds**—7.5 to 9.3 µg/L.

- Lab-tested acid extractable phosphorus concentrations at the combined watercourse and lake locations included the following ranges by catchment scale, noting that the observed phosphorus concentrations at eight of the crossing locations (located within two watershed areas: Lower Ogoki and Upper Albany Makokibatan) were shown to be elevated relative to lowest effect levels for *Provincial Sediment Quality Guidelines* (i.e., 600 mg/L):
  - **Small Watersheds**—380 to 710 mg/L.
  - **Medium Watersheds**—270 to 900 mg/L.
  - **Large Watersheds**—340 to 650 mg/L.
- Lab-tested concentrations of acid extractable aluminum (with a sample range of 3,000 to 22,000 µg/L), calcium (2,900 to 48,000 µg/L), iron (4,400 to 34,000 µg/L), magnesium (1,400 to 12,000 µg/L), and potassium (240 to 3,500 µg/L), showed naturally abundant concentrations.

The results of the surface water and sediment quality aspects of the field investigations demonstrated that, with some exceptions, the lakes and watercourses at the waterbody crossing locations generally satisfied the full suite of relevant water and sediment quality guidelines. However, for water quality, the observed concentrations of iron, manganese, and methylmercury at one or more waterbody crossing locations were elevated relative to *Ontario Drinking Water Standards*, *Provincial Water Quality Objectives*, and / or Canadian Council of the Ministers of the Environment, while, for sediment quality, the observed concentrations of total Kjeldahl nitrogen, chromium, iron, manganese, mercury, nickel, and phosphorus at one or more waterbody crossing locations were elevated relative to Canadian Council of the Ministers of the Environment and / or *Provincial Sediment Quality Guidelines*. The water and sediment quality results for most parameters varied little with catchment scale (i.e., concentrations were similar across the small, medium, and large-scale watersheds), but parameter concentrations for water quality varied markedly with flow at the time of the sampling, with higher concentrations of several of the metals under summer low flows (versus under moderate to high flows in spring and fall). In addition, a review of the water and sediment results from the current field investigations with the associated results from Cliffs Chromite Project, presented in **Attachment E**, demonstrated that, where concurrent results or observations were available at crossing locations, the water and sediment quality conditions at the watercourses were largely consistent.

5.2.3 Field Investigations Summary

The key findings of the field investigations component of the existing surface water conditions included the following, noting that of the 55 potential waterbody crossing locations that were visited between 2020 and 2022 (including multiple visits at a majority of the 55 locations) as part of the ground-based field surveys, 13 fall into the category of a small-sized watershed (less than 10 km^2), 34 fall into the category of a medium-sized watershed (between 10 km^2 and 1,000 km^2), and eight fall into the category of a large-sized watershed (greater than 1,000 km^2):

- **Surface water quantity**—The results of the surface water hydrology aspects of the field investigations demonstrated that the watercourses at the waterbody crossing locations were generally characterized by moderately to well-defined channels (with bankfull geometry ranging from less than 1 to 9 m, 2.3 to 40 m, and 43 to 210 m at small, medium, and large watersheds, respectively) that cut across broad tracts of bog and fen terrain. These channels included mostly low sinuosity, low channel slopes (0.2% to 2.0%), and limited evidence of erosion–sedimentation processes (i.e., the bed and banks of the channels were generally stable with, in some instances, examples of minor bank erosion, bed aggradation, and planform adjustment). As expected, the bankfull and wetted geometry of the channels, as well as the seasonal flow rates, were well-correlated to catchment size (i.e., channel geometry and flows increased with each incremental change in watershed area). In addition, a review of the results from the current field investigations with the associated results from the Cliffs Chromite Project showed that, where concurrent results / observations were available at crossing locations, the physical conditions at the watercourses remained largely consistent; and

- **Surface water and sediment quality**—The results of the surface water and sediment quality aspects of the field investigations demonstrated that, with some exceptions, the lakes and watercourses at the waterbody crossing locations generally met applicable water and sediment quality guidelines, standards, and objectives. However, for water quality, the observed concentrations of iron, manganese, and methylmercury at one or more waterbody crossing locations were elevated relative to *Ontario Drinking Water Standards*, *Provincial Water Quality Objectives*, and / or Canadian Council of the Ministers of the Environment, while, for sediment quality, the observed concentrations of total Kjeldahl nitrogen, chromium, iron, manganese, mercury, nickel, and phosphorus at one or more waterbody crossing locations were elevated relative to Canadian Council of the Ministers of the Environment and / or *Provincial Sediment Quality Guidelines*. The water and sediment quality results for most parameters varied little with catchment scale (i.e., concentrations were similar across the small-, medium-, and large-scale watersheds), but parameter concentrations for water quality varied markedly with flow at the time of the sampling, with higher concentrations of several of the metals under summer low flows (versus under moderate to high flows in spring and fall). In addition, a review of the water and sediment results from the current field investigations with the associated results from Cliffs Chromite Project demonstrated that, where concurrent results / observations were available at crossing locations, the water and sediment quality conditions at the watercourses remained largely consistent.

6 Selection of the Preferred Route

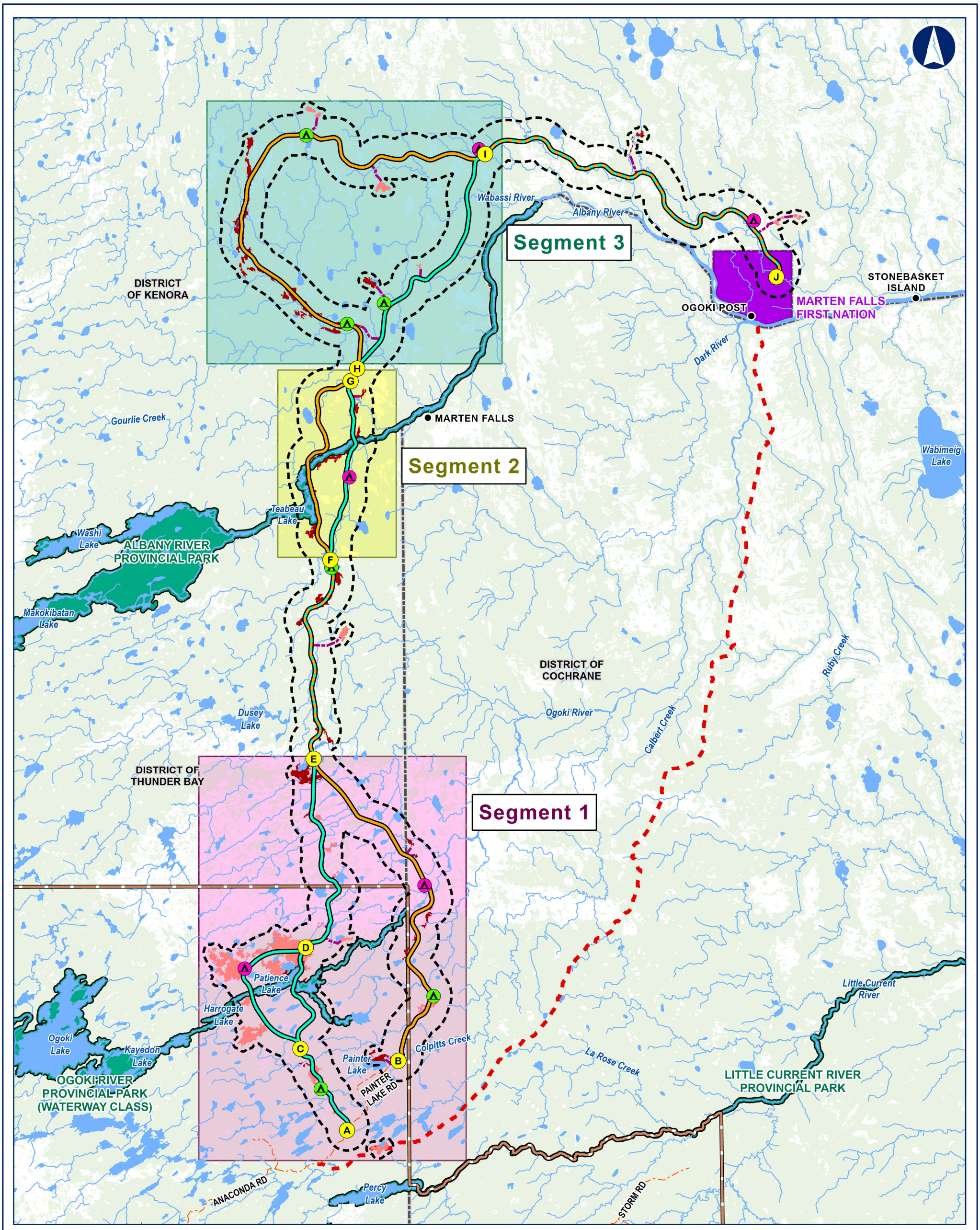
Following the collection of existing conditions information on the study areas described in **Section 5**, the Project Team undertook an exercise to select a Preferred Route. The methodology and detailed results of this exercise are described in the *Environmental Assessment / Impact Statement Report* and are summarized at a high level in **Section 6.1**. The Preferred Route includes the footprint of any temporary features such as pits and quarries, temporary access roads, and worker camps associated with the construction of that route. The effects assessment will be completed using the identified Preferred Route.

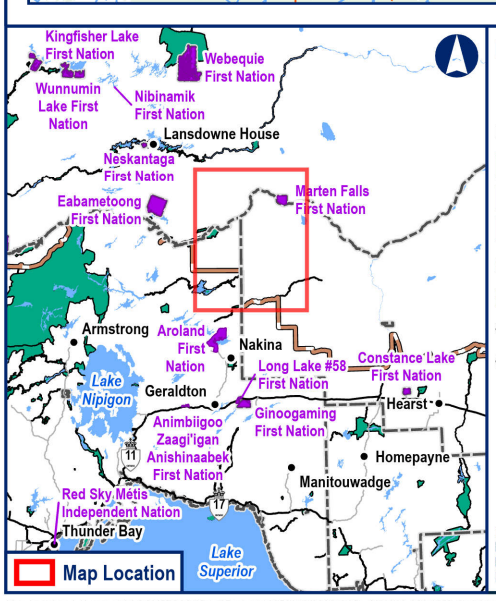
6.1 Alternative Segments and Routes Within Each Segment

To simplify the evaluation of the alternatives, the alternatives were divided into three separate segments based on their geographical locations as shown in **Figure 6-1**. The segments were determined so that any alternative route in one segment could connect with any alternative route in the next segment, allowing for decisions to be made based on the environment in each segment and not based on the whole. This approach considers the variable environmental conditions within the Project area, allowing for flexibility to avoid sensitive natural features encountered within the Construction Disturbance Area for each segment instead of requiring decision makers to balance trade-offs of one long route versus the other.

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Route Alternatives and Segments





Legend

- Segment Node
- Project Study Area
- Segment 1
- Segment 2
- Segment 3

Construction Disturbance Area

Route Alternatives (100 m Right-of-Way)

- Alternative 1
- Alternative 4

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10 m Width)

Potential Aggregate Source

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10 m Width)

General Features

- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary
- Far North Boundary
- Provincial Park

Data Source:
Base Data: Provided by MNRF 2023; Route Infrastructure - Provided by AECOM 2021. Contains Information licensed under the Government Licence Ontario.

Notes:
First Nation Reserves of MFFN CAR Neighboring Indigenous Communities are shown within the inset extent.

0 5 10 20
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

January 2026 | 1:450,000 * when printed 11"x17"

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Figure 6-1

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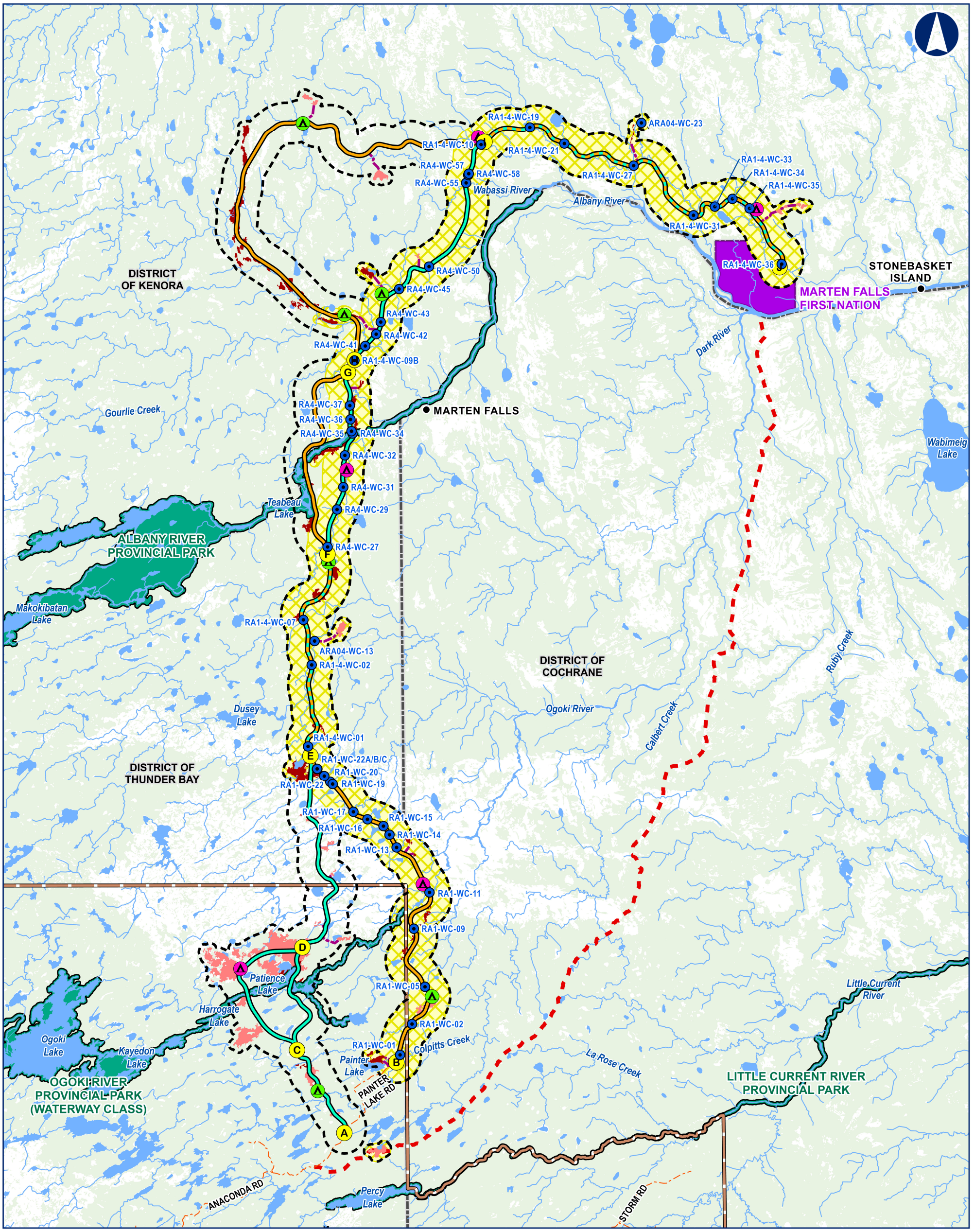
6.2 Preferred Route

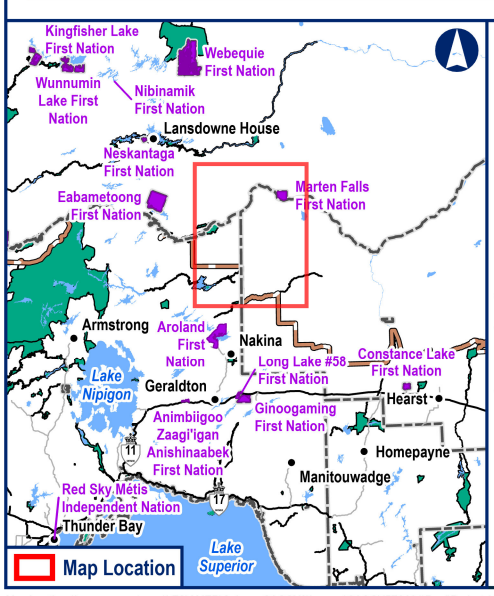
The selection of the Preferred Route within each segment involved a thorough analysis of technical, economic, natural, social, and cultural factors. The route alternative evaluation considered the potential effects and standard or known mitigation approaches to determine the net positive or negative effects of each alternative; it was completed using the reasoned argument (trade-off) method. The reasoned argument method qualitatively compares the advantages and disadvantages of each alternative including the relative significance of the potential residual effects.

After completing the steps outlined in the previous paragraph, following direction from the community of Marten Falls First Nation and Aroland First Nation, and collecting input from the public and regulators, the Proponent identified a Preferred Route alignment for each segment.

- Segment 1 – Ogoki Crossing: Alternative 1;
- Segment 2 – Albany Crossing: Alternative 4; and
- Segment 3 – North of the Albany: Alternative 4.

The combination of segments 1, 2 and 3 create the final Preferred Route as shown in **Figure 6-2**.





Legend

- Water Crossing
- Segment Node (A)
- Project Study Area
- Final Route Recommendation

Construction Disturbance Area

Route Alternatives (100 m Right-of-Way)

- Alternative 1
- Alternative 4

N/A

- Alternative 1 and Alternative 4

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

Potential Aggregate Source

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10 m Width)

General Features

- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary
- Far North Boundary
- Provincial Park

Data Source:
Base Data: Provided by MNRF 2023; Route Infrastructure - Provided by AECOM 2021. Contains Information licensed under the Government Licence Ontario.

Notes:
First Nation Reserves of MFFN CAR Neighboring Indigenous Communities are shown within the inset extent.

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Final Route Recommendation

0 5 10 20
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

January 2026 | 1:450,000 * when printed 11"x17"

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Figure 6-2

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7 Residual Effects Assessment

Effects assessment results are provided for the Preferred Route, with consideration of the temporal boundaries of the Project as described in **Section 4.2**. This includes the potential effects (positive and negative), mitigation and enhancement measures, and an assessment of residual effects.

7.1 Summary of Project Components and Existing Environment

A summary of surface water existing conditions within both Local and Regional Study Areas of the Preferred Route is provided in **Table 7-1**. A total of 45 waterbodies are crossed by the Preferred Route, including the Dusey (RA1-4-WC-02), Buffaloskin (RA1-4-WC-31), Ogoki (RA1-WC-05 and RA1-WC-11), Albany (RA4-WC-34), and Wabassi (*Wabihzii Wih Ziibih*) (RA4-WC-55) rivers, and 24 defined waterbodies are crossed by the temporary aggregate access roads. Each of the 45 waterbody crossings along the Preferred Route will have permanent waterbody crossing structures installed, including 13 culverts, 22 clear span bridges, and 10 multi-span bridges (**Table 7-2**). For temporary access roads, there will be 24 temporary waterbody crossings, including six culverts, 12 clear span bridges, and six multi-span bridges (**Table 7-4**). Specific crossing types that have been proposed may change during detailed design, after hydraulic models have been completed for each respective crossing location. A summary of the proposed crossing structures for permanent and temporary routes is provided in **Table 7-4**.

Table 7-1: Summary of Existing Conditions

Valued Component	Indicators	Measures of Change	Summary of Existing Conditions
Surface Water Quantity	■ Changes in drainage patterns ■ Changes in flow ■ Changes in water levels ■ Changes in channel hydraulics ■ Changes in channel stability or erosion–sedimentation processes	■ Potential effects have been measured quantitatively and / or qualitatively as a possible change in streamflows, water levels, cross-section hydraulics, erosion, and sedimentation processes in waterbodies as well as overall drainage patterns within the both the local and Regional Study Areas.	■ Surface water flows and water levels from the available hydrometric monitoring records at locations within and slightly outside of the Regional Study Area were shown to be largely controlled by snowmelt- and rainfall-generated runoff patterns. The spring and fall hydrographs for these stations were typically characterized by high flows in response to the annual snowmelt event in April-May and rainfall-generated runoff in October-November, while hydrographs during the summer and winter months were marked by mostly low to moderate flows (due to comparatively dry or frozen conditions). Mean annual surface water yields varied from 122 to 384 mm based on data retrieved from Ontario Watershed Information Tool and Water Survey of Canada. Detailed results of the hydrologic study can be found in **Section 5.1.3**. ■ The results of the surface water hydrology aspects of the field investigations demonstrated that the watercourses at the waterbody crossing locations along the Preferred Route and route alternatives were generally characterized by moderately to well-defined channels (with bankfull geometry ranging from less than 1 to 9 m, 2.3 to 40 m, and 43 to 210 m at small, medium, and large watersheds, respectively) that cut across broad tracts of bog and fen terrain. These channels included mostly low sinuosity, low channel slopes (0.2% to 2.0%), and limited evidence of erosion–sedimentation processes (i.e., the bed and banks of the channels were generally stable with, in some instances, examples of minor bank erosion, bed aggradation, and planform adjustment). As expected, the bankfull and wetted geometry of the channels, as well as the seasonal flow rates, were well-correlated to catchment size (i.e., channel geometry and flows increased with each incremental change in watershed area). In addition, a review of the results from the current field investigations combined with the results from the previously completed Cliffs Chromite Project showed that, where concurrent results / observations were available at crossing locations, the physical conditions at the watercourses remained largely consistent. Detailed results of the surface water quantity field investigation can be found in **Section 5.2.1.** ■ There were no active Permits to Take Water within or near the aquatics Local Study Area or Regional Study Area (based on Ministry of the Environment, Conservation and Parks records) at the time of the desktop review. Similarly, no active hydropower generating stations were shown to be located within the Local Study Area or Regional Study Area (according to publicly available mapping, Ontario Power Generation reports, and hydro network datasets). It is expected that local communities rely on surface water sources for potable and recreational purposes. Detailed results of the surface water use can be found in **Section 5.1.2**. ■ Surface water and sediment quality results from the available monitoring records at locations within and slightly outside of the Regional Study Area (including the available water quality monitoring results from the Provincial Water Quality Monitoring Network Stations and samples collected as part of the previously completed Cliffs Chromite Project) were shown to generally satisfy the relevant guideline values, noting that the concentrations of some metals (e.g., aluminum at the Kenogami River at Coltman Island station, cadmium at the Ogoki River and Albany River at Comb Island stations, iron at the Albany River near Nottick Island station, and lead and mercury at the Little Current River and Ogoki River stations for water and chromium, manganese, and nickel for sediment samples collected for the Cliffs Chromite Project) were elevated likely due to natural background conditions at certain locations, while the concentrations of several other parameters (including methylmercury, polycyclic aromatic hydrocarbons / hydrocarbons, and hexavalent chromium) were at or below laboratory detection limits. Turbidity ranged from 0.49 to 7.50 nephelometric turbidity units, while pH generally demonstrated slightly acidic to alkaline conditions. Detailed results of the surface water and sediment quality can be found in **Section 5.1.4**. ■ The results of the surface water and sediment quality aspects of the field investigations demonstrated that, with some exceptions, the lakes and watercourses at the waterbody crossing locations generally met applicable water and sediment quality guidelines, standards and objectives. That said, water quality concentrations of iron and manganese at several of the waterbody crossing locations exceeded *Ontario Drinking Water Standards, Provincial Water Quality Objective*, and / or *Water Quality Guidelines for the Protection of Aquatic Life*. Sediment quality concentrations of total Kjeldahl nitrogen, chromium, iron, manganese, nickel, and phosphorus at a number of the waterbody crossings exceeded *Water Quality Guidelines for the Protection of Aquatic Life* and / or *Provincial Sediment Quality Guidelines*. The water and sediment quality results for most parameters varied little with catchment scale (i.e., concentrations were similar across the small-, medium-, and large-scale watersheds), but parameter concentrations for water quality varied markedly with flow at the time of the sampling, with higher concentrations of several of the metals during summer low flows (versus under moderate to high flows in spring and fall). In addition, a review of the water and sediment results from the current field investigations with the associated results from previously completed Cliffs Chromite Project demonstrated that, where concurrent results / observations were available at crossing locations, the water and sediment quality conditions at the watercourses remained largely consistent. Detailed results of the surface water and sediment quality field investigation can be found in **Section 5.2.2.**
Surface Water Quality	■ Change in physical parameters of water ■ Change in chemical parameters of water	■ Potential effects have been measured quantitatively and / or qualitatively as an increase to concentrations of suspended solids or chemical constituents in receiving waters within both local and Regional Study Areas.	
Sediment Quality	■ Change in physical and chemical characteristics of sediment	■ Potential effects are measured quantitatively and / or qualitatively as an increase to concentrations of suspended solids or chemical constituents in lake and riverbed sediment deposits within the study areas.	

mm = millimetre; m = metre; % = percent.

Table 7-2: Existing Conditions of Permanent Water Crossing Locations Along the Preferred Route

Water Crossing ID	Name of Watercourse / Waterbody	Mean Wetted Width (m)	Mean Bankfull Width (m)	Mean Water Depth (m)	Bed Substrate	General Channel Characteristics of Field Visited Sites	Geological or Biophysical Controls on Channel Form	Approx. Drainage Area (km²)	Category of Water-shed Size	Measured Flow Rate (L/s)	Prorated low and high Flows (L/s)[a]				Proposed Crossing Structure[e]
											7Q20	25-Year	50-Year	100-Year	
RA1-4-WC-01	Unnamed	1.3	3	0.7	Or, Si	Large permanent watercourse with poorly defined bed and banks, moderately stable channel conditions (i.e., densely vegetated); wide bankfull with incised channel in the middle	Bedrock or Alluvial-Type Influences	6	Small	31	7.7	364.8	402.8	439.6	Culvert
RA1-4-WC-02	Dusey River	34.7	44	1.3	Co, Bo, Gr, Sa, Si	Large permanent watercourse with well-defined bed and banks, notable entrenchment, and moderately stable channel conditions (i.e., densely vegetated with some evidence of slumping)	Bedrock or Alluvial-Type Influences	1,494	Large	1,098	1916.8	90846.2	100297.9	109450.4	Multi-Span Bridge
RA1-4-WC-07	Unnamed	6	12	1.5	Or	Medium permanent watercourse with moderately defined bed and banks and mostly incised and braided channels, grassy wetted riparian area	Peat / Bog Influenced	23	Medium	977	29.5	1398.6	1544.1	1685.0	Multi-Span Bridge
RA1-4-WC-09B	Unnamed	3	6	-[b]	Or, Si	-[b]	-[b]	27	Medium	-[b]	25.8	868.8	956.2	1043.0	Clear Span Bridge
RA1-4-WC-10	Unnamed	6	6	1.5	Or	Medium-sized permanent watercourse intersecting a fen / bog with moderately defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation)	Peat / Bog Influenced	55	Medium	-	52.6	1769.7	1947.8	2124.6	Clear Span Bridge
RA1-4-WC-19	Unnamed	35	27	1.5	Or	Large permanent watercourse with poorly defined bed and banks, unconfined, flooded, and mostly stable channel conditions between two waterbodies (i.e., densely vegetated through muskeg [*asabi'biiyaa / asabi'gama*]).	Peat / Bog Influenced	120	Medium	-[c]	114.8	3861.1	4249.7	4635.5	Multi-Span Bridge
RA1-4-WC-21	Unnamed	5.5	6	1.2	Or	Medium-sized permanent watercourse through muskeg, fairly defined bed and banks, little to no entrenchment (flooded to tree line), and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation)	Peat / Bog Influenced	20	Medium	-[c]	19.1	643.5	708.3	772.6	Multi-Span Bridge
RA1-4-WC-27	Unnamed	5	7	1	Or	-[b]	-[b]	135	Medium	-[b]	129.2	4343.8	4780.9	5214.9	Clear Span Bridge
RA1-4-WC-31	Buffaloskin River (Oji-Cree translation, *Majih Waayaan ih Ziibih*)	7	8	0.78	Or	-[b]	-[b]	239	Medium	-[b]	228.7	7690.1	8463.9	9232.3	Clear Span Bridge
RA1-4-WC-33	Unnamed	5.2 / 2.0	5.7	0.6 / 0.7	Or	Small permanent watercourse moderately defined banks, unconfined, and mostly stable channel conditions (i.e., densely vegetated with limited erosion)	Peat / Bog Influenced	3	Small	43	2.9	96.5	106.2	115.9	Clear Span Bridge
RA1-4-WC-34	Unnamed	20	25	-[b]	Or	-[b]	-[b]	81	Medium	-[b]	77.5	2606.3	2868.5	3128.9	Clear Span Bridge
RA1-4-WC-35	Unnamed	2.7	3.2	0.7	Or, Sa	Small permanent watercourse with poorly defined bed and banks, moderate entrenchment, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks)	Bedrock or Alluvial-Type Influences	15	Medium	166	14.4	482.6	531.2	579.4	Clear Span Bridge
RA1-4-WC-36	Unnamed	14.5	15.5	>2	-	Medium-sized permanent watercourse with moderately defined bed and steep banks, meandering and neutral, little to no entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation)	Peat / Bog Influenced	130	Medium	-[c]	124.4	4182.9	4603.8	5021.8	Clear Span Bridge
RA1-WC-01	Unnamed	4.75	5.5	0.5	Or, Bo, Co, Si, Sa	Medium-sized permanent watercourse with well-defined bed and banks, riffles in reach from cobbles and boulders, little to no entrenchment, stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation); upstream beaver dam restricting flow	Bedrock or Alluvial-Type Influences	31	Medium	51	39.8	1885.0	2081.1	2271.1	Clear Span Bridge
RA1-WC-02	Unnamed	8	8	1.3	Bo, Co, Si	Large-sized permanent watercourse with well-defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation)	Peat / Bog Influenced	129	Medium	1,126	165.5	7844.1	8660.3	9450.5	Clear Span Bridge
RA1-WC-05	Ogoki River	48	73	>1.5	Bo, Co, Gr, Sa	-[b]	-[b]	98	Medium	-[b]	125.7	5959.1	6579.1	7179.5	Multi-Span Bridge
RA1-WC-09	Unnamed	2.1	2.4	2.6	Or	Small permanent watercourse with well-defined bed and banks, moderate entrenchment, and stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation such as undercut banks)	Peat / Bog Influenced	6	Small	2	7.7	364.8	402.8	439.6	Culvert

Water Crossing ID	Name of Watercourse / Waterbody	Mean Wetted Width (m)	Mean Bankfull Width (m)	Mean Water Depth (m)	Bed Substrate	General Channel Characteristics of Field Visited Sites	Geological or Biophysical Controls on Channel Form	Approx. Drainage Area (km^2)	Category of Water-shed Size	Measured Flow Rate (L/s)	Prorated low and high Flows (L/s)[a]				Proposed Crossing Structure[e]
											7Q20	25-Year	50-Year	100-Year	
RA1-WC-11	Ogoki River	100	110	2	Co, Si, Or	Large permanent watercourse with well-defined bed and banks, little to no entrenchment and stable channel conditions (i.e., densely vegetated with bedrock and cobble substrates, some evidence of sedimentation from flooding)	Bedrock or Alluvial-Type Influences	2,535	Large	-[c]	3252.5	154146.7	170184.1	185714.1	Multi-Span Bridge
RA1-WC-13	Unnamed	9	9	-[b]	Co, Bo	-[b]	-[b]	191	Medium	-[b]	245.1	11614.2	12822.6	13992.7	Clear Span Bridge
RA1-WC-14	Unnamed	3	3.5	1.2	Or, Si	Small permanent watercourse with well-defined bed and banks, little to no entrenchment, and mostly stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation such as undercut banks)	Peat / Bog Influenced	6	Small	42	7.7	364.8	402.8	439.6	Clear Span Bridge
RA1-WC-15	Unnamed	22	4	-[b]	Or	-[b]	-[b]	8	Small	-[b]	10.3	486.5	537.1	586.1	Clear Span Bridge
RA1-WC-16	Unnamed	50/70	6.5	1.7	Or	Medium-sized permanent watercourse meandering, with poorly defined bed and banks, little to no entrenchment, and mostly stable incised channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation)	Peat / Bog Influenced	23	Medium	-[c]	29.5	1398.6	1544.1	1685.0	Clear Span Bridge
RA1-WC-17	Unnamed	9	10	0.9	Gr, Sa, Si, Co, Bo, Or	Medium-sized permanent watercourse with moderately defined bed and banks, some entrenchment, and moderately stable channel conditions (i.e., densely vegetated with some evidence of undercut banks)	Peat / Bog Influenced	119	Medium	669	152.7	7236.1	7988.9	8717.9	Clear Span Bridge
RA1-WC-19	Unnamed	20	2	1	Or, Si	-[b]	-[b]	6	Small	-[b]	7.7	364.8	402.8	439.6	Culvert
RA1-WC-20	Unnamed	2	2	<1	Or	-[b]	-[b]	-[d]	Small	-[b]	-	-	-	-	Culvert
RA1-WC-22	Unnamed	50	17	1	Or, Si	Medium-sized permanent watercourse with poorly defined bed and banks, little to no entrenchment (flooding into adjacent grass hummocks), and mostly stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation); large beaver dam present upstream with impoundment pond	Peat / Bog Influenced	63	Medium	-[c]	80.8	3830.9	4229.4	4615.4	Clear Span Bridge
RA1-WC-22A	Unnamed	1	2	N/A	Or, Si	-[b]	-[b]	<1	Small	-[b]	-	-	-	-	Culvert
RA1-WC-22B	Unnamed	1	2	N/A	Or, Si	-[b]	-[b]	<1	Small	-[b]	-	-	-	-	Culvert
RA1-WC-22C	Unnamed	1	2	N/A	Or, Si	-[b]	-[b]	<1	Small	-[b]	-	-	-	-	Culvert
RA4-WC-27	Unnamed	53	178	>1	Or	Large permanent watercourse; well defined bed and banks, stable channel conditions; flooded banks, lined with shrubs, surrounded by coniferous forests	Peat / Bog Influenced	323	Medium	-[c]	309.0	10392.9	11438.7	12477.1	Multi-Span Bridge
RA4-WC-29	Unnamed	8	8	<1	Or	-[b]	-[b]	13	Medium	-[b]	12.4	418.3	460.4	502.2	Culvert
RA4-WC-31	Unnamed	2.5	3	0.4	Sa, Co, Bo, Gr	Small permanent watercourse with moderately defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks)	Peat / Bog Influenced	4	Small	90	3.8	128.7	141.7	154.5	Culvert
RA4-WC-32	Unnamed	50	3	<1	Or	-[b]	-[b]	3	Small	-[b]	2.9	96.5	106.2	115.9	Clear Span Bridge
RA4-WC-34	Albany River	50	70	>2	Bo, Sa, Co, Gr	Large permanent watercourse with well-defined bed and banks, notable entrenchment and stable channel conditions (i.e., densely vegetated with boulders and cobbles some evidence of erosion)	Bedrock or Alluvial-Type Influences	18,361	Large	-	17567.6	590787.8	650236.7	709265.0	Multi-Span Bridge
RA4-WC-35	Unnamed	1.3	1.7	0.3	Gr, Si, Sa, Or	-[b]	-[b]	6	Small	-[b]	5.7	193.1	212.5	231.8	Culvert
RA4-WC-36	Unnamed	1	N/A	N/A	Or, Si	-[b]	-[b]	1	Small	-[b]	1.0	32.2	35.4	38.6	Culvert
RA4-WC-37	Unnamed	9	6	>1.5	Or, Si	-[b]	-[b]	1	Small	-[b]	1.0	32.2	35.4	38.6	Clear Span Bridge
RA4-WC-41	Gourlie Creek	31	34	1.5	Sa, Si	Large permanent watercourse with well defined bed and banks, notable entrenchment and mostly stable channel conditions (i.e., densely vegetated with silt and sand substrates)	Peat / Bog Influenced	956	Medium	-[c]	914.7	30760.5	33855.8	36929.2	Multi-Span Bridge
RA4-WC-42	Unnamed	4	6	0.9	Or, Si	Small deeply incised watercourse through muskeg, moderately defined bed and banks, little to no entrenchment with flooded banks, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks)	Peat / Bog Influenced	17	Medium	-[c]	16.3	547.0	602.0	656.7	Clear Span Bridge
RA4-WC-43	Unnamed	25	-[b]	<0.8	Or	-[b]	-[b]	2	Small	-[b]	1.9	64.4	70.8	77.3	Culvert
RA4-WC-45	Unnamed	7	10	1.1	Si, Or	Medium-sized permanent watercourse with a defined channel through muskeg, unconfined flooded bank, mostly stable channel conditions (i.e., densely vegetated)	Peat / Bog Influenced	26	Medium	-[c]	24.9	836.6	920.8	1004.4	Multi-Span Bridge
RA4-WC-50	Unnamed	1	2	N/A	Or	-[b]	-[b]	1	Small	-[b]	1.0	32.2	35.4	38.6	Culvert

Water Crossing ID	Name of Watercourse / Waterbody	Mean Wetted Width (m)	Mean Bankfull Width (m)	Mean Water Depth (m)	Bed Substrate	General Channel Characteristics of Field Visited Sites	Geological or Biophysical Controls on Channel Form	Approx. Drainage Area (km^2)	Category of Water-shed Size	Measured Flow Rate (L/s)	Prorated low and high Flows (L/s)[a]				Proposed Crossing Structure[e]
											7Q20	25-Year	50-Year	100-Year	
RA4-WC-55	Wabassi River (*Wabihzii Wih Ziibih*)	45	50	1.2	Sa, Co, Gr, Bo	Large permanent watercourse with well defined bed and banks, notable entrenchment and mostly stable channel conditions (i.e., densely vegetated with silt and sand substrates)	Bedrock or Alluvial-Type Influences	1,656	Large	-[c]	1584.4	53283.8	58645.6	63969.4	Multi-Span Bridge
RA4-WC-57	Unnamed	2	2	0.5	Or, Si, Sa, Bo	Small permanent watercourse with moderately defined bed and banks, little to no entrenchment (flooded banks), and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks); 95 m downstream of crossing, watercourse transitions to an undefined and braided channel	Peat / Bog Influenced	4	Small	68	3.8	128.7	141.7	154.5	Culvert
RA4-WC-58	Unnamed	5	15	0.8	Or	Medium-sized permanent watercourse with poorly defined bed and banks with little to moderate entrenchment (some areas of flooding), and stable channel conditions (i.e., densely vegetated with grasses and limited evidence of erosion and sedimentation)	Peat / Bog Influenced	14	Medium	-[c]	13.4	450.5	495.8	540.8	Culvert

Notes:

(a) Low flow (7Q20 - the minimum 7-day average flow with recurrence interval of 20 years) and high flows (25-, 50-, and 100-year flows with recurrence interval of 25, 50 and 100 years, respectively) are prorated flows. Waterbody crossing located within Albany River watershed were prorated based on flow data at Station 04GD001 (Albany River above Nottick Island), whereas waterbody crossings located within Ogoki River watershed were prorated based on flow data at Station 04JF001 (Little Current River at Percy Lake). These flows represent a high-level estimate; further analysis may be necessary to determine crossing-specific design flow values that fulfill all design and permitting requirements. Refer to Section 5.1.3 and Table 5-5 for details about water survey of Canada hydrometric gauges in the Local Study area and low and high flows analysis used for prorated flows.

(b) Blank values indicate that survey information was not collected at the select crossing location. Only a selection of the total number of water crossings were surveyed as part of the field reconnaissance program. Additionally, health and safety protocols prevented some crossing locations from being surveyed (e.g., water was too deep to measure, water current was too fast at the time of survey), which are indicated above.

(c) Not measured (unable to safely retrieve measurement due to deep water conditions).

(d) Ontario Watershed Information Tool (Ministry of Natural Resources and Forestry, 2022) could not calculate approximate drainage area.

(e) Proposed for the *Environmental Assessment / Impact Statement Report*; may change during detailed design. Crossing structure type will be primarily based on channel width.

Approx. = Approximately; Bo = boulder; Co = cobble; Gr = gravel; km^2 = square kilometre; L/s = litres per second; m = metre; Or = organics; RA = route alternative; Sa = sand; Si = silt; WC = water crossing; > = greater than; < = less than; N/A = not applicable.

Table 7-3: Existing Conditions of Pit or Quarry Access Road Water Crossing Locations

Water Crossing ID	Name of Watercourse / Waterbody	Tertiary Watershed	Identification as Mapped or Unmapped Water Feature	Approx. Drainage Area (km^2)	Category of Watershed Size	Mean Wetted Width (m)[(a)]	Mean Bankfull Width (m)[(a)]
ARA04-WC-01	Unnamed	Lower Ogoki River	Mapped	25	Medium	13	25
ARA04-WC-02	Unnamed	Lower Ogoki River	Mapped	4	Small	5	11
ARA04-WC-03	Unnamed	Lower Ogoki River	Mapped	30	Medium	9	17
ARA04-WC-04	Unnamed	Lower Ogoki River	Mapped	30	Medium	8	17
ARA04-WC-05	Unnamed	Lower Ogoki River	Mapped	30	Medium	8	17
ARA04-WC-06	Unnamed	Lower Ogoki River	Mapped	8	Small	8	24
ARA04-WC-07	Unnamed	Lower Ogoki River	Mapped	8	Small	45	55
ARA04-WC-08	Unnamed	Lower Ogoki River	Mapped	4	Small	4	45
ARA04-WC-09	Unnamed	Lower Ogoki River	Mapped	205	Medium	11	14
ARA04-WC-10	Unnamed	Lower Ogoki River	Mapped	27	Medium	14	45
ARA04-WC-11	Unnamed	Lower Ogoki River	Mapped	1	Small	2	3
ARA04-WC-12	Unnamed	Lower Ogoki River	Mapped	16	Medium	6	20
ARA04-WC-13	Dusey River	Lower Ogoki River	Mapped	1,507	Large	34	35
ARA04-WC-14	Unnamed	Lower Ogoki River	Mapped	4	Small	3	6
ARA04-WC-15	Unnamed	Makokibatan - Upper Albany River	Mapped	<1	Small	1	2
ARA04-WC-16	Unnamed	Makokibatan - Upper Albany River	Mapped	5	Small	3	6
ARA04-WC-17	Unnamed	Makokibatan - Upper Albany River	Mapped	<1	Small	1	2
ARA04-WC-18	Unnamed	Makokibatan - Upper Albany River	Mapped	13	Medium	4	9
ARA04-WC-19	Unnamed	Makokibatan - Upper Albany River	Mapped	17	Medium	4	8
ARA04-WC-20	Unnamed	Makokibatan - Upper Albany River	Mapped	3	Small	2	3
ARA04-WC-21	Unnamed	Makokibatan - Upper Albany River	Mapped	1	Small	3	5
ARA04-WC-22	Gourlie Creek	Makokibatan - Upper Albany River	Mapped	777	Medium	35	37
ARA04-WC-23	Buffaloskin River	Makokibatan - Upper Albany River	Mapped	110	Medium	15	30
ARA04-WC-24	Unnamed	Makokibatan - Upper Albany River	Mapped	1	Small	1	2

Note:
(a) Values are based on desktop estimates using publicly available aerial imagery.
Approx. = Approximately; km^2 = square kilometre; m = metre; RA = route alternative; WC = water crossing; < = less than.

Table 7-4: Number of Proposed Crossings Structures and Area Impacts at Waterbody Crossings Along the Preferred Route and Temporary Access Roads

Road	Crossing Structure [(a)]			Total
	Culvert	Clear Span Bridge	Multi-Span Bridge	
Number of Proposed Waterbody Crossings				
Preferred Route	15	19	11	**45**
Temporary Access	6	12	6	**24**
Total	**21**	**31**	**17**	**69**
Area Impacted of Proposed Waterbody Crossings (ha)				
Preferred Route	0.7	1.6	6.1	**8.3**
Temporary Access	0.2	1.7	2.5	**4.4**
Total	**0.9**	**3.3**	**8.6**	**12.7**

Note:
(a) Proposed for the *Environmental Assessment / Impact Statement Report*; may change during detailed design.
ha = hectare.

7.2 Project–Environment Interactions

The analysis of Project–environment interactions for surface water that are likely to have a potential effect is provided in **Table 7-5.**

Table 7-5: Project–Environment Interactions

Project Phase	Project Activities	Valued Component	Indicator(s)	Description of Project–Environment Interaction
Construction Phase	Clearing of the right-of-way for the Community Access Road and supporting access roads Blasting rock (e.g., maintaining road construction grade, aggregate activities) Road construction (e.g., stripping, subgrade excavation, embankment fill placement, grading, ditching, concrete batch plants) Bridge and Culvert Installation (e.g., approach embankments, foundations, substructures, superstructures, traffic protection, erosion controls) Constructing and operating temporary infrastructure Decommissioning temporary infrastructure	■ Surface Water Quantity ■ Surface Water Quality ■ Sediment Quality	■ Changes in drainage patterns ■ Changes in flow ■ Changes in water levels ■ Changes in channel hydraulics ■ Changes in channel stability or erosion–sedimentation processes ■ Change in physical parameters of water ■ Change in chemical parameters of water ■ Change in physical and chemical characteristics of sediment	■ The overall effects due to Project–environment interaction during the Construction Phase can be summarized as follows: ○ Changes to surface water quantity from short-term water taking ○ Changes to surface water quantity, surface water quality, and sediment quality from short-term water discharges ○ Changes to surface water quantity, surface water quality, and sediment quality during short-term water diversions at waterbody crossings ○ Changes to surface water quantity, surface water quality, and sediment quality due to changes in channel hydraulics at waterbody crossings ○ Changes to surface water quantity, surface water quality, and sediment quality due to changes in land cover ○ Changes to surface water quality from the emission and deposition of airborne particulate matter to nearby waterbodies ○ Changes to surface water quality from the wash-off of trash, domestic waste, and leachate at waste handling and storage facilities to nearby waterbodies ○ Changes to surface water quality from the wash-off of organic debris from vegetation maintenance activities to adjacent waterbodies ○ Changes to surface water quality and sediment quality from the wash-off of organic debris to nearby waterbodies and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies ○ Changes to surface water quality and sediment quality from the wash-off of fuel from accidental spills and leaks to nearby waterbodies ○ Changes to surface water quality and sediment quality from the wash-off of explosive chemicals or residue from spills and blasting activities to nearby waterbodies
Operation and Maintenance Phase	Operate the Community Access Road and permanent access roads Maintain[(a)] the Community Access Road and permanent access roads (if required), including bridges and culverts	■ Surface Water Quantity ■ Surface Water Quality ■ Sediment Quality	■ Changes in drainage patterns ■ Changes in flow ■ Changes in water levels ■ Changes in channel hydraulics ■ Changes in channel stability or erosion–sedimentation processes ■ Change in physical parameters of water ■ Change in chemical parameters of water ■ Change in physical and chemical characteristics of sediment	■ The overall effects due to Project–environment interaction during the Operation and Maintenance Phase can be summarized as follows: ○ Changes to surface water quantity, surface water quality, and sediment quality due to changes in channel hydraulics at waterbody crossings ○ Changes to surface water quantity, surface water quality, and sediment quality due to changes in land cover ○ Changes to surface water quality from the emission and deposition of airborne particulate matter to nearby waterbodies ○ Changes to surface water quality from the wash-off of organic debris from vegetation maintenance activities to adjacent waterbodies ○ Changes to surface water quality and sediment quality from the wash-off of fuel from accidental spills and leaks to nearby waterbodies

Note:
(a) Includes General Maintenance (e.g., grading, erosion control, quarrying, pits and quarries), Seasonal Maintenance (e.g., snow clearing, bridge and culvert maintenance), and Special Maintenance (e.g., slope failures, road settlement / break-up).

7.3 Assessing Residual Effects

This section presents the potential effects, appropriate mitigation and enhancement measures, and predicted residual Project effects for surface water Valued Components. A summary of the potential effects, mitigation and enhancement measures, and residual effects is presented in **Table 7-7**. Residual effects are brought forward for characterization into **Section 7.3.2** and into the cumulative effects assessment in **Section 8**.

7.3.1 Potential Effects, Mitigation and Enhancement Measures, and Predicted Residual Effects

This section presents the potential effects, mitigation, and enhancement measures and determines whether there are residual Project effects for surface water Valued Components. The potential effects on surface water Valued Components (surface water quantity, surface water quality and sediment quality) due to Project activities were discussed together as the surface water Valued Components are directly linked with each other. For instance, an increase in streamflow (surface water quantity) due to a Project activity is also expected to result in increased erosion / sedimentation processes thus affecting the surface water quality and sediment quality. A summary of the potential effects, mitigation and enhancement measures, and predicted residual effects is provided in **Section 7.3.1.12**

7.3.1.1 Changes to Surface Water Quantity from Short-Term Water Taking during Construction

7.3.1.1.1 Potential Effects

Construction

During the Construction Phase, short-term water takings may be required from surface water or both the surface water and groundwater sources for the purposes of construction water supply. These short-term water takings could result in changes to surface water quantity in the form of reductions in streamflows and / or water levels at nearby waterbodies. The specific locations for short-term water takings, as well as the anticipated water taking duration and volumes, will be determined during the permitting and detailed design stage of the Project. These water takings may include:

- Dewatering of excavations for road construction and waterbody crossing structure foundations (e.g., bridges and culverts), if required;
- Dewatering for quarry operations, if required;
- Water diversion to create and maintain a dry work area for the construction of waterbody crossings;

- Water for drilling;
- Water for on-site concrete mixing and earthworks (compaction);
- Water for dust suppression at work sites and along access roads;
- Water for construction of temporary access roads, trails, and winter roads (i.e., snow fills, ice bridges, and maintenance);
- Water for washing concrete mixing equipment, concrete delivery systems, vehicles, and equipment as well as for work sites, temporary construction camps, and temporary laydown areas; and
- Water for drinking and sanitation at construction offices, temporary construction camps, temporary laydown areas, and other work areas.

7.3.1.1.2 Mitigation and Enhancement Measures

Construction

All short-term water takings from surface water and / or groundwater sources for construction purposes will be carried out in accordance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 64/16* under the *Ontario Water Resources Act* (Government of Ontario, 1990c) and industry best standards, recognizing that designated water taking activities will require registration on the Environmental Activity and Sector Registry or a Permit to Take Water from the Ministry of the Environment, Conservation and Parks. As part of the permitting and / or approvals process through Environmental Activity and Sector Registry and Permit to Take Water, a Water Taking and Discharge Plan will be developed for each source of water taking, as required, noting that by design, the daily and instantaneous rates of water taking associated with the plan will be protective of the existing surface water, groundwater, and natural environment conditions in the local area. In turn, this is expected to result in minimal changes (if any) to streamflows and / or water levels at nearby waterbodies. Water flow and / or levels triggers will be developed for sensitive water sources that have potential of being affected by water takings. These actions will be site-specific and will be developed to support necessary Permit to Take Water applications. Water quantity and quality monitoring will be completed, where appropriate, to confirm the effectiveness of the Water Taking and Discharge Plan and associated mitigation measures as well as to maintain compliance with regulatory permits / approvals.

The specific requirements for short-term water taking and discharge activities will be determined during the permitting and detailed design stage of the Project. An initial engagement with Ministry of the Environment, Conservation and Parks will be used to establish the preferred method to apply for and secure water-taking- and discharge-related permits and approvals.

It is possible that specific water taking and discharge activities may be eligible for Environmental Activity and Sector Registry (e.g., construction dewatering between 50,000 and 400,000 litres per day [L/day] during excavations for the Community Access Road and waterbody crossing structure foundations), noting that each relevant Environmental Activity and Sector Registry would be tied to a discrete activity and location along the Project alignment. Other water taking and discharge activities will require a Permit to Take Water (e.g., direct surface water taking from a lake or river of greater than 50,000 L/day for the purposes of water supply), recognizing that multiple sources of surface water takings or surface water and groundwater takings could potentially be captured under a single Permit to Take Water. Noting that although water takings associated with waterbody crossing structure foundations, including groundwater and stormwater may be eligible for Environmental Activity and Sector Registry, water taking directly from a stream/river water to accommodate waterbody crossing structure foundation work may need to be pumped and may require a Permit to Take Water. Additionally, water takings for highway and transit projects, for purposes such as hydro-demolition, cleaning and flushing, seeding, mulching, sodding or landscaping, dust suppression, compaction of earth and granular materials, and on-site preparation of materials to be used in the construction, maintenance or repair of the highway may be activities eligible to register on the Environmental Activity and Sector Registry. Where the activity does not meet the criteria for an Environmental Activity and Sector Registry, a Permit to Take Water may be required. Finally, it is understood that discharge of wastewater from stormwater management facilities and other sewage works will require an Environmental Compliance Approval (e.g., wash water from vehicles and equipment, wastewater from concrete batch plants, and domestic wastewater and grey water from domestic use to leaching beds [if daily flow rates are more than 10,000 L/day]).

Dewatering for the safe and efficient operation of pits and quarries and water takings for other construction-related activities (e.g., to supply concrete batch plants, for earthworks and for washing vehicles and equipment) will be in compliance with the approval conditions of the Permit to Take Water (if the water taking is greater than 50,000 L/day) and / or carried out in a manner that avoids unacceptable negative environmental effects or interference with other water users. Construction water sources and volume of water for concrete production is not known at this stage of Project planning but will be conducted in accordance with applicable regulatory requirements. Water used for dust suppression will be brought to the site via tanker trucks. Calcium chloride may be used along roads to reduce dust and improve safety where there is increased Project traffic interface with public road users. Application of calcium chloride by the Owner/Operator will be completed in consultation with road authorities and will not occur within 120 m of a waterbody or wetland.

Potable water for work sites, temporary construction camps, and temporary laydown areas will be obtained from the surface water sources with appropriate treatment as needed and

/ or from bottled sources for drinking and sanitation. If necessary, as a last resort, groundwater wells may be drilled at the temporary construction camps in accordance with *Revised Regulations of Ontario, 1990 (Regulation 903: Wells)*, under the *Ontario Water Resources Act* (Government of Ontario, 1990c).

Overall, all water taking will be in compliance with the applicable legislation, regulations, and best industry practices.

7.3.1.1.3 Predicted Residual Effects

Measurable changes to surface water quantity (i.e., residual effects) are predicted to occur as a result of water taking activities, even with the effective implementation of the mitigation measures identified previously and summarized in **Table 7-7**. The measurable changes would potentially involve reduction in streamflows and / or water levels at waterbodies (specific to or adjacent to the source of the water taking). Therefore, this Project–environment interaction during Construction Phase is carried forward to the residual effects characterization (**Section 7.3.2.1**).

7.3.1.2 Changes to Surface Water Quantity, Surface Water Quality, and Sediment Quality from Short-Term Water Discharges during Construction

7.3.1.2.1 Potential Effects

Construction

Discharges of water from Project activities during the Construction Phase could result in changes to both surface water quantity and quality and to sediment quality if not effectively mitigated. Discharges could result in an increase to streamflow and / or water levels in receiving waterbodies as well as an increase to the concentrations of suspended solids and chemical constituents in these same receivers. Sources of water during the Construction Phase include:

- Construction water from dewatering activities during excavations for road construction and waterbody crossing structure foundations;
- Water from dewatering activities during operation of pits and quarries;
- Water from aggregate and concrete batch plants;
- Wash water from cleaning concrete mixing equipment and concrete delivery systems on work sites;
- Wash water from vehicle and equipment wash facilities on work sites, at temporary construction camps, and at temporary laydown areas; and
- Domestic waste water and grey water from temporary construction camps and construction offices.

7.3.1.2.2 Mitigation and Enhancement Measures

Construction

All discharges of Project water will be conducted in accordance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 64/16* under the *Ontario Water Resources Act* (Government of Ontario, 1990c) or *Ontario Regulation 63/16* under the *Environmental Protection Act* (Government of Ontario, 1990d), where applicable, recognizing that these discharge activities will require permitting or approvals through the Ministry of the Environment, Conservation and Parks Environmental Activity and Sector Registry; Permit to Take Water; or an Environmental Compliance Approval. As part of the permitting and / or approvals process associated with Environmental Activity and Sector Registry; Permit to Take Water; and Environmental Compliance Approval, a Water Taking and Discharge Plan and supporting technical analysis will be developed for each source of construction water, wastewater, and wash water, as required, noting that, by design, the applicable water quantity and quality criteria (e.g., effluent limits) associated with the plan will be protective of the existing surface water, groundwater, and natural environment conditions in the local area and, in turn, are expected to result in minimal changes (if any) to streamflows, water levels, and the concentrations of suspended solids and chemical constituents in nearby waterbodies. Water quantity and quality monitoring will be completed, where appropriate, to confirm the effectiveness of the discharge plan and associated mitigation measures as well as to maintain and demonstrate compliance with regulatory permits / approvals.

It is recognized that wastewater associated with discharges from Project activities will need to be characterized, and in some cases, an assimilative capacity study may need to be carried out to accurately assess the potential effect of the discharge on the receiving environment and develop effluent limits where necessary. The specific requirements for short-term water taking and discharge activities will be determined during the permitting and detailed design stage of the Project. An initial engagement with Ministry of the Environment, Conservation and Parks will be used to establish the preferred method to apply for and secure water-taking- and discharge-related permits and approvals. It is possible that specific water taking and discharge activities may be eligible for Environmental Activity and Sector Registry (e.g., construction dewatering between 50,000 and 400,000 L/day during excavations for access road and waterbody crossing structure foundations), noting that each relevant Environmental Activity and Sector Registry would be tied to a discrete activity and location along the Project alignment. Other water taking and discharge activities (e.g., direct surface water taking from a lake or river of greater than 50,000 L/day for the purposes of water supply) would require a Permit to Take Water. Finally, if daily flow rates are more than 10,000 L/day, it is understood that discharge of water from stormwater management facilities and other sewage works will require an Environmental Compliance Approval (e.g., wash water from vehicles and equipment, water from concrete batch plants, and domestic wastewater and grey water from temporary construction camps and construction offices).

Further to the mitigation measures described previously, the following will also be implemented for the Project during the Construction Phase:

- Concrete for the Project will be produced in batch plants at pits and quarries and delivered to site in concrete mixer trucks to the extent feasible. Where applicable, treatment and disposal of water from any such concrete batch plants will be in compliance with Environmental Compliance Approvals issued by the Ministry of the Environment, Conservation and Parks under the *Environmental Protection Act* (Government of Ontario, 1990d);
- Wash water from cleaning concrete mixing equipment and delivery systems, as well as from vehicles and equipment, will be collected in designated wash-out sites, located at least 30 m from a waterbody. The wash-out site will be monitored regularly to verify that runoff from the area does not report to a waterbody (i.e., does not contaminate waterbody with foreign material). Following the Construction Phase, all temporary wash-out sites will be capped with local backfill and regraded prior to construction crews departing the site;
- Domestic wastewater from temporary construction camps and construction offices / sites will be disposed of on site, where possible, in leaching beds constructed at the temporary construction camps, approved under the Ontario Building Code 2012 (*Ontario Regulation 332/12: Building Code*) under *Building Code Act* (Government of Ontario, 1992). The treatment unit (i.e., septic tank system) shall be connected to a leaching bed constructed in accordance with the requirements of Section 8.7 of the Ontario Building Code. In compliance with the Code, leaching beds will be sited a minimum of 15 m away from any waterbody. A sewage Environmental Compliance Approval may be required for the leaching beds serving the temporary construction camp, depending on the total theoretical flow rate, noting that a sewage Environmental Compliance Approval would be needed if the theoretical daily flows of domestic wastewater and grey water are more than 10,000 L/day, while a permit from the Ministry of Natural Resources, who is a partner with Ministry of Northern Development and Mines, Ministry of Environment, and Ministry of Municipal Affairs and Housing for waste management in unincorporated territory, would be required instead if the theoretical daily flows are less than 10,000 L/day. Further, if required and when feasible, wastewater will be collected in approved vehicles and hauled to wastewater treatment plants authorized to accept this type of wastewater;
- Discharging construction/wastewater, that may not require an Environmental Compliance Approval, at a minimum to down-gradient low lying vegetation area to promote infiltration, and utilizing measures such as filter fabric on inlet pump head and/or straw bale/filter fabric device or equivalent to minimize sediment transport during excavation / construction dewatering; and
- Marten Falls First Nation, with the Owner/Operator, will review discharge sites / locations to avoid discharging to sensitive areas, including areas identified through the Indigenous Knowledge Program.

7.3.1.2.3 Predicted Residual Effects

Measurable changes (i.e., residual effects) to surface water quantity (increase in streamflows and / or water levels at receiving waterbodies) and surface water quality (increase to the concentrations of suspended solids and chemical constituents in receiving waterbodies) are predicted to occur as a result of short-term water discharges during the Construction Phase of the Project, even with the effective implementation of the mitigation and enhancement measures outlined previously and summarized in **Table 7-5**. Therefore, this Project–environment interaction during Construction Phase is carried forward to the residual effects characterization (**Section 7.3.2.2**).

7.3.1.3 Changes to Surface Water Quantity, Surface Water Quality, and Sediment Quality During Short-Term Water Diversions at Waterbody Crossings during Construction

7.3.1.3.1 Potential Effects

Construction

The construction of temporary and decommissioning of waterbody crossings for temporary access roads and construction of permanent waterbody crossings for the Community Access Road and permanent access roads will, in most cases, require a short-term diversion of water to maintain a dry work site either wholly or partially within the waterbody. The short-term diversion will involve the use of a temporary dam and pump bypass system (active in-stream diversion) or temporary diversion channels and / or dams (passive in-stream diversion). The implementation of short-term water diversions may result in changes to both surface water quantity and quality and to sediment quality. Concerns related to water quantity (primarily for navigational purposes) were also noted by Marten Falls First Nation, in particular for the Ogoki River and Albany River (Marten Falls First Nation, 2023). Concerns were also noted by Fort Albany First Nation specific to potential surface water contamination being transmitted downstream and “down-muskeg”, particularly for the Albany River, which flows northeast, beyond the Project Footprint into Fort Albany First Nation’s traditional territory towards the coast (Firelight Research Inc., 2024). Additionally, members of Kashechewan First Nation have shared concerns related to water levels in surface water features and peatlands resulting from watercourse crossings and road construction (MNP LPP, 2024a).

The potential effects on both surface water quantity and quality and to sediment quality may include:

- Localized changes to streamflows and / or water levels and erosion–sedimentation processes within or immediately upstream and downstream of the work area, depending on the dewatering method and dewatering controls chosen (e.g., pumping rates that exceed streamflow conditions could result in a decrease in water levels upstream of the diversion works and, in turn, a slight increase downstream);

- Increases to the concentrations of suspended solids in waterbodies as a result of increased rates of erosion–sedimentation processes during water taking and discharge activities (specific to the points of water taking and discharge in the waterbody), or following the removal of the diversion works and / or installation or removal of temporary waterbody crossing structures due to the disturbance of the bed and banks of the waterbody (specific to the limits of the work area, with the opportunity for sediment to be mobilized and transported downstream); and
- Increases to the concentrations of chemical constituents in waterbodies due to equipment leaks.

There will also be the temporary, short-term, and local bypass of flow through the work site (i.e., change in drainage patterns) and the potential for increased rates of erosion–sedimentation following the removal of the diversion works and / or installation or removal of temporary waterbody crossing structures due to the disturbance of the waterbody bed and banks within the work area.

A review of lists of waterbody crossings on the Community Access Road and supporting access roads, presented in **Table 7-2** and **Table 7-3** (**Section 7.1**), indicate the following:

- A total of 45 permanent waterbody crossings are planned for Preferred Route right-of-way and a total of 24 waterbody crossings are planned for access roads; and
- Approximately 44 (98%) of the Preferred Route right-of-way waterbody crossing locations are on waterbodies with permanent flow regime, while the remaining 1 crossing (2%) are on waterbodies with unknown flow regime. Based on the surficial geology underlying the waterbody crossings, the following is observed:
    - 21 (47%) of the waterbody crossings are located over organic deposits.
    - 11 (24%) of the waterbody crossings are located over till.
    - 4 (9%) of the waterbody crossings are located over bedrock.
    - The remaining waterbody crossings are located over glaciolacustrine deposits (4%) and unknown surficial geology (16%).

The waterbody crossings located over bedrock (exposed or covered by a thin layer of drift) are expected to be relatively stable with a lower likelihood of experiencing increased opportunities for erosion–sedimentation processes.

7.3.1.3.2 Mitigation and Enhancement Measures

Construction

Short-term water diversions (active or passive) will be carried out in accordance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 301/21* under the *Ontario Water Resources Act* (Government of Ontario, 1990c). This includes the implementation of the following conditions under *Ontario Regulation 387/04*, which represent the key mitigation for the diversion works and allow exemption from Permit to Take Water or Environmental Activity and Sector Registry approvals:

- Diverted water will remain in, or be directed back to, the same waterbody (e.g., pumped water from a waterbody will be returned to that same waterbody at a location immediately downstream of the construction area);
- The diversion works will be installed / operated to maintain water quality and quantity conditions upstream and downstream of the construction area;
- Pumped water will contain no visible contaminants (e.g., petroleum hydrocarbon sheen of film);
- Sediment and erosion control measures will be properly installed and maintained, with a plan to dispose of any trapped / collected materials after diversion activities have been completed; and
- Marten Falls First Nation, with the Owner/Operator, will satisfy these conditions and will construct the waterbody crossings in compliance with Ministry of Natural Resources approvals, required under *Ontario Regulation 454/96* of the *Lakes and Rivers Improvement Act* (Government of Ontario, 1990f), as applicable. The purpose of Ministry of Natural Resources approvals is to prevent alteration to fish and wildlife habitat, flooding, erosion, and pollution. Waterbody crossings will be designed and constructed in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990) as well as *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (Ministry of Natural Resources, 2010) and *Technical Guide River & Stream Systems: Flooding Hazard Limit* (Ministry of Natural Resources, 2002), as applicable.

The Owner/Operator will manage dewatering activities to minimize potential adverse environmental effects and interference with downstream water users. Planned mitigation and enhancement measures consist of the following:

- Minimizing the number of waterbody crossings required, to the extent possible, by appropriate alignment of the right-of-way and access roads;
- Limiting the number of waterbody crossings installed simultaneously on a single waterbody, where more than one crossing structure is required;

- Constructing waterbody crossings in compliance with Ministry of the Environment, Conservation and Parks-specified conditions and Ministry of Natural Resources approvals, if required;
- Accounting for streamflow changes (under extreme storm events) caused by climate change in the planning and design of short-term diversions; and
- Constructing waterbody crossings over a relatively short time period and under low water conditions (during the winter and / or summer seasons) where possible.

To account for climate change effects, Marten Falls First Nation will also implement mitigation measures as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024). Specific measures to be undertaken during water diversion activities to satisfy the conditions listed previously will be determined in the detailed design stage of the Project.

The implementation of these mitigation measures are anticipated to limit the potential for changes to streamflows, water levels, and erosion–sedimentation processes at the time of the active or passive diversion works as well as the potential for increased rates of erosion–sedimentation following the removal of the diversion works and / or installation or removal of temporary waterbody crossing structures due to the disturbance of the bed and banks of the waterbody (within the limits of the work area).

Project activities are not expected to result in consequential increases to suspended solids and associated chemical constituents (i.e., metals) in waterbodies crossed by the Project due to diversions, beyond the concentrations observed during baseline studies completed to assess surface water conditions. That said, the use of short-term water diversions to create and maintain a dewatered area to support installation of temporary and permanent waterbody crossings and removal of temporary waterbody crossing structures, may result in a measurable increase or reduction in streamflows, water levels, and erosion sedimentation processes at discrete locations upstream or downstream of the waterbody crossing, resulting in an increase to the concentrations of suspended solids and chemical constituents in waterbodies during these short-term water diversions. Environmental monitoring (including water quality sampling / testing noted in **Section 9.2**) will be conducted during the Construction Phase to verify the performance and effectiveness of the planned mitigation implemented at these locations. Monitoring will occur during installation works, including all in-water activities, will continue through the duration of the Construction Phase, including the removal of temporary crossing structures as part of construction decommissioning activities. The monitoring program will be under the direction of the Environmental Monitor and Indigenous Environmental Monitor. An Adaptive Management Plan will be developed in the event of an unexpected change to water quantity or quality (i.e., increase in turbidity in accordance with Canadian Council of Ministers of the Environment standards).

Overall, the mitigation measures and commitments identified previously are expected to minimize opportunities for increased concentrations of suspended solids and chemical constituents (due to any associated changes to erosion–sedimentation processes). Water quantity and quality monitoring will be monitored, where appropriate, to confirm the effectiveness of the diversion works and any associated mitigation measures as well as to maintain compliance with regulatory permits / approvals.

7.3.1.3.3 Predicted Residual Effects

The use of short-term water diversion to create and maintain a dewatered area to support installation of temporary and permanent waterbody crossings and removal of temporary waterbody crossing structures may result in a measurable increase or reduction in streamflows, water levels, and erosion–sedimentation processes at locations upstream or downstream of the waterbody crossing and an increase to the concentrations of suspended solids and chemical constituents in waterbodies, even with the implementation of the mitigation identified previously (also summarized in **Table 7-7**). Therefore, this Project–environment interaction during Construction Phase is carried forward to the residual effects characterization (**Section 7.3.2.3**).

7.3.1.4 Changes to Surface Water Quantity, Surface Water Quality, and Sediment Quality due to Changes in Channel Hydraulics at Waterbody Crossings during Construction and Operation and Maintenance

7.3.1.4.1 Potential Effects

Construction

The installation of temporary and permanent waterbody crossing structures during the Construction Phase of the Project may result in changes to channel hydraulics at the affected portion of the waterbody and, in turn, potential changes in surface water quantity due to modifications in channel form and function. More specifically, the installation of waterbody crossing structures may result in a localized increase or reduction to flow velocities, shear stresses, water levels, and erosion–sedimentation processes at locations upstream or downstream of the crossing. For example, local impedance of streamflow (i.e., backwater with an increase in water levels and opportunities for sedimentation) may occur upstream of a waterbody crossing, with a corresponding reduction in flow velocities and shear stresses. There is also the potential for a localized increase in flow velocities at the inlets (Oji-Cree translation, *zaakiing*) and outlets of waterbody crossing structures, which in turn could result in increased rates of erosion at the waterbodies. These effects were also noted as a concern by the community of Marten Falls First Nation and Fort Albany First Nation ((Marten Falls First Nation, 2023; Firelight Research Inc., 2024). Specifically, Marten Falls First Nation highlighted generalized concerns related to how the construction of infrastructure such as bridges might result in effects on surface water quality (Marten Falls First Nation, 2023), and Fort Albany First Nation noted concerns relating to how the Project could act as an additional barrier to natural water flow.

Fort Albany First Nation also highlighted specific concerns related to how the Attawapiskat River, Albany River, Moose River, and Winisk River might be impacted as a result (Firelight Research Inc., 2024).

By extension, an increase to erosion and shear stress processes (both of which are tied to surface water quantity) in the vicinity of the waterbody crossing structure may result in an effect on surface water and sediment quality due to the associated increase to downstream concentrations of suspended solids, while an increase to sedimentation upstream of the crossing structure could instead result in a corresponding decrease to downstream concentrations of suspended solids.

A review of lists of waterbody crossings on the Community Access Road and supporting access roads, presented in **Table 7-2** and **Table 7-3** (**Section 7.1**), indicate the following:

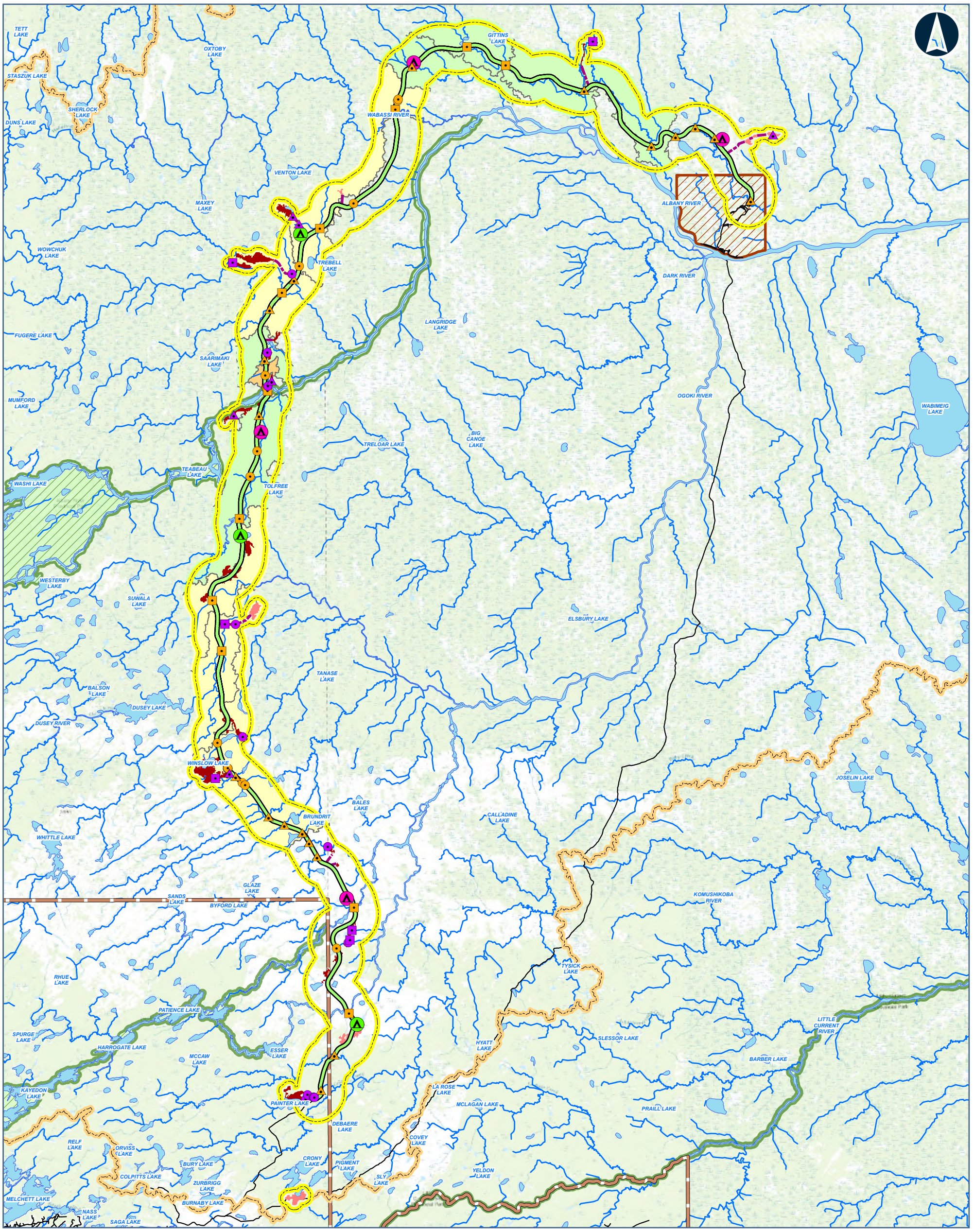
- A total of 45 permanent waterbody crossings are planned for Preferred Route, and a total of 24 temporary waterbody crossings are planned for access roads; and
- Of these 45 waterbody crossings on Preferred Route, 1 crossing will be located on Lakes / Ponds, and 44 will be located on defined waterbodies.

Methods for crossing waterbodies are described in **Table 7-6** and presented in **Figure 7-1**.

Table 7-6: Identified Methods for Crossing Waterbodies

Road	Crossing Structure[(a)]			Total
	Culvert	Clear Span Bridge	Multi-Span Bridge	
Number of Proposed Waterbody Crossings				
Preferred Route	15	19	11	**45**
Temporary Access[(b)]	6	12	6	**24**
Total	**21**	**31**	**17**	**69**

Notes:
(a) Proposed for the *Environmental Assessment / Impact Statement Report*; may change during detailed design.
(b) Temporary culverts are to be placed along the aggregate access route crossing locations.



Legend

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- BEDROCK
- SAND AND GRAVEL

METHODS OF CROSSINGS

PREFERRED ROUTE

- Culvert
- Multi-Span Bridge
- Clear Span Bridge

TEMPORARY ACCESS

- Clear Span Bridge
- Multi-Span Bridge
- Culvert

- ROAD
- WATERBODY
- WATERCOURSE
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- LOCAL STUDY AREA
- REGIONAL STUDY AREA

Data Source:
Base Data: Provided by MNRF 2019; Route Infrastructure - Provided by AECOM 2019. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan
World Topographic Map: Esri Canada, Esri, © OpenStreetMap contributors, HERE, Garmin, USGS, NGA, EPA, USDA, NPS, AAFC, NRCan

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Identified Methods of Crossing Waterbodies

0 2.25 4.5 9 13.5 18
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:400,000 * when printed 11"x17"
Rev:0	

Figure 7-1

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0034_SW_EA_Reporting\21455151-0034-CS-0000\21455151-0034-CS-0000.aprx
Date Saved: 2/10/2026 6:22 PM User Name: INRR172702

Operation and Maintenance

During the Operation and Maintenance Phase of the Project, changes to the channel hydraulics may occur at waterbody crossing structures and surrounding areas. Common problems which may be encountered during operation of waterbody crossings include:

- Scour or erosion around or under waterbody crossings;
- Debris, ice or beaver activity blocking culvert inlet;
- Debris or beaver activity constricting the waterway opening;
- Damage or decay of structural component of a waterbody crossing structure; and
- Unstable embankment or soil around waterbody crossings.

To help confirm safe operation of waterbody crossing structures as per the design and to meet environmental protection requirements, waterbody crossings are expected to undergo maintenance during their operational life. Maintenance of waterbody crossing structures may require one or more of the following alterations / modifications:

- Repair or complete replacement of defective / damaged structural component of a waterbody crossings;
- Stabilization of surrounding areas to stop scour and erosion;
- Removal of debris, ice, or beaver activity reducing the discharge capacity of waterbody crossing and / or obstructions preventing fish passage; and
- Reinstallation / reconstruction if the problem cannot be fixed using maintenance techniques or where problems persist.

The disturbances / alterations to channel geometry due to common problems encountered during the operational life and / or maintenance activities may result in a localized increase or reduction to flow velocities, shear stresses, water levels, and erosion–sedimentation processes at locations upstream or downstream of the crossing.

7.3.1.4.2 Mitigation and Enhancement Measures

Construction

Waterbody crossing structures will be designed and constructed in accordance with permits and approvals through Fisheries and Oceans Canada and / or Ministry of Natural Resources, if applicable. All newly installed or upgraded crossing structures at mapped or unmapped waterbodies are expected to require permitting through one or more of *Ontario Regulation 239/13* under the *Public Lands Act* (Government of Ontario, 1990h) for water crossings on traditional territory and *Ontario Regulation 454/96* under the *Lakes and Rivers Improvements Act* (Government of Ontario, 1990f) for water crossings on Private or

traditional territory. It is also expected that approvals through Fisheries and Oceans Canada under the protocol for the review and approval of forestry water crossings protocol will be required (Ministry of Natural Resources and Forestry and Fisheries and Oceans Canada, 2021).

Marten Falls First Nation recognises the importance of climate change effects on the Project. The Climate Adaption and Resiliency Technical Support Document (AECOM, 2024) identified and evaluated the risk that climate-related hazards may have on the Marten Falls First Nations Community Access Road, Indigenous communities, as well as the natural environment, and provided recommendations to mitigate the associated risks. Climate change is anticipated to effect rainfall amounts and intensities that could lead to increased streamflows in waterbodies which in return can amplify potential effects at waterbody crossings, if not mitigated.

The Owner/Operator will implement mitigation measures as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024). In addition, it is worth highlighting that the design of waterbody crossing structures (culverts and bridges) will consider climate change effects. Specific measures to be undertaken to mitigate the climate change effects at waterbody crossings will be determined in the detailed design stage of the Project.

The specific configuration of waterbody crossing structures, including clear span bridges, bridges with piers and abutments, and culverts, will be primarily based on hydrologic and hydraulic design flow calculations, which consider, but are not limited to, expected rainfall and peak flow within the geographic area (including climate change), as well as the relevant catchment area, channel slope, and channel substrate.

At some locations, where it is determined that spring-melt or storm runoff needs to pass from one side of the right-of-way to the other to prevent flooding and / or erosion, equalization culverts will be installed. The purpose of equalization culverts is to maintain the existing surface water drainage patterns in the area. Culverts will be put in place as construction progresses along the Project.

Each waterbody crossing will be visited ahead of construction by qualified environmental personnel, fisheries biologists and / or technicians (i.e., Aquatics Specialist) to verify that the crossing location is conducive to the planned crossing structure installation, such that any changes in site conditions can be addressed through necessary design adjustments. If site-specific features prevent the installation of a crossing structure, a different crossing method will be selected and implemented. During pre-construction site visits, surface water surveys at any waterbody crossing location that has not already been assessed as part of the field investigations will be conducted. Refer to **Section 9.1** for details about pre-construction surveys.

Marten Falls First Nation, with the Owner/Operator, will carefully design and construct waterbody crossing structures to minimize potential adverse environmental effects resulting from changes to cross section hydraulics. If site-specific changes to waterbody crossing structure type are required, engagement with appropriate regulatory authorities (i.e., Fisheries and Oceans Canada, Ministry of Natural Resources) will occur prior to any instream construction activities, where appropriate (i.e., placement of additional fill, regrading and / or stabilization of bed or banks). Similar to short-term water diversions (**Section 7.3.1.3**), the mitigation measures to reduce the potential effects on cross-section hydraulics will involve the following:

- Minimizing the number of waterbody crossings required, to the extent possible, by appropriate alignment of the right-of-way for the Community Access Road, and use of existing roads or trails;
- Carrying out construction activities without any permanent in-water works (i.e., permanent waterbody crossings will be installed above the high-water mark) is anticipated except where culverts will be used;
- Designing the infrastructure at waterbody crossings to pass peak flows (including extreme storm events caused by climate change, as appropriate) and maintain sufficient flow conveyance in such a way that no discernible effects on stream hydraulics occur;
- Maintaining the characteristic channel width, depths, slopes, and substrate in the event that a channel realignment is required, noting that:
    - Channel realignments and / or infillings will be avoided through Project planning and design to the extent practicable by fitting a culvert to the creek alignment to minimize change in stream morphology.
    - Channel realignments and / or infilling will only be undertaken in locations where specific conditions are met and / or where required for safety and security purposes.
    - A realignment would avoid the use of a Fisheries and Oceans Canada code of practice (required approval by Fisheries and Oceans Canada), with the plan and mitigations requiring reviewed by Ministry of Natural Resources through permitting the water crossing.
- Implementing erosion and sediment control measures prior to commencing construction work;
- Returning the watercourse banks to their original profile and stabilizing disturbed areas as necessary to prevent soil erosion upon completion of construction work;

- Designing and constructing waterbody crossings in compliance with Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990) as well as *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (Ministry of Natural Resources, 2010) and *Technical Guide River & Stream Systems: Flooding Hazard Limit* (Ministry of Natural Resources, 2002), as applicable;
- Constructing waterbody crossings in compliance with Ministry of Natural Resources approvals; and
- Reclaiming temporary waterbody crossings at the end of construction.

Operation and Maintenance

Mitigation and enhancement measures to reduce the potential effects on cross-section hydraulics during the Operation and Maintenance Phase will involve the following:

- Monitoring permanent culverts in accordance with the Culvert Inspection Guide (Ministry of Transportation, 2022) to identify and remove blockages (e.g., ice, woody debris), as needed, that could otherwise lead to scouring and effects on channel morphology and fish habitat and potentially interfere with fish passage;
- Monitoring and inspecting new permanent waterbody crossing structures (bridge) and roadside drainage features for physical function and condition in accordance with the Ontario Structure Inspection Manual (Ministry of Transportation, 2018);
- Maintaining waterbody crossings in accordance with permits and approvals through Fisheries and Oceans Canada and Ministry of Natural Resources, as applicable;
- Increasing the inspection and monitoring frequency during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024);
- Fixing the problems identified during monitoring and inspection immediately to prevent any further damage to the channel hydraulics, aquatic habitat and the fisheries resources;
- Minimizing in-water works and limiting the timing to avoid period of fish spawning, incubation and migration;
- Implementing appropriate erosion and sediment control measures in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805) prior to commencement of repair work;
- Restoring and revegetating disturbed areas to mitigate erosion and sediment entry to waterbodies;
- Repairing and reinforcing waterbody crossings in a manner that prevents waterbody crossing structure materials from entering waterbodies;

- Preventing entry of waste materials to be stabilized or disposed of in waterbodies; and
- Reconstructing waterbody crossings in compliance with Ministry of Natural Resources approvals, when necessary.

7.3.1.4.3 Predicted Residual Effects

Even with the effective implementation of the mitigation and enhancement measures identified previously and summarized in **Table 7-7**, the installation of waterbody crossings along the right-of-way of the Community Access Road and support access roads may result in measurable changes (i.e., residual effects) to channel hydraulics at some crossing locations, with the potential for changes in surface water quantity (i.e., localized increase or reduction to flow velocities, shear stresses, water levels, and erosion–sedimentation processes at locations upstream or downstream of the crossing) and quality (increase or reduction to the concentrations of suspended solids at locations downstream of the crossings due to the corresponding changes to erosion–sedimentation processes in the vicinity of the crossing). Therefore, this Project–environment interaction during Construction and Operation and Maintenance Phases is carried forward to the residual effects characterization (**Section 7.3.2.4**).

7.3.1.5 Changes to Surface Water Quantity, Surface Water Quality and Sediment Quality due to Changes in Land Cover during Construction and Operation and Maintenance

7.3.1.5.1 Potential Effects

Construction

Construction of the right-of-way for the Community Access Road, as well as the construction of waterbody crossing foundations, temporary access roads and trails, temporary construction camps, turn-around areas, temporary laydown areas, and pits and quarries, could result in changes to surface water quantity, and surface water and sediment quality. For instance, construction of Project components could result in changes to the existing land cover, such as existing treed and peatland (Oji-Cree translation, *maashkiigwabo*) areas changed to bare ground and / or low-growing grasses and shrubs (i.e., due to construction of the right-of-way and temporary construction easements) or from treed and peatland areas to gravel or roofed surfaces (i.e., required access roads, temporary construction camps, turn-around areas, and temporary laydown areas).

The potential effect on surface water quantity as a result of the identified changes in land cover may include a local increase in runoff rates and / or runoff volumes from the various Project components and, in turn, an increase in streamflows, water levels, and erosion / sedimentation processes at nearby waterbodies (i.e., downstream receivers). By extension, the identified increase in streamflows with the potential for higher rates of sediment erosion / transport (all of which are tied to surface water quantity) may result in

an associated increase to the concentrations of suspended solids and metal leaching (surface water quality and sediment quality) in these respective waterbodies.

In addition to the above, recreational off-road vehicle use may increase as a result of new access routes, temporary access roads and trails along Project areas. While the recreational access is currently unauthorized within the right-of-way, the potential for heightened unauthorized use of off-road vehicles within the right-of-way could further exacerbate the identified effects mentioned previously (e.g., changes / disturbance to land cover with the potential for increased rates of runoff and associated erosion–sedimentation processes). Changes / disturbance due to unsanctioned off-road vehicle crossings (via fording) at waterbodies could result in effects at a channel scale (e.g., disturbance and / or alterations to channel form / hydraulics with potential implications on flow conveyance, fish and fish habitat, and erosion–sedimentation processes) (Carrot River Valley Watershed Association n.d.; Guldin, 2004; Fisheries and Oceans Canada, n.d.).

Operation and Maintenance

Project activities during the Operation and Maintenance Phase, although expected to be limited in scale and tied to discrete locations, may also result in potential changes to surface water quantity and surface water and sediment quality. For example, changes to the existing land cover (e.g., existing treed and peatland areas changed to bare ground and / or low-growing grasses) due to maintenance activities could result changes to flowrates, water levels, erosion / sedimentation processes. Maintenance activities requiring changes to land cover may include:

- Repair of unstable foreslope or backslope of ditches, eroded roadbed and / or foreslopes, loose material and debris on the right-of-way creating hazard, erodible soil along the road shoulders, resurfacing and regrading of the Community Access Road, when necessary;
- Repair / replacement of waterbody crossings, stabilization of surrounding areas and / or removal of ice, debris, fallen tress, or beaver dams.
- Clearing / establishing temporary access roads, turn-around areas, and temporary laydown areas for the maintenance activities.

In addition to above, recreational off-road vehicle usage because of new access route, temporary access roads and trails along Project areas is also expected to persist during Operation and Maintenance Phase of the Project. The heightened unauthorized use of off-road vehicles within the right-of-way, as discussed previously, could further exacerbate the identified effects (e.g., changes / disturbance to land cover with the potential for increased rates of runoff and associated erosion–sedimentation processes) and lead to changes / disturbance causing effects at a channel scale (Carrot River Valley Watershed Association n.d.; Guldin, 2004; Fisheries and Oceans Canada, n.d.).

7.3.1.5.2 Mitigation and Enhancement Measures

Construction

The Owner/Operator will carefully manage runoff from disturbed areas to minimize or avoid potential changes in surface water quantity, surface water and sediment quality in receiving waterbodies. Mitigation measures include:

- Progressive revegetation of the right-of-way including natural revegetation using native seed or appropriate tree species, as appropriate;
- Use of existing access roads and trails for access, if available, to the extent practicable, to minimize new disturbance;
- Upgrading and constructing new access road in accordance with Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossing* (Ministry of Natural Resources, 1990), which provides comprehensive guidance with respect to design and construction practices to mitigate environmental effects;
- Locating temporary construction camp facilities, temporary laydown areas, and other Project activities a minimum of 30 m from the ordinary high-water mark of a waterbody;
- Progressively restoring temporary construction camps, temporary laydown areas, turn-around areas, and construction easements through the Construction phase to pre-existing compatible condition. Seeding will follow as close as possible to final cleanup and topsoil material replacement pending seasonal or weather conditions;
- Only materials cleared for acid rock drainage (i.e., non-potentially acid generating rock) by a geochemical verification process will be used for the road surface to avoid acid rock drainage or associated metal leaching;
- Limiting use of off-road vehicles by the Owner/Operator during the Construction Phase, noting that:
    - Off-road vehicle use will follow Fisheries and Oceans Canada's Code of Practice for Fording (Fisheries and Oceans Canada, 2022), Fisheries and Oceans Canada's All Terrain Vehicle Guidance (Fisheries and Oceans Canada, 2010) and *Ontario Regulation 316/03* under *Highway Traffic Act* (Government of Ontario, 1990g).
    - Inspecting and cleaning off-road vehicle before and after each use to prevent the spread of invasive species and to identify any fuel leaks or equipment damage.
    - Avoidance of sensitive features and waterbody crossings to the extent practicable.
- Developing an Erosion and Sediment Control Plan and implementing control measures in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805). This includes provision of multistage drainage and sediment controls to collect and treat stormwater runoff from Project components, as appropriate.

These controls may include diversion swales / dykes, collection ditches, silt fences, rock check dams, sediment traps / basins, level spreaders and riparian buffer strips. An Erosion and Sediment Control Plan will be provided in permit/approval applications for review by regulatory agencies, as applicable, in advance of construction activities.

- Considering climate change factors in the selection and implementation of site-specific mitigation and enhancement measures, and increasing the inspection and monitoring frequency during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024);

Operation and Maintenance

To minimize or avoid potential effects in receiving waterbodies due to change in land cover during the Operation and Maintenance Phase, mitigation and enhancement measures will include the following:

- Minimizing the disturbance to existing land cover during maintenance works;
- Restoring and revegetating disturbed areas, including natural revegetation, to mitigate changes to runoff rates and erosion / sedimentation processes;
- Making use of existing access roads and trails for access, if available, to the extent practicable, to minimize new disturbance;
- Upgrading new access road in accordance with Ministry of Natural Resources' Environmental Guidelines for Access Roads and Water Crossing (Ministry of Natural Resources, 1990), which provides comprehensive guidance with respect to design and construction practices to mitigate environmental effects;
- Using materials cleared for acid rock drainage (i.e., non-potentially acid generating rock) by a geochemical verification process for the road resurfacing, when necessary, to avoid acid rock drainage or associated metal leaching;
- Inspecting and cleaning off-road vehicles before and after each use to prevent the spread of invasive species and to identify any fuel leaks or equipment damage; and
- Implementing appropriate erosion and sediment control measures in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805) prior to commencement of maintenance work.
- Considering climate change factors in the selection and implementation of site-specific mitigation and enhancement measures, and increasing the inspection and monitoring frequency during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024);

7.3.1.5.3 Predicted Residual Effects

Even with the effective implementation of the mitigation identified previously, changes to land cover, during the Construction and Operation and Maintenance Phases, may result in a measurable increase in streamflows, water levels, and erosion–sedimentation processes at receiving waterbodies (due to associated increases in runoff rates and runoff volumes from the surrounding area). Changes to land cover may also result in an increase to the concentrations of suspended solids in receiving waterbodies (due to corresponding increase to streamflow and sediment erosion / transport processes). As described in **Section 7.3.2.5**, the results of the assessment demonstrated that the magnitude of the effect is expected to be negligible at most of the assessment points, given that the percentage of disturbed area relative to the overall catchment is expected to be 5% or less at the majority of locations. For the locations where the proportion of total disturbed area to total catchment area will be higher than 5%, it was shown that the land cover change is primarily dominated by temporary disturbed areas and the contribution of permanent disturbed areas is less than 5%. Further to this, the waterbodies generally have ephemeral or intermittent flow regimes with comparatively small catchment sizes, meaning that any increase in downstream flows and water levels at these waterbodies (mainly restricted to the Construction Phase only) will be limited in spatial extent, recognizing that the anticipated effects will be largely indiscernible a short distance downstream of the crossing (as the ephemeral or intermittent water feature joins the broader surface water system and / or drains towards a progressively larger catchment area). Based on this, the Project–environment interaction during Construction and Operation and Maintenance Phases is carried forward to the residual effects characterization (**Section 7.3.2.5**).

7.3.1.6 Changes to Surface Water Quality from the Emission and Deposition of Airborne Particulate Matter to Nearby Waterbodies during Construction and Operation and Maintenance

7.3.1.6.1 Potential Effects

Construction

Air emissions from Project activities during the Construction Phase could result in changes to surface water quality, if not mitigated. The emission and deposition of airborne particulate matter could result in increased concentrations of chemical constituents and suspended solids in receiving waterbodies. During the Construction Phase, particulate matter may be combustion products and / or fugitive dust generated from:

- Vehicle and equipment exhausts;
- Transportation of personnel, materials, and equipment on access roads and trails;
- Site preparation, earthworks, stockpiling, and demolition activities;
- Blasting activities;

- Concrete mixing on site and / or batch plants; and
- Site maintenance activities.

Air quality modelling was used to predict maximum ground-level concentrations of criteria air contaminant emissions during Construction and Operation and Maintenance. The methods and results for air quality modelling are presented in detail in the Atmospheric Environment Technical Support Document: Existing Conditions & Effects Assessment (Dillon, 2026). Predicted concentrations of air criteria contaminants were compared to Canadian Ambient Air Quality Standards and / or Ontario Ambient Air Quality Criteria thresholds. During construction, threshold exceedances for the Project are predicted for particulate matter less than 2.5 micrometres (µm) (PM2.5) and particulate matter less than 10 µm (PM10) and total suspended particulate (TSP) emissions. Threshold exceedances for dust emissions are predicted to be reached at less than 300 m from the emission source. It should be noted that the air quality modelling incorporated conservative assumptions (i.e., using worst-case scenarios) to make sure that effects were not underestimated.

Operation and Maintenance

During Operation and Maintenance Phase, Community Access Road will be available for public use. Fugitive dust emissions are expected to be produced by the road traffic on the Community Access Road, in addition to road maintenance activities. Air emissions from the road traffic and maintenance activities and deposition of airborne particulate matter in nearby waterbodies could result in changes to surface water quality, if not mitigated.

During the Operation and Maintenance Phase, particulate matter may be combustion products and / or fugitive dust generated from:

- Vehicular traffic on Community Access Road;
- Road maintenance activities including use of vehicles and equipment, transportation of personnels, material and equipment, and site preparation and earthwork.

Air quality modelling was used to predict maximum ground-level concentrations of criteria air contaminant emissions during Construction and Operations and Maintenance Phases. The methods and results for air quality modelling are presented in detail in the Atmospheric Environment Technical Support Document: Existing Conditions & Effects Assessment (Dillon, 2026). Predicted concentrations of air criteria contaminants were compared to Canadian Ambient Air Quality Standards and / or Ontario Ambient Air Quality Criteria thresholds. During operations, threshold exceedances for the Project are predicted for PM2.5, PM10 and TSP. The PM2.5 levels are predicted to reach the 24-hour and annual criteria thresholds at 115 m and 134 m from the road, respectively. Levels of PM10 are predicted to reach the 24-hour threshold at 1,986 m from the road. Emissions of TSP are predicted to reach the 24-hour and annual thresholds at 3,004 m and 899 m from the road, respectively.

7.3.1.6.2 Mitigation and Enhancement Measures

Construction

Mitigation and enhancement measures planned to reduce the potential effects of airborne particulate matter on the surface water quality include:

- Mitigation measures as outlined in the Atmospheric Environment Technical Support Document: Existing Conditions & Effects Assessment (Dillon, 2026); and
- Potential mitigation measures outlined in the Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions for Provincial Transportation Projects (Ontario Ministy of Transportation, 2020) may be implemented, if feasible.

The effectiveness of mitigation measures will be evaluated during Construction Phase and mitigation measures will be modified or enhanced as necessary through adaptive management.

Operation and Maintenance

Mitigation and enhancement measures planned to reduce the potential effects of airborne particulate matter on the surface water quality include:

- Mitigation measures as outlined in the Atmospheric Environment Technical Support Document: Existing Conditions & Effects Assessment (Dillon, 2026); and
- Potential mitigation measures outlined in the Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions for Provincial Transportation Projects (Ontario Ministy of Transportation, 2020) may be implemented, if feasible.

7.3.1.6.3 Predicted Residual Effects

The results of air quality modelling (Dillon, 2024a) predicted dust emissions to be higher during the Operation and Maintenance Phase than Construction Phase. Because, during Construction Phase, Marten Fall First Nation and / or their contactors are expected to have better control over mitigation measures and implementation of Adaptive Management Plan, mitigation measures to limit dust emissions are predicted to be more effective during Construction Phase compared to Operation and Maintenance Phase.

With the implementation of the mitigation measures (also summarized in Table 7-7), no residual effect on existing ambient concentration of particulate matter is expected during the Construction Phase. To that end, no residual effect on surface water quality is expected as a result of the transport and delivery of airborne particulate matter. However, during Operation and Maintenance Phase, dust dispersion and potential deposition are expected to effect surface water quality of nearby waterbodies, if not mitigated.

There are currently no plans to decommission the Project and dust deposition is expected over the life of the Project. Therefore, this effect (i.e., increase to the concentrations of chemical constituents and suspended solids in receiving waterbodies from the transport and delivery of airborne particulate matter) during Operation and Maintenance Phase only is carried forward to the residual effects characterization.

7.3.1.7 Changes to Surface Water Quality from the Wash-Off of Trash, Domestic Waste, and Leachate at Waste Handling and Storage Facilities to Nearby Waterbodies during Construction

7.3.1.7.1 Potential Effects

Construction

The Owner/Operator will establish and operate temporary waste handling and storage facilities at various locations during the Construction Phase of the Project. The wash-off of trash, domestic waste (i.e., rainwater that has direct contact with the trash and may mobilize solids to downstream receivers), and leachate at these facilities to nearby waterbodies could result in changes to surface water quality relative to the Baseline Characterization. This potential effect has been noted as a concern by Indigenous communities including Fort Albany First Nation (Firelight Research Inc., 2024). Changes may include increases in concentrations of suspended solids (including floating debris) and chemical constituents in the receiving water.

7.3.1.7.2 Mitigation and Enhancement Measures

Construction

The Owner/Operator will prepare and implement Waste Management Plans that describe the appropriate management of solid, liquid, and hazardous waste. Portable, secure, solid waste receptacles will be provided on work sites and at temporary laydown areas for the collection and temporary storage of domestic waste (e.g., food scraps, paper, cardboard, bottles, and cans) and non-hazardous construction waste (e.g., wiring, metal, and rubble). These receptacles will be located outside a minimum 30 m buffer around waterbodies, to the extent practicable. The solid waste collected in these receptacles will be hauled periodically to waste handling and storage facilities located at the temporary construction camps.

Waste handling and storage facilities and waste recycling areas will be established at each temporary construction camp. These facilities will be located outside of the minimum 30 m buffer zone around waterbodies to the extent practicable, provided with drainage controls and require personnel to be trained in industry standard waste management practices and procedures. Organic waste, recyclable materials, and non-hazardous solid waste at waste handling and storage facilities will be separated and will be temporarily stored in appropriate containers.

The waste will be transported to a waste disposal site designed to accept this type of waste and / or, whenever possible, the waste will be treated and disposed of at the site. Hazardous solid and liquid waste at waste handling and storage facilities will be temporarily stored in labelled, closed, compatible containers, with secondary containment if appropriate. The Owner/Operator will also prepare and implement a Spill Prevention and Emergency Response Plan that describes specific measures that would be implemented if a spill occurred.

To avoid acid rock drainage or associated metal leaching, only the material that has been cleared for acid rock drainage (i.e., non-potentially acid generating rock) through a geochemical verification process will be utilized for the road surface.

Hazardous, solid, and liquid waste will be managed and disposed of in compliance with *Ontario Regulation 347* as amended by *Ontario Regulation 105/24* under the *Environmental Protection Act* (Government of Ontario, 1990d).

Hazardous waste will be periodically transported by a registered hauler to an approved disposal site. The generation of hazardous waste is expected to be mainly associated with the servicing and maintenance of construction vehicles and equipment, although there may be other sources. Hazardous waste may include used oils, lubricants, and antifreeze as well as spent lubricating cartridges, oily rags, oily drums, fuel containers, batteries, and fluorescent bulbs.

7.3.1.7.3 Predicted Residual Effects

Based on the effective implementation of the mitigation described previously and summarized in **Table 7-7**, coupled with other planning and strategies inherent to the design, no measurable increase to the concentrations of suspended solids and chemical constituents is expected in receiving waterbodies as a result of the wash-off of trash, domestic waste, and leachate at waste handling and storage facilities. The volume of trash or leachate-influenced water that collects near a solid waste handling and storage area is expected to be small, meaning that potential loading of suspended solids and chemical constituents to the broader surface water system is anticipated to be relatively inconsequential. In addition, the likelihood that this water is subsequently conveyed to a nearby waterbody is expected to be low, given the plan to maintain a 30 m waterbody buffer and implement / maintain erosion and sediment controls. As such, this potential Project–environment interaction during Construction Phase is not carried forward to the residual effects characterization.

7.3.1.8 Changes to Surface Water Quality from the Wash-Off of Organic Debris from Vegetation Maintenance Activities to Adjacent Waterbodies during Construction and Operation and Maintenance

7.3.1.8.1 Potential Effects

Construction

During the Construction Phase of the Project, vegetation maintenance activities will be required along the Community Access Road right-of-way to minimize the potential for vegetation to grow into, or fall onto, the road. Activities will generally include mechanical and / or manual methods to manage vegetation to an appropriate height. Mechanical vegetation maintenance activities along the right-of-way could result in changes to surface water quality if not mitigated. For instance, potential effects may include the transport of organic debris to nearby waterbodies, with the opportunity for increased concentrations of suspended solids in the receiving water.

Operation and Maintenance

Similar to the Construction Phase, vegetation maintenance activities during the Operation and Maintenance Phase of the Project will be required along the Community Access Road right-of-way and could result in changes to surface water quality, if not mitigated. Vegetation maintenance activities will include:

- Clearing and / or trimming vegetation along Community Access Road right-of-way to main line of sight safety requirements;
- Clearing and / or trimming vegetation along access roads and waterbody crossings requiring maintenance work;
- Minor landscaping to restore seasonal vegetation loss and improve aesthetics;
- Maintaining desired planting densities and vegetation height along slopes and in swales / ditches;
- Weed control (i.e., removal of undesirable plant species); and
- Removal of fallen trees / vegetation blocking flow in waterbodies (including emergency cases and before and after a significant storm event).

7.3.1.8.2 Mitigation and Enhancement Measures

Construction

- To minimize potential effects on waterbodies, a riparian buffer of 30 m around waterbodies will be maintained for the right-of-way, unless required for access to install waterbody crossing structures, in which case a 10 m wide right-of-way for equipment access will be cleared within right-of-way. Temporary access roads will be cleared and will be 10 m wide.

- Vegetation clearing will consist of cutting tree trunks parallel to and within 15 cm of the ground or lower as well as the removal of all shrubs, debris, and other such materials. Grubbing may be required along some parts of the right-of-way. Vegetation will be largely removed by mechanical means, except within 10 m of a watercourse or wetland. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the undergrowth and duff layer undisturbed to prevent erosion.
- The temporary disturbance within the 30 m buffer up to 10 m from a waterbody will have potential to effects surface water during the construction time period. Vegetation clearing or disturbed areas within the 30 m buffer will be provided with appropriate erosion and sediment controls in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805). After the construction time period, the 30 m riparian buffer is expected to rehabilitate within a two-year timeframe and will be maintained through Operation and Maintenance. Removed vegetation will be immediately relocated outside a waterbody buffer zone (30 m) and above its high-water mark.
- Herbicides use is not planned. Vegetation will be largely removed by mechanical means, except within 10 m of a watercourse or wetland. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the undergrowth undisturbed to prevent erosion.

Operation and Maintenance

- To minimize the potential effects on the water quality of receiving waterbodies due to vegetation maintenance activities, mitigation and enhancement measures will include:
- Removal of vegetation using mechanical means, except within 10 m of a waterbody where chain saws and other hand-held equipment will be used;
- Avoiding soil disturbance, including grubbing, 30 m of a waterbody;
- Maintaining a riparian buffer of 30 m around waterbodies for the right-of-way, unless required for access to repair / replace waterbody crossing structures, in which case a 10 m wide right-of-way for equipment access will be cleared within right-of-way. Temporary access roads will be cleared and will be 10 m wide;
- Implementing appropriate erosion and sediment controls in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805) when clearing or disturbing areas within the 30 m buffer;
- Relocating removed vegetation immediately outside a waterbody buffer zone (30 m) and above its high-water mark; and
- Herbicides use is not planned. Vegetation will be largely removed by mechanical means, except within 10 m of a watercourse or wetland. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the undergrowth undisturbed to prevent erosion.

7.3.1.8.3 Predicted Residual Effects

Based on the effective implementation of the mitigation measures described previously and summarized in **Table 7-7**, coupled with other planning and strategies inherent to the design, no measurable changes to the concentrations of suspended solids are expected at receiving waterbodies as a result of wash-off of organic debris from mechanical vegetation maintenance activities during Construction and Operation and Maintenance Phases. The volume of water that could be potentially affected by clearing activities is expected to be small, meaning that potential loading of suspended solids including organic debris to the broader surface water system is anticipated to be relatively inconsequential. Further to this, the likelihood that this water is subsequently conveyed to a nearby waterbody is expected to be low, given the plans to maintain buffer zones of 30 m around waterbodies, and limit clearing of riparian vegetation to the extent practicable and to the requirement of the Community Access Road and alignment clearing width only. Clearing at waterbody crossings along the 100 m wide Community Access Road right-of-way will generally be limited to a 10 m for equipment access to waterbody crossing structures (e.g., temporary bridges). Vegetation clearing or disturbed areas within the 30 m buffer will be provided with appropriate erosion and sediment controls. As such, this potential Project–environment interaction during Construction and Operation and Maintenance Phases is not carried forward to the residual effects characterization.

7.3.1.9 Changes to Surface Water Quality and Sediment Quality from the Wash-Off of Organic Debris to Nearby Waterbodies, and / or Increased Rates of Erosion in Disturbed and Exposed Areas with Sediment Transport and Delivery to Adjacent Waterbodies during Construction

7.3.1.9.1 Potential Effects

Construction

Site preparation, earthworks, and stockpiling activities during the Construction Phase could result in changes to surface water quality and sediment quality, recognizing that activities involving vegetation clearing and / or ground disturbance or exposure may result in increased rates of erosion, transport, and delivery of organic debris and sediments to nearby waterbodies. This in turn may result in an increase to the concentrations of suspended solids in receiving waterbodies, noting that suspended solids will be used as an indicator to assess other chemical constituents (including methylmercury and other metals). Potential effects including increased rates of erosion were noted as a concern by Indigenous communities including Marten Falls First Nation and Weenusk First Nation (Marten Falls first Nation, 2022b; MNP LPP, 2024b). This includes concerns related to effects to streams / surface water quality (i.e., increased turbidity) (Marten Falls First Nation, 2022b).

Details of site preparation, earthworks, and stockpiling activities follow.

- The preparation of sites for the Community Access Road right-of-way and waterbody crossings will include vegetation removal, grubbing, stripping of topsoil, removal of unsuitable subsoil, and rough grading;
- The right-of-way preparation will be carried out over a typical 60 m wide area, noting that the total width of right-of-way is approximately 100 m. There may be additional right-of-way easement required at major waterbody crossings. Vegetation, including timber and shrubs, will be removed along the right-of-way. In addition, diseased or damaged trees located at the edge of the right-of-way will be removed;
- Temporary access roads and trails and temporary workspaces will also be cleared of vegetation, grubbed, stripped of topsoil and unsuitable subsoil (where required), and roughly graded;
- Earthworks will include excavation, fill, backfill, and final grading activities. Excavations along the right-of-way may include blasting, drilling and shallow digs. Excavation and fill for access road upgrades and construction will be required along the right-of-way to provide appropriate grades, widths, and travel surfaces (road subbase and base courses) for the safe transportation of personnel, materials and equipment;
- Fording of watercourses at crossing locations with clearing and crossing installation equipment may be necessary to facilitate installation of crossing structures;
- Earthworks for the installation of waterbody crossings will be required to provide the structural stability for bridges and culverts and to provide adequate widths and travel surfaces for vehicular traffic. Earthworks at waterbody crossings will include removal of unsuitable subsoil, excavation and placement of bedding and / or backfill materials for bridge foundations and culverts and fill to construct road embankments and travel surfaces; and
- Stockpiling will consist of the short-term storage of topsoil and unsuitable subsoil removed during site preparation as well as excavated materials (rock, soil) and required aggregates (sand, gravel, crushed rock) for the construction of the Community Access Road, waterbody crossings, and their foundations.

7.3.1.9.2 Mitigation and Enhancement Measures

Construction

The preparation of work sites will include vegetation removal, grubbing, stripping of topsoil and removal of unsuitable subsoil, and rough grading. The Community Access Road right-of-way preparation will be carried out in accordance with standard practices and procedures and will involve the removal of all incompatible vegetation. Removal will consist of cutting trees within 15 cm of the root collar or lower as well as the removal of all shrubs, debris, and other such materials. Diseased or damaged trees located outside of the right-of-way that have potential to fall onto the Community Access Road right-of-way or waterbody crossing structures will also be removed.

Clearing of the right-of-way will take the following factors into consideration:

- Widths of watercourses;
- Location of wetlands;
- Locations of known archaeological and heritage sites;
- Areas of timber storage and the method of cutting and storing timber; and
- Required buffer zones (e.g., for watercourses).

Vegetation removal will take into consideration 30 m buffer zones around waterbodies, and clearing of riparian vegetation will be restricted to the extent feasible. Vegetation removal at waterbody crossings along the right-of-way will generally be limited to a 10 m wide Community Access Road right-of-way for equipment access to waterbody crossing structures (e.g., temporary bridges). Cleared vegetation will be immediately removed outside a waterbody buffer zone and above its high-water mark where this is identified to extend beyond the buffer zone.

Small trees and branches will be burned or chipped on site; the chips may be spread over the right-of-way. Salvaged merchantable timber will be de-limbed and decked along the edge of the right-of-way for short-term storage according to clearing contract requirements. The Owner/Operator will work with applicable Forest Resource Licence or Sustainable Forest Licence holders and Indigenous communities to manage merchantable timber cleared by the Project. Timber, chips, and other organic debris will be stored outside the buffer zone and above the high-water mark of any nearby waterbody. Slash and debris will be chipped or burned on site with other organic debris in compliance with *Ontario Regulation 207/96* as amended by *Ontario Regulation 94/18* under the *Forest Fires Prevention Act* (Government of Ontario, 1990e).

Earthworks will include excavation, fill, backfill, and final grading activities. Excavations for waterbody crossing foundations along the right-of-way may include blasting, drilling and shallow digs. Excavation and fill for the Community Access Road construction will be required to provide appropriate grades, widths, and travel surfaces (i.e., road subbase and base courses) for the safe transportation of personnel, materials, and equipment. Earthworks for the installation of waterbody crossing structures will be required to provide the structural stability for bridges and culverts, and to provide adequate widths and travel surfaces for vehicular traffic. Earthworks at waterbody crossings will include removal of unsuitable subsoil, excavation and placement of bedding and / or backfill materials for bridge foundations and culverts and fill to construct road embankments and travel surfaces. Earthworks for the Community Access Road construction and the installation of waterbody crossing structures will be accomplished using heavy construction equipment where possible, with light equipment being used in sensitive areas.

Some excavations will be internally draining, and eroded material from disturbed and exposed surfaces will be contained within the excavation. Such excavations will be subject to temporary dewatering activities, as described previously, when discussing short-term discharges during construction.

The Owner/Operator will develop and implement an Erosion and Sediment Control Plan. The Erosion and Sediment Control Plan will include appropriate locations of selected control measures, scheduling information for the installation of erosion and sediment control practices, and details of the assigned responsibilities for implementation, operation, modification, inspection, and maintenance. Erosion and sediment control measures will be installed and maintained in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI.805). Where disturbed and exposed areas are externally draining, multiple stages of drainage, erosion and sediment controls will be employed, as appropriate, consistent with good industry practice. Control measures may include seeding, surface roughening (scarification), lockdown netting, straw bales, straw and / or wood fibre logs, rock check dams, silt fences, sediment traps / basins, diversion swales / dykes, and collection ditching. Similar to the clearing of vegetation, earthworks will take into consideration buffer zones around waterbodies to the extent practicable. Progressive reclamation of disturbed areas will be practiced. Revegetation of work areas will be initiated at the first opportunity, where appropriate, to stabilize disturbed and exposed ground. All aggregate pits and quarries will be located a minimum of 120 m away from the ordinary high-water mark of a waterbody, where possible. The aggregate pits and quarries will follow the guidelines and associated conditions / requirements of the approved permits, including development of a Rehabilitation Plan, outlined in the *Aggregate Permits on Crown Lands for Pits and Quarries above Water* (Ontario Ministry of Natural Resources and Forestry, 2014) and the *Forest Management Planning Manual* (Ontario Ministry of Natural Resources and Forestry, 2017).

Stockpiling will consist of the short-term storage of topsoil and unsuitable subsoil removed during site preparation as well as excavated materials (rock, subsoil) and required aggregates (sand, gravel, crushed rock) for the construction of waterbody crossing foundations and the Community Access Road and the installation of waterbody crossings. Stockpiling will be accomplished using heavy or light construction equipment, as appropriate.

Sedimentation in the receiving environment will be controlled by directing sediment-laden water to various temporary storage and settlement features (i.e., sumps, settling ponds, or catch basins) prior to discharge. Alternately, where appropriate, the sediment-laden water will be directed to drain / filter through low gradient, well-vegetated areas away from watercourses (i.e., using pumps and hoses).

Erosion and sediment control measures will be incorporated prior to construction activities or immediately after disturbance on site-specific cases throughout the Project to avoid introduction of sediment to the environment, and, as part of this, to stabilize drifting soils or loss of topsoil, as practicable. Erosion and sediment control measures may include silt fences, filter bags, straw bale fences, berms, ponds and gravel or vegetative filters, check dams, erosion control blankets, and other features.

To limit the disturbance caused by new construction, the Owner/Operator will use the existing roads and trails, if available, for access, to the extent practicable. In addition, temporary laydown areas will be constructed on existing disturbed areas with appropriate land use designations, where possible. Additional contingency measures will be implemented as appropriate in the event of excessive rain, wet weather or flood-like conditions (when the planned activity could cause significant damage to soils, such as rutting by traffic through the topsoil, soil structure damage during soil handling, or compaction and associated pulverization of topsoil structure damage due to heavy traffic). These measures include:

- Rescheduling work or reducing / detouring traffic in areas where soils are considered to be excessively wet;
- Restricting construction traffic, where feasible, to equipment with low-ground pressure tires or wide pad tracks;
- During excessively wet conditions, work only in non-problem areas, such as well-drained soil or well-sodded lands, until conditions improve;
- Limiting vehicle access through soft / wet areas to periods when frozen conditions occur (i.e., early morning / evening) and have crews park in a stable area and walk to on-site equipment if feasible;
- Installing access or rig matting in problem areas to protect soils; and
- If necessary, suspending work until soils dry out or appropriate site-specific mitigation can be used to prevent soil disturbance.

The Community Access Road and waterbody crossings will be constructed in accordance with Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990) to the extent practicable. The document provides comprehensive guidance with respect to sound design and construction practices to mitigate potential environmental effects. Also note that the geometric design of the Community Access Road will follow Ontario Ministry of Transportation Road design Manual (Ontario Ministry of Transportation, 2020) and latest and best management practices from the Transportation Association of Canada and Ministry of Transportation of Ontario Design Supplement. Where applicable, waterbody crossings will also be constructed in compliance with Ministry of Natural Resources approvals issued under *Ontario Regulation 239/13* under the *Public Lands Act* (Government of Ontario, 1990h) and / or *Ontario Regulation 454/96* under the *Lakes and Rivers Improvement Act* (Government of Ontario, 1990f). In accordance with these approvals, the Owner/Operator will be required to complete construction along waterbody shorelines as well as in-water works in a manner that minimizes adverse environmental effects such as increased flooding, waterbody and shoreline erosion, and sediment loads.

Climate change factors will also be considered in design of Community Access Road, waterbody crossings, and stormwater management works, and the implementation of proposed mitigation and enhancement measures (including measures outlined in the Climate Adaption and Resiliency Technical Support Document [AECOM, 2024])

7.3.1.9.3 Predicted Residual Effects

Even with the effective implementation of the mitigation measures identified previously and summarized in **Table 7-7**, measurable changes to surface water quality (i.e., residual effects) may occur due to the wash-off of organic debris and / or increased rates of sediment erosion / transport to nearby waterbodies as part of site preparation, earthworks, stockpiling activities, and construction of the Community Access Road and waterbody crossings during the Construction Phase of the Project. Therefore, this Project–environment interaction during Construction Phase is carried forward to the residual effects characterization (**Section 7.3.2.7**).

7.3.1.10 Changes to Surface Water Quality and Sediment Quality from the Wash-Off of Accidental Spills and Leaks to Nearby Waterbodies during Construction and Operation and Maintenance

7.3.1.10.1 Potential Effects

Construction

Accidental spills and leaks from the transportation, storage, and handling of hazardous materials and the operation of vehicles and equipment during the Construction Phase have the potential to change surface water and sediment quality.

Spills and leaks could be washed off into nearby waterbodies during a runoff event and, if occurring in high enough volumes, could change the chemical constituents in receiving waters and affect surface water and sediment quality. These effects were also noted as a concern within the community of Marten Falls First Nation, Kashechewan First Nation, Fort Albany First Nation, Weenusk First Nation, and Aroland First Nation (Firelight Research Inc., 2024; MNP LPP 2024a; MNP LPP, 2024b; Marten Falls First Nation, 2022a; 2022b; 2023; Shared Value Solutions, 2024). Marten Falls First Nation highlighted pollution concerns (i.e., accidental spills, leaks, application of road salt) related to effects on water quality as a result of additional traffic to the area (Marten Falls First Nation, 2022a; 2022b; 2023). Members of Kashechewan First Nation highlighted concerns relating to accidental spills and leaks and associated contamination of surface water features due to previous experiences with Victor Diamond Mine (MNP LPP, 2024a). Additionally, Aroland First Nation also highlighted concerns related to the potential for accidents along the road resulting in contamination of the waterways and surrounding environment in the event of a truck overturning, sliding off the road in poor weather, contamination spills, etc. One interview participant spoke of their previous experience with seeing contamination from oil tanks and garbage out on the land, and was concerned that this could happen again if there is an accident on the road close to the water. While they noted the contamination they saw was cleaned up with bales of hay, they also emphasized that doing more to prevent these incidents is necessary (Shared Value Solutions, 2024).

Hazardous materials that may be handled and stored during the Project Construction Phase include:

- Fuels and batteries for vehicle and equipment operation;
- Oils, grease, and liquid chemicals for vehicle and equipment maintenance;
- Explosives for blasting activities; and
- Sand and dust suppressant for maintenance activities.

Operation and Maintenance

During the Operation and Maintenance Phase of the Project, Community Access Road will be available to the public and will connect communities and enable the smooth flow of goods and people. However, due to increased vehicular traffic and transportation of goods including hazardous materials, accidental spills, and leaks may occur and potentially change surface water and sediment quality. As discussed above (Construction Phase), potential effects were also noted as a concern within the community of Marten Falls First Nation.

The causes of spills and leaks during Operation and Maintenance Phase include:

- Road accidents involving vehicles (including hazardous material carrying vehicles), collisions, rollovers or other incidents that can rupture the oil containers and cause spill to road surface;
- Mechanical failure of vehicles involving fuel tank leaks, engine leaks, faulty or worn-out component leaks; and
- Improper handling and transportation of hazardous materials such as spillage during refuelling, negligence in securing containers, overloading or inadequate storage method.

Hazardous materials expected to be transported, handled or stored during Operation and Maintenance Phase include fuels (gasoline, diesel, propane), lubricating oils, greases, liquid chemicals, pesticides, sand, salts, and dust suppressants.

In addition to above, maintenance activities during Operation and Maintenance Phase will also include transportation, storage, and handling of hazardous materials and the operation of vehicles and equipment. Accidental spills and leaks from the maintenance activities may also occur and potentially change surface water and sediment quality, if not mitigated.

7.3.1.10.2 Mitigation and Enhancement Measures

Construction

The transportation, storage, and handling of fuels during construction will be in compliance with Canada's *Transportation of Dangerous Goods Act* (Government of Canada, 1992) and the *Technical Standards and Safety Act* (Government of Ontario, 2000). Fuels will be transported to temporary construction camps and temporary laydown areas in tanker trucks, drums, or other approved containers and stored in aboveground storage tanks featuring secondary containment. Note that at the onset of the Project, fuel will be transported by aircraft to the fuel storage facility. Vehicles used for transportation will be licensed and maintained according to safety requirements. The aboveground storage tanks will meet the requirements of the Canadian Council of Ministers of the Environment (Canadian Council of Ministers of the Environment, 2003). Transportation of fuel on winter roads will only take place in safe ice conditions (e.g., open roads where ice thickness has been measured). The Owner/Operator will prepare Waste Management Plans that describe the appropriate management of solid, liquid, and hazardous waste. Drums and containers for disposal will be transported off-site and disposed at a waste disposal site designed to accept this type of waste.

Refuelling, service, and maintenance of vehicles and equipment will generally be carried out in designated areas at temporary construction camps and temporary laydown areas located a minimum of 120 m from waterbodies to the extent possible. Designated refuelling, service, and maintenance areas will have adequate lighting available to help prevent the potential for spills during hours when daylight is not available.

These areas will be designed and constructed to collect and contain minor leaks and spills. For example, spill containment measures may consist of low permeability liners, sloped appropriately, and buried in the ground, portable berms (e.g., insta-berms) or concrete pads with perimeter drainage control. Drainage will be passed through an oil-water separator to remove hydrocarbons prior to its release to a vegetated area. If refuelling within 120 m of a waterbody cannot be avoided, enhanced spill containment measures, including but not limited to the above mentioned measures and use of drip-trays and automatic shut-off nozzles, avoiding refuelling in riparian areas together with implementation of Spill and Emergency Response Plan, will be used. In the event that refuelling, servicing and maintenance are required in the field, 120 m buffer will be respected to the extent possible. There may be locations where this is not possible due to the prevalence of wetlands; however, in these locations, enhanced spill containment measures will be used.

The Owner/Operator will prepare and implement a Spill Prevention and Emergency Response Plan in accordance with Part X of the *Environmental Protection Act* and *Ontario Regulation 675/98* under *Environmental Protection Act* (Government of Ontario, 1990d). The Plan will describe specific measures that would be implemented if a spill occurred. Spill Prevention and Emergency Response Plan will be provided in permit/approval applications for review by regulatory agencies, as applicable, in advance of construction activities. Spill response kits will be provided in fuel and hazardous materials storage and handling facilities at temporary construction camps and temporary laydown areas, in on-site work areas, and / or in vehicles and equipment, and personnel will be trained in spill response practices and procedures. Spills and leaks will be contained and cleaned up as soon as possible following incidents.

It is noted that a sewage Environmental Compliance Approval may be required for the management of stormwater drainage from the storage areas / facilities. In the event of a spill, it is anticipated that the water will be collected and transported in trucks to a treatment facility for disposal (similar to the management of wash water from vehicle and equipment).

Operation and Maintenance

During the operational life of the Community Access Road, it is expected that the operators of vehicles (private and / or commercial vehicle drivers) will follow the regulations regarding the road safety, vehicle safety, and transportation and handling of hazardous material to ensure the safety of road users and protect environment. It is also expected that highway Ontario Provincial Police will patrol the Community Access Road regularly, enforce relevant regulations, when necessary, and respond to accidents immediately, and, in the event of a spill, the spill will be contained and cleaned up as soon as possible.

In addition to the above expectations, mitigation and enhancement measures to minimize the potential effects on the water and sediment quality of receiving waterbodies due to accidental spills and leaks during the maintenance activities will include:

- Using vehicles or equipment for maintenance activities that are licensed and maintained according to safety requirements;
- Performing regular inspections of vehicles and equipment for leaks;
- Storing hazardous materials in designated areas designed and constructed to collect and contain minor leaks and spills;
- Developing and implementing Spill Prevention and Emergency Response Plan (including clean-up equipment and material, instructions, education and emergency numbers) for maintenance activities;
- Removing and hauling contaminated soil to an approved land facility for disposal; and
- Using sand on bridge decks and roadways for de-icing instead of salt.

7.3.1.10.3 Predicted Residual Effects

The wash-off of fluids from accidental spills and leaks may result in an increase to the concentrations of chemical constituents in receiving waterbodies. However, leaks or spills are considered avoidable with good planning, adequate design, and proper emergency response. Further to this, the frequency, spatial extent, and severity of accidental spills or leaks during the Construction and Operation and Maintenance Phases of the Project are anticipated to be minimized with the effective implementation of the mitigation and enhancement measures identified previously and summarized in **Table 7-7**. However, it is recognized that, even with the best planning and the implementation of mitigation measures, the potential exists for accidents and malfunctions. As such, measurable changes (i.e., residual effects) to surface water and sediment quality in the form of increase to the concentrations of chemical constituents in receiving waterbodies could occur in the event of the wash-off from accidental spills or leaks to nearby waterbodies. Therefore, this Project–environment interaction during Construction and Operation and Maintenance Phases is carried forward to the residual effects characterization (**Section 7.3.2.8**).

7.3.1.11 Changes to Surface Water Quality and Sediment Quality from the Wash-Off of Explosive Spills and Residues from Blasting Activities to Nearby Waterbodies during Construction

7.3.1.11.1 Potential Effects

Construction

During the Construction Phase of the Project, blasting may be required for aggregate extraction from pits and quarries and to facilitate excavation for the Community Access Road, supporting access roads (both temporary and permanent), and waterbody crossing structure foundations where other options are not feasible. The blasting agents employed for structure foundation works can be accidentally released during storage, transfer, or loading. These blasting activities may result in changes to surface water and sediment quality, recognizing that explosives spills and residues could be washed off into nearby waterbodies during a runoff event and, if occurring in high enough volumes, may result in changes to the concentrations of chemical constituents in receiving waters. A waterbody may be influenced by these potential effects only if there is need to employ blasting in close proximity to the feature. Therefore, it is anticipated that only a limited number of waterbodies may be potentially affected.

7.3.1.11.2 Mitigation and Enhancement Measures

Construction

The transportation and storage of explosives will be in compliance with the *Explosives Act* (Government of Canada, 1985) and the *Transportation of Dangerous Goods Act* (Government of Canada, 1992), where applicable, recognizing that explosives will be transported in vehicles with valid Natural Resources Canada permits and stored in properly sited and secured magazines licensed by Natural Resources Canada. Blasting activities in aggregate pits and quarries will abide by the hours of operation and any blasting restrictions on the aggregate permit / licence issued under *Aggregate Resources Act* (Government of Ontario, 1990i), where applicable, to help to ensure the effects on the environment are mitigated.

Ammonium nitrate and fuel oil will not be used. Explosives will be in emulsion form (ammonium nitrate emulsion) to mitigate potential dissolution and poor explosive performance in the presence of water, noting that emulsion type explosives are highly water resistant.

The Owner/Operator will prepare and implement a Blasting and Communication Management Plan that describes specific measures that would be implemented if blasting is required. Marten Falls First Nation will employ only qualified persons with appropriate training and experience to carry out the transportation and handling of explosives. Good housekeeping practices will be observed during loading of explosives with a plan to immediately clean up spills and undetonated explosives.

Proper loading techniques will be implemented to minimize the use of excess explosives and the potential for spillage. Waste rock (from the construction of waterbody crossing foundations) and aggregates (from quarrying activities) are expected to be free of blasting residues. The Environmental Inspector will monitor blasting operations for adherence to the Blasting and Communication Management Plan.

Blasting wastes may include discarded explosives and packaging containing chemical residues (classified as hazardous wastes) as well as waste rock. Discarded explosives will either be detonated on site as part of the blast with explosives packaging daily or temporarily stored in the explosives magazine and returned to the explosives' distributor.

7.3.1.11.3 Predicted Residual Effects

Measurable changes to surface water quality (i.e., residual effects) at nearby waterbodies may occur due to the wash-off of explosives spills and residues from blasting activities, especially at locations where structural foundation work is required, even with the effective implementation of the mitigation measures identified previously and summarized in **Table 7-7**. Therefore, this Project–environment interaction during Construction Phase is carried forward to the residual effects characterization (**Section 7.3.2.9**).

7.3.1.12 Summary of Potential Effects, Mitigation and Enhancement Measures, and Identification of Residual Effects

Table 7-7 provides a summary of the potential effects due to Project–environment interactions during Construction and Operation and Maintenance Phases of the Project, mitigation and enhancement measures, and identification of residual effects identified in previous sections.

Table 7-7: Potential Surface Water Effects, Mitigation and Enhancement Measures, and Predicted Residual Effects

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
Surface Water Quantity	■ Constructing the Community Access Road ■ Constructing and installation of bridges and culverts ■ Construction and operation of temporary infrastructure	■ Construction	■ Changes to surface water quantity from short-term water taking	■ Water taking will be in compliance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 64/16* (Government of Ontario, 1990c) (pertaining to permits, data and reporting, and water transfers), where applicable, and best industry practices. ■ Eligible activities will be registered on the Environmental Activity and Sector Registry. If an activity does not meet these criteria, a Permit to Take Water will be obtained. ■ Site specific water flow and/or levels triggers will be developed for sensitive water sources that may be affected by water takings, if needed. ■ Potable water for work sites, temporary construction camps, and temporary laydown areas will be obtained from surface water sources (with appropriate treatment as needed), bottled sources, and groundwater wells (only if necessary). ■ All water taking will be in compliance with the applicable legislation, regulations, and best industry practices.	■ Residual effects to surface water quantity during Construction from short-term water taking
Surface Water Quantity Surface Water Quality Sediment Quality	■ Constructing the Community Access Road ■ Construction and installation of bridges and culverts ■ Construction and operation of temporary infrastructure	■ Construction	■ Changes to surface water quantity, surface water quality, and sediment quality from short-term water discharges	■ Construction water will be discharged in compliance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 64/16* (Government of Ontario, 1990c) or *Ontario Regulation 63/16* (Government of Ontario, 1990d), where applicable, and good industry practice. ■ Treatment and disposal of water from concrete batch plants at pits and quarries will be in compliance with Environmental Compliance Approvals issued by the Ministry of the Environment, Conservation and Parks under the *Environmental Protection Act* (Government of Ontario, 1990d), where applicable. ■ Wastewater associated with discharges from Project will be characterised and, in some cases, assimilative capacity study may be conducted, where necessary. ■ Wash water from cleaning concrete mixing equipment and delivery systems, as well as from vehicles and equipment, will be collected in designated wash-out sites, located at least 30 m from a waterbody. The wash-out site will be monitored regularly to verify that runoff from the area does not report to a waterbody. Following the Construction Phase, all temporary wash-out sites will be capped with local backfill and regraded prior to construction crews departing the site. ■ Domestic wastewater will be discharged to on site leaching beds at the temporary construction camps. All required permits and authorizations will be acquired for construction and operation of the leaching beds. Leaching beds will be designed and constructed according to Ontario Building Code 2012 (*Ontario Regulation 332/12: Building Code)* under *Building Code Act* (Government of Ontario, 1992). ■ If required and when feasible, domestic wastewater will be removed by approved disposal trucks and disposed of at wastewater treatment plants with authorization and capacity to accept this wastewater. ■ Construction water / wastewater (not requiring approvals) will be directed at, a minimum, to low-lying vegetated areas for infiltration, and measures such as filter fabric or straw bales will be utilized to minimize sediment transport during dewatering. ■ Marten Falls First Nation with the Owner/Operator will review discharge sites / locations to avoid discharging to sensitive areas, including areas identified through the Indigenous Knowledge Program.	■ Residual effects to surface water quantity, surface water quality and sediment quality from short-term water discharges

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
Surface Water Quantity Surface Water Quality Sediment Quality	■ Constructing bridges and install culverts ■ Decommissioning temporary infrastructure (e.g., remove temporary culverts and bridges)	■ Construction	■ Changes to surface water quantity, surface water quality, and sediment quality during short-term water diversions at waterbody crossings	■ The construction (and removal as needed) of temporary and permanent waterbody crossings, and removal of temporary waterbody crossing structures following the completion of the relevant work, will be in compliance with Ministry of the Environment, Conservation and Parks-specified conditions and Ministry of Natural Resources regulatory permits and approvals, as applicable. ■ Short-term water diversions (active or passive) will be carried out in accordance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 301/21* (Government of Ontario, 1990c). ■ Waterbody crossings will be designed and constructed in compliance with *Ontario Regulation 454/96* of the *Lakes and Rivers Improvement Act* (Government of Ontario, 1990f), as applicable. ■ Waterbody crossings will be constructed in compliance with Ministry of the Environment, Conservation and Parks-specified conditions and Ministry of Natural Resources approvals, if required. ■ Waterbody crossings will be designed and constructed in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990) as well as *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (Ministry of Natural Resources, 2010) and *Technical Guide River & Stream Systems: Flooding Hazard Limit* (Ministry of Natural Resources, 2002), as applicable. ■ To account for climate change effects, Marten Falls First Nation will also implement mitigation measures as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024). ■ Environmental monitoring (including water quality sampling / testing noted in **Section 9.2** will be conducted during Construction Phase to verify the performance and effectiveness of the planned mitigation measures. Monitoring will occur during installation works, including all in-water activities, and continue during the Construction Phase, including the removal of temporary crossing structures as part of construction decommissioning activities. The monitoring program will be under the direction of the Environmental Monitor and Indigenous Environmental Monitor. ■ Temporary waterbody crossings will be remediated at the end of Construction Phase. The remediation will involve removal of temporary waterbody crossing structures (if constructed), restoration, and stabilization of waterbody banks and other disturbed areas when the crossing is no longer required. ■ An Adaptive Management Plan will be developed in the event of an unexpected change to water quantity or quality (i.e., increase in turbidity in accordance with Canadian Council of Ministers of the Environment standards).	■ Residual effects to surface water quantity, surface water quality, and sediment quality during short-term water diversions at water crossings
Surface Water Quantity Surface Water Quality Sediment Quality	■ Constructing and installing bridges and culverts	■ Construction	■ Changes to surface water quantity, surface water quality, and sediment quality due to changes in channel hydraulics at waterbody crossings	■ Waterbody crossings will be designed and constructed in accordance with permits and approvals through Fisheries and Oceans Canada, and Ministry of Natural Resources, as applicable. ■ All newly installed or upgraded waterbody crossing structures will be in compliance with *Ontario Regulation 239/13* (Government of Ontario, 1990h) and *Ontario Regulation 454/96* (Government of Ontario, 1990f), as applicable. ■ Waterbody crossings will be designed and constructed in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990) as well as *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (Ministry of Natural Resources, 2010) and *Technical Guide River & Stream Systems: Flooding Hazard Limit* (Ministry of Natural Resources, 2002), as applicable.as applicable. ■ Marten Falls First Nation will implement mitigation measures as outlined in the Climate Adaption and Resiliency Technical Support Document	■ Residual effects to surface water quantity, surface water quality, and sediment quality due to changes in channel hydraulics at waterbody crossings

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
				(AECOM, 2024). In addition, it is worth highlighting that the design of waterbody crossing structures (culverts and bridges) will consider climate change effects. ■ Waterbody crossing structures, including clear span bridges, ice bridges / snow fills, rig mats and culverts, will be primarily based on hydrologic and hydraulic design flow calculations, which consider, but are not limited to, expected rainfall and peak flow within the geographic area as well as the relevant catchment area, channel slope, and channel substrate. ■ At some locations where it is determined that spring-melt or storm runoff needs to pass from one side of the right-of-way to the other to prevent flooding and / or erosion, equalization culverts will be installed. ■ Each waterbody crossing will be visited ahead of construction by qualified environmental personnel and fisheries biologists and / or technicians (i.e., Aquatics Specialist) to verify that the crossing location is conducive to the planned crossing structure installation, such that any changes in site conditions can be addressed through necessary design adjustments. During pre-construction site visits, surface water surveys at any waterbody crossing location that has not already been assessed as part of the field investigations will be conducted. Refer to Section **9.1** for details about pre-construction surveys. ■ If site-specific changes to waterbody crossing structure type are required, engagement with appropriate regulatory authorities (i.e., Fisheries and Oceans Canada, Ministry of Natural Resources) will occur prior to any instream construction activities, where appropriate (i.e., placement of additional fill, regrading and / or stabilization of bed or banks). ■ To reduce the potential effects on cross-section hydraulics mitigation measures will include: ○ Minimizing the number of waterbody crossings required, to the extent possible and use of existing roads or trails; ○ Carrying out construction activities without any permanent in-water works except where culverts will be used; ○ Designing the infrastructure at waterbody crossings to pass peak flows (including extreme storm events cause by climate change, as appropriate) and maintain sufficient flow conveyance in such a way that no discernible effects on stream hydraulics occur ■ Waterbody crossing design and construction will maintain the characteristic channel width, depths, slopes, and substrate in the event that a channel realignment is required, noting that: ○ Channel realignments and / or infillings will be avoided through Project planning and design to the extent practicable. ○ Channel realignments and / or infilling will only be undertaken in locations where specific conditions are met and / or where required for safety and security purposes; and if required. ○ A realignment would avoid the use of a Fisheries and Oceans Canada code of practice (required approval by Fisheries and Oceans Canada), with the plan and mitigations requiring reviewed by Ministry of Natural Resources through permitting the water crossing. ■ Prior to commencing construction work, the Owner/Operator will implement erosion and sediment control measures. ■ Upon completion of construction work, watercourse banks will be returned to their original profile and disturbed areas will be stabilized as necessary to prevent soil erosion. ■ At the end of construction, temporary waterbody crossings will be reclaimed.	

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
	■ Maintain[(a)] the Community Access Road and permanent access roads, including bridges and culverts	■ Operation and Maintenance		■ Permanent culverts will be monitored in accordance with the Culvert Inspection Guide (Ministry of Transportation, 2022) to identify and remove blockages (e.g., ice, woody debris), as needed, that could otherwise lead to scouring and effects on channel morphology and fish habitat and potentially interfere with fish passage. ■ New permanent waterbody crossing structures (bridges), and roadside drainage features will be monitored and inspected for physical function and condition in accordance with the Ontario Structure Inspection Manual (Ministry of Transportation, 2018). ■ Waterbody crossings will be maintained in accordance with permits and approvals through Fisheries and Oceans Canada and Ministry of Natural Resources, as applicable. ■ Inspection and monitoring frequency will be increased during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024). ■ Problems identified during monitoring and inspection will be fixed immediately to prevent any further damage to the channel hydraulics, aquatic habitat and the fisheries resources. ■ In-water works will be minimized, where possible, and timing of work will also be limited to avoid period of fish spawning, incubation and migration. ■ Appropriate erosion and sediment control measures will be implemented in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805) prior to commencement of repair work. ■ Disturbed areas will be restored and revegetated to mitigate erosion and sediment entry to waterbodies. ■ Waterbody crossings will be repaired and reinforced in a manner that prevents waterbody crossing structure materials from entering waterbodies. ■ Entry of waste materials to be stabilized or disposed of will be prevented in waterbodies. ■ Waterbody crossings will be reconstructed, when necessary, in compliance with Ministry of Natural Resources approvals.	
Surface Water Quantity Surface Water Quality Sediment Quality	■ Clearing of the right-of-way for the Community Access Road and supporting access roads ■ Constructing the Community Access Road ■ Constructing and operating temporary infrastructure ■ Decommissioning temporary infrastructure	■ Construction	■ Changes to surface water quantity, surface water quality, and sediment quality due to changes in land cover	■ The right-of-way, roads, and trails (existing and new) will be used for access, to the extent practicable, to minimize changes in land cover. ■ Upgrade and construction of new access road will be in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990). ■ Temporary construction camps, temporary laydown areas, and other Project activities will be located a minimum of 30 m away from the ordinary high-water mark of a waterbody. ■ Progressive revegetation of the right-of-way including natural revegetation using native seed or appropriate tree species will be implemented, as appropriate. Temporary access roads and trails, temporary construction camps, turn-around areas, waterbody crossings, and temporary laydown areas will be progressively restored to pre-existing compatible condition through the Construction Phase. ■ Seeding will follow as close as possible to final cleanup and topsoil material replacement pending seasonal or weather conditions. ■ Only materials cleared for acid rock drainage (i.e., non-potentially acid generating rock) by a geochemical verification process will be used for the road surface to avoid acid rock drainage or associated metal leaching. ■ The Owner/Operator will limit the use of off-road vehicles during Construction Phase, noting that:	■ Residual effects to surface water quantity, surface water quality, and sediment quality due to changes in land cover

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
				○ Off-road vehicle use will follow Fisheries and Oceans Canada's *Code of Practice for Fording* (Fisheries and Oceans Canada, 2022), *Fisheries and Oceans Canada's All Terrain Vehicle Guidance* (Fisheries and Oceans Canada, 2010) and *Ontario Regulation 316/03* under *Highway Traffic Act* (Government of Ontario, 1990g). ○ Inspections and maintenance activities will include cleaning of off-road vehicles before and after each use to prevent the spread of invasive species and to identify any fuel leaks or equipment damage. ○ Avoidance of sensitive features and waterbody crossings to the extent practicable. ■ Erosion and Sediment Control Plan will be developed and implemented in accordance with Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV.804, OPSS.MUNI 182 and OPSS.MUNI.805). This includes provision of multistage drainage and sediment controls to collect and treat stormwater runoff from Project components, as appropriate. These controls may include diversion swales / dykes, collection ditches, silt fences, rock check dams, sediment traps / basins, level spreaders and riparian buffer strips. An Erosion and Sediment Control Plan will be provided in permit/approval applications for review by regulatory agencies, as applicable, in advance of construction activities. ■ Climate change factors will be considered in the selection and implementation of site-specific mitigation and enhancement measures, and increasing the inspection and monitoring frequency during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024).	
	■ Maintain[(a)] the Community Access Road and permanent access roads, including bridges and culverts	■ Operation and Maintenance		■ Disturbance to existing land cover during maintenance works will be kept to a minimum level. ■ Disturbed areas will be restored and revegetated, including natural revegetation, to mitigate changes to runoff rates and erosion / sedimentation processes. ■ Existing access roads and trails for access, if available, will be used, to the extent practicable, to minimize new disturbance. ■ New access road will be upgraded in accordance with Ministry of Natural Resources' Environmental Guidelines for Access Roads and Water Crossing (Ministry of Natural Resources, 1990), which provides comprehensive guidance with respect to design and construction practices to mitigate environmental effects. ■ Materials cleared for acid rock drainage (i.e., non-potentially acid generating rock) by a geochemical verification process for the road resurfacing, when necessary, will be used to avoid acid rock drainage or associated metal leaching. ■ Off-road vehicles will be inspected and cleaned before and after each use to prevent the spread of invasive species and to identify any fuel leaks or equipment damage. ■ Appropriate erosion and sediment control measures will be implemented in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805) prior to commencement of maintenance work. ■ Climate change factors will be considered in the selection and implementation of site-specific mitigation and enhancement measures, and increasing the inspection and monitoring frequency during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024).	

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
Surface Water Quality	■ Clearing of the right-of-way for the Community Access Road and supporting access roads ■ Blasting rock ■ Constructing the Community Access Road ■ Constructing and operating temporary infrastructure ■ Decommissioning temporary infrastructure	■ Construction	■ Changes to surface water quality from the transport and delivery of airborne particulate matter to nearby waterbodies	■ Mitigation measures provided in the *Air Quality and Greenhouse Gas Technical Support Document: Existing Conditions & Effects Assessment* (Dillon, 2026) will be implemented. ■ Potential mitigation measures outlined in the Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions for Provincial Transportation Projects (Ontario Ministy of Transportation, 2020) may be implemented, if feasible.	■ No residual effect anticipated
	■ Operate the Community Access Road and permanent access roads ■ Maintain[(a)] the Community Access Road and permanent access roads, including bridges and culverts	■ Operation and Maintenance		■ Mitigation measures provided in the *Air Quality and Greenhouse Gas Technical Support Document: Existing Conditions & Effects Assessment* (Dillon, 2026) will be implemented. ■ Potential mitigation measures outlined in the Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions for Provincial Transportation Projects (Ontario Ministy of Transportation, 2020) may be implemented, if feasible.	
Surface Water Quality	■ Clearing of the right-of-way for the Community Access Road and supporting access roads ■ Constructing the Community Access Road ■ Construction and operation of temporary infrastructure	■ Construction	■ Changes to surface water quality from the wash-off of trash, domestic waste, and leachate at waste handling and storage facilities to nearby waterbodies	■ The Owner/Operator will prepare and implement Waste Management Plans that describe the appropriate management of solid, liquid, and hazardous waste. ■ Portable, secure, solid waste receptacles will be provided on work sites and temporary laydown areas and the solid waste collected will be hauled periodically to waste handling and storage facilities located at the temporary construction camps; ■ Solid waste handling and storage facilities at temporary construction camps will be sited outside a minimum 30 m buffer around waterbodies. ■ Solid waste handling and storage facilities at temporary construction camps and aggregate pits and quarries will be provided with drainage controls. ■ The Owner/Operator will prepare and implement a Spill Prevention and Emergency Response Plan that describes specific measures that would be implemented if a spill occurred. ■ Only materials cleared for acid rock drainage (i.e., non-potentially acid generating rock) by a geochemical verification process will be used for the road surface to avoid acid rock drainage or associated metal leaching. ■ Solid waste will be managed and disposed in compliance with *Ontario Regulation 347* as amended by *Ontario Regulation 105/24* under the *Environmental Protection Act* (Government of Ontario, 1990d). ■ Hazardous waste will be periodically transported by a registered hauler to an approved disposal site.	■ No residual effect anticipated
Surface Water Quality	■ Clearing of the right-of-way for the Community Access Road and supporting access roads	■ Construction	■ Changes to surface water quality from the wash-off of organic debris from vegetation maintenance activities to adjacent waterbodies	■ A riparian buffer of 30 m around waterbodies will be maintained for the right-of-way, unless required for access to install waterbody crossing structures, in which case a 10 m wide right-of-way for equipment access will be cleared within right-of-way. ■ Temporary access roads will be cleared and will be 10 m wide. ■ Vegetation clearing will consist of cutting tree trunks parallel to and within 15 cm of the ground or lower as well as the removal of all shrubs, debris, and other such materials. ■ Vegetation will be largely removed by mechanical means, except within 10 m of a watercourse or wetland. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the undergrowth and duff layer undisturbed to prevent erosion. ■ Vegetation clearing or disturbed areas within the 30 m buffer will be provided with appropriate erosion and sediment controls in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805).	■ No residual effect anticipated

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
				■ Removed vegetation will be immediately transported outside a waterbody buffer zone (30 m) and above its high-water mark. ■ Herbicides use is not planned. Vegetation will be largely removed by mechanical means, except within 10 m of a watercourse or wetland. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the undergrowth undisturbed to prevent erosion.	
	■ Maintain[(a)] the Community Access Road and permanent access roads, including bridges and culverts	■ Operation and Maintenance		■ Vegetation will be removed using mechanical means, except within 10 m of a waterbody where chain saws and other hand-held equipment will be used. ■ Soil disturbance, including grubbing, will be avoided within 30 m of a waterbody. ■ A riparian buffer of 30 m around waterbodies for the right-of-way will be maintained, unless required for access to repair / replace waterbody crossing structures, in which case a 10 m wide right-of-way for equipment access will be cleared within right-of-way. Temporary access roads will be cleared and will be 10 m wide. ■ Appropriate erosion and sediment controls will be implemented in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805) when clearing or disturbing areas within the 30 m buffer. ■ Removed vegetation will be relocated immediately outside a waterbody buffer zone (30 m) and above its high-water mark. ■ Herbicides use is not planned. Vegetation will be largely removed by mechanical means, except within 10 m of a watercourse or wetland. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the undergrowth undisturbed to prevent erosion.	
Surface Water Quality Sediment Quality	■ Clearing of the right-of-way for the Community Access Road and supporting access roads ■ Constructing the Community Access Road ■ Constructing and operating temporary infrastructure ■ Decommissioning temporary infrastructure	■ Construction	■ Changes to surface water quality and sediment quality from the wash-off of organic debris to nearby waterbodies and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies	■ During Construction, existing access to roads or trails, if available, will be used as much as possible to limit disturbance resulting from construction of new Community Access Road. ■ Temporary laydown areas and temporary construction camps will be constructed on existing disturbed areas and / or at reasonably flat areas with stable soil, where possible. ■ The new Community Access Road and waterbody crossings will be designed and constructed in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990). ■ Water crossings will be constructed in compliance with *Ontario Regulation 239/13* under *Public Lands Act* (Government of Ontario, 1990h) and / or *Ontario Regulation 454/96* under the *Lakes and Rivers Improvement Act* (Government of Ontario, 1990f), as applicable. ■ Buffer zones of 30 m will be maintained around waterbodies and clearing of riparian vegetation will be limited to the extent practicable and to the requirement of the access road and alignment clearing width only. Clearing at waterbody crossings along the Community Access Road right-of-way will generally be limited to a 10 m wide right-of-way for equipment access to waterbody crossing structures (e.g., temporary bridges). ■ Removed vegetation will be immediately transported outside a waterbody buffer zone and above its high-water mark to minimize disturbance to the bed and banks. ■ Marten Falls First Nation with the Owner/Operator will work with both Indigenous communities and forest management units to manage merchantable timber cleared by the Project. ■ Slash and debris will be chipped and spread over the right-of-way or will be burned in accordance with provincial *Forest Fires Prevention Act*	■ Residual effects to surface water quality and sediment quality from the wash-off of organic debris to nearby waterbodies and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
				and in compliance with *Ontario Regulation 207/96* (Government of Ontario, 1990e). ■ Marten Falls First Nation with the Owner/Operator will develop and implement Erosion and Sediment Control Plan. The Owner/Operator will install, monitor, and manage appropriate erosion and sedimentation control measures in accordance with Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV.804, OPSS.MUNI 182 and OPSS.MUNI.805) to minimize or avoid sediment mobilization to drainages, or waterbodies. Adequate and appropriate erosion and sedimentation control materials shall be on site and available prior to commencement of Construction. ■ Disturbed areas will be stabilized (e.g., cover exposed areas with erosion control blankets or tarps to keep the soil in place and prevent erosion) as needed. Such areas will be covered with mulch to prevent erosion. ■ Sedimentation in the receiving environment will be controlled by directing sediment-laden water to various temporary storage and settlement features (i.e., sumps, settling ponds or catch basins) prior to discharge. Alternately, where appropriate, the sediment-laden water will be directed to drain / filter through low gradient, well-vegetated areas away from watercourses (i.e., using pumps and hoses). ■ Sediment control measures will be incorporated prior to construction activities or immediately after disturbance on site-specific cases throughout the Project to avoid introduction of sediment to the environment, and, as part of this, to stabilize drifting soils or loss of topsoil, as practicable. Sediment control measures may include silt fences, filter bags, straw bale fences, berms, ponds and gravel or vegetative filters, check dams, erosion control blankets, and other features. ■ Additional contingency measures will be implemented as appropriate in the event of excessive rain, wet weather, or flood-like conditions (when the planned activity could cause significant damage to soils, such as rutting by traffic through the topsoil, soil structure damage during soil handling, or compaction and associated pulverization of topsoil structure damage due to heavy traffic): ○ Reschedule work or reduce / detour traffic in areas where soils are considered to be excessively wet. ○ Restrict construction traffic, where feasible, to equipment with low-ground pressure tires or wide pad tracks. ○ During excessively wet conditions, work only in non-problem areas, such as well-drained soil or well-sodded lands, until conditions improve. ○ Limit vehicle access through soft / wet areas to periods when frozen conditions occur (i.e., early morning / evening) and have crews park in a stable area and walk to on-site equipment if feasible. ○ Install access or rig matting in problem areas to protect soils. ○ If necessary, work will be suspended until soils dry out or appropriate site-specific mitigation can be used to prevent soil disturbance. ■ Progressive reclamation of disturbed areas will be practiced. Natural recovery will be the preferred method over seeding of reclamation on level terrain where erosion is not expected. If seeding is required, erosion prone areas will be seeded with a native cover crop and certified seed mix approved by the applicable regulatory agency, as soon as feasible after Construction. ■ All aggregate pits will be located a minimum of 120 m away from the ordinary high-water mark of a waterbody, where possible. The aggregate pits will follow the guidelines and associated conditions /	

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
				requirements of the approved permits, including development of a rehabilitation plan, outlined in the *Aggregate Permits on Crown Lands for Pits and Quarries above Water* (Ministry of Natural Resources and Forestry, 2014) and the *Forest Management Planning Manual* (Ministry of Natural Resources and Forestry, 2017). ■ Climate change factors will also be considered in design of Community Access Road, waterbody crossings, and stormwater management works, and the implementation of proposed mitigation and enhancement measures (including measures outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024))	
Surface Water Quality Sediment Quality	■ Clearing of the right-of-way for the Community Access Road and supporting access roads ■ Blasting rock ■ Constructing the Community Access Road ■ Constructing bridges and install culverts ■ Construction and operation of temporary infrastructure ■ Decommissioning temporary infrastructure	■ Construction	■ Changes to surface water quality and sediment quality from the wash-off of accidental spills and leaks to nearby waterbodies	■ The transportation, storage, and handling of fuels during construction will be in compliance with Canada's *Transportation of Dangerous Goods Act* (Government of Canada, 1992) and the *Technical Standards and Safety Act* (Government of Ontario, 2000). ■ The aboveground storage tanks will meet the requirements of the Canadian Council of Ministers of the Environment (2003). ■ The Owner/Operator will prepare and implement Waste Management Plans that describe the appropriate management of solid, liquid, and hazardous waste. ■ The Owner/Operator will prepare and implement a Spill Prevention and Emergency Response Plan in accordance with Part X of the *Environmental Protection Act* and Ontario Regulation 675/98 under *Environmental Protection Act* (Government of Ontario, 1990d). ■ A Spill Prevention and Emergency Response Plan will be provided in permit/approval applications for review by regulatory agencies, as applicable, in advance of construction activities. ■ Fuel and hazardous materials will be transported in approved containers in licensed vehicles. ■ Transportation of fuel on winter roads will only take place in safe ice conditions, noting that at the onset of the Project, fuel will be transported by aircraft to the fuel storage facility. ■ Vehicles used for transportation will be licensed and maintained according to safety requirements. Vehicles and equipment used for construction will be regularly serviced, maintained and inspected for leaks. ■ Fuel and hazardous materials will be stored and handled in designated areas with appropriate secondary containment. ■ Refuelling, service, and maintenance of vehicles and equipment will generally be carried out in designated areas at temporary construction camps and temporary laydown areas located a minimum of 120 m from waterbodies to the extent possible. ■ Designated refuelling, service, and maintenance areas will be designed and constructed to collect and contain minor leaks and spills, and will also have adequate lighting available to help prevent the potential for spills during hours when daylight is not available. ■ If refuelling within 120 m of a waterbody cannot be avoided, enhanced spill containment measures, such as a Spill Prevention and Emergency Response Plan, will be used. ■ In the event that refuelling, servicing, and maintenance is required in the field, 120 m buffer will be respected to the extent possible. There may be locations where this is not possible due to the prevalence of wetlands; however, in these locations, enhanced spill containment measures will be used. ■ Spill response kits will be provided in fuel and hazardous materials storage and handling facilities at temporary construction camps and temporary laydown areas, in on-site work areas, and / or in vehicles and	■ Residual effects to surface water quality and sediment quality from the wash-off of accidental spills and leaks to nearby waterbodies

Valued Component	Project Activities	Project Phase	Description of Potential Effect	Mitigation and Enhancement Measures	Predicted Residual Effect
				equipment, and personnel will be trained in spill response practices and procedures. ■ Spills and leaks will be contained and cleaned up as soon as possible following incident, and disposed of at a treatment facility with authorization and capacity to accept this waste.	
	■ Maintain[(a)] the Community Access Road and permanent access roads, including bridges and culverts	■ Operation and Maintenance		■ Vehicles or equipment for maintenance activities will be licensed and maintained according to safety requirements. ■ Regular inspections of vehicles and equipment for leaks will be performed. ■ Hazardous materials will be stored in designated areas designed and constructed to collect and contain minor leaks and spills. ■ Spill Prevention and Emergency Response Plan (including clean-up equipment and material, instructions, education and emergency numbers) for maintenance activities will be developed and implemented. ■ Contaminated soil will be removed and hauled to an approved land facility for disposal. ■ Sand will be used on bridge decks and roadways for de-icing instead of salt.	
Surface Water Quality Sediment Quality	■ Clearing of the right-of-way for the Community Access Road and supporting access roads ■ Blasting rock (e.g., remove rock at quarries and, as required, at specific locations in association with road and bridge construction) ■ Constructing the Community Access Road ■ Constructing bridges and install culverts	■ Construction	■ Changes to surface water quality and sediment quality from the wash-off of explosives spills and residues from blasting activities to nearby waterbodies	■ The transportation and storage of explosives will be in compliance with the *Explosives Act* (Government of Canada, 1985) and the *Transportation of Dangerous Goods Act* (Government of Canada, 1992), where applicable. ■ Ammonium nitrate and fuel oil will not be used. Explosives will be in emulsion form (ammonium nitrate emulsion) to mitigate potential dissolution and poor explosive performance in the presence of water. ■ Blasting activities will also be in accordance with aggregate permit / licence issued under *Aggregate Resources Act* (Government of Ontario, 1990i). ■ The Owner/Operator will prepare and implement a Blasting and Communication Management Plan that describes specific measures that would be implemented if blasting is required. ■ The Environmental Inspector will monitor blasting operations for adherence to the Blasting and Communication Management Plan. ■ Discarded explosives will either be detonated on site as part of the blast with explosives packaging daily or temporarily stored in the explosives magazine and returned to the explosives' distributor.	■ Residual effects to surface water quality and sediment quality from the wash-off of explosives spills and residues from blasting activities to nearby waterbodies

Notes:
(a) Includes General Maintenance (e.g., *grading, erosion control, quarrying, pits and quarries), Seasonal Maintenance (e.g., snow clearing and bridge and culvert maintenance), and Special Maintenance (e.g., slope failures and road settlement / break-up).*
m = metre; cm = centimetre; OPSS = Ontario Provincial Standard Specifications.

7.3.2 Characterization of Predicted Residual Effects

Assuming effective implementation of all mitigation and enhancement measures presented in **Table 7-7**, residual effects as a result of the Project are predicted for surface water and are included in the characterization of predicted residual effects and cumulative effects assessment. Predicted residual effects are characterized according to the effect characteristics of context, direction, magnitude, geographic extent, duration, frequency, reversibility, likelihood, and uncertainty (**Section 4.4.2**). A description of the predicted residual effects of the Project on surface water, a determination of significance, and prediction confidence are presented in the following sections and summarized in **Table 7-8**.

7.3.2.1 Residual Effects to Surface Water Quantity from Short-Term Water Taking

Construction

As described in **Section 7.3.1.1** and summarized in **Table 7-7**, short-term water takings from surface water or surface water and groundwater sources for the purposes of construction and water supply could result in changes to surface water quantity in the form of reductions in streamflows and / or water levels at nearby waterbodies (specific to or adjacent to the source of the water taking). The specific locations for short-term water takings, as well as the anticipated water taking duration and volumes, will be determined during the permitting and detailed design stage of the Project.

The residual effect will be direct because the relevant Project activities during the Construction Phase are expected to directly affect surface water. The residual effect was assessed as negative in direction because the relevant Project activities may result in a reduction in streamflows and / or water levels at nearby waterbodies. The residual effect was assessed as negligible in magnitude because short-term water taking activities will be carried out in accordance with the conditions and requirements of Environmental Activity and Sector Registry, a Permit to Take Water, or an Environmental Compliance Approval, recognizing that the Water Taking and Discharge Plans associated with these permits and approvals are by design protective of the existing surface water, groundwater, and natural environment conditions in the local area and, in turn, are expected to result in minimal changes (if any) to streamflows and / or water levels at affected waterbodies. The residual effect is expected to be short-term in duration, given that water taking activities will be limited to the anticipated timeline of the Construction Phase of the Project. The residual effect was assessed to be frequent, given that water taking activities were expected to occur periodically during the Construction Phase (although likely limited to discrete water taking events). The residual effect is predicted to be reversible as the surface water quantity is expected to return to existing conditions upon completion of construction activities requiring short-term water taking and implementation of mitigation measures.

The geographic residual effect is anticipated to be limited to the Local Study Area because any reductions in streamflow and / or water level (due to water taking) will be limited to a small portion of the waterbody near the point of water withdrawal; however, the effect could be carried a short distance downstream (i.e., greater than 120 m) within the Local Study Area. The likelihood of occurrence of the residual effect was assessed as probable (the effect is likely to occur). A summary of characterization of predicted residual effect is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1,** the effect was carried forward into the cumulative effects assessment.

7.3.2.2 Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality from Short-Term Water Discharges

Construction

As described in **Section 7.3.1.2** and summarized in **Table 7-7**, discharges of construction water, dewatering of quarries, and wash water from Project activities during the Construction Phase have the potential to result in changes to surface water quantity in the form of an increase in streamflows and / or water levels at receiving waterbodies. It could also result in changes to surface water and sediment quality in the form of an increase to the concentrations of suspended solids and chemical constituents in receiving waterbodies. The specific locations for short-term discharges will be determined during the permitting and detailed design stage of the Project. Where appropriate, construction water, or wash water from Project activities will be discharged to a well-vegetated ground surface at a distance greater than 30 m from a waterbody and treated prior to discharge in compliance with Environmental Activity and Sector Registry, Permit to Take Water or Environmental Compliance Approval, if required.

The residual effect will be direct because the relevant Project activities during the Construction Phase are expected to directly affect surface water. The effect was assessed as negative in direction because the relevant Project activities may result in an increase in streamflows and / or water levels and an increase to the concentrations of suspended solids and chemical constituents at receiving waterbodies. The residual effect was assessed as negligible in magnitude because short-term water discharge activities will be carried out in accordance with the conditions and requirements of Environmental Activity and Sector Registry, a Permit to Take Water, or Environmental Compliance Approval, recognizing that the Water Taking and Discharge Plans associated with these permits and approvals are by design protective of the existing surface water, groundwater, and natural environment conditions in the local area and, in turn, are expected to result in minimal changes (if any) to streamflows and / or water levels at receiving waterbodies and minimal changes (if any) to surface water quality at nearby waterbodies. The residual effect was characterized as short-term in duration, given that discharge activities will be limited to the anticipated timeline of the Construction Phase.

The residual effect was assessed to be frequent, given that discharge activities were expected to occur periodically during the construction stage (although likely limited to discrete water discharge events). The residual effect is predicted to be reversible as the surface water quantity and quality are expected to return to existing conditions upon completion of Project activities causing short-term discharges and implementation of mitigation measures. The geographic extent of this residual effect is expected to be limited to the Local Study Area because any increases to streamflows and / or water levels and any increases to the concentrations of suspended solids and chemical constituents due to discharges are expected to be limited to the portion of the waterbody immediately downgradient of the point of water discharge; however, the effect could be carried short distance downstream (i.e., beyond 120 m from the waterbody crossing) into the Local Study Area. The likelihood of occurrence of the residual effect was assessed as probable (the effect is likely to occur). A summary of characterization of predicted residual effect is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was carried forward into the cumulative effects assessment.

7.3.2.3 Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality during Short-Term Water Diversions at Water Crossings

Construction

As described in **Section 7.3.1.3** and summarized in **Table 7-7**, the installation and removal of water crossing structures during the Construction Phase, along with short-term water diversions, could result in the following potential changes to surface water quantity:

- Localized increases or reductions in streamflows, water levels, and erosion–sedimentation processes, depending on the specific assessment point relative to the work area (i.e., upstream or downstream of the isolation works, or within the dewatered area) and the diversion method and operations; and
- Localized increases in in-stream erosion–sedimentation processes at the points of the water taking and discharge (to facilitate the diversion).

There will also be temporary, short-term, and local bypass of flow through the Construction Disturbance Area (i.e., change in drainage patterns) and the potential for increased rates of erosion–sedimentation following the removal of the diversion works and / or installation or removal of waterbody crossing structures due to the disturbance of the bed and banks of the waterbody within the limits of the work area.

The installation and removal of waterbody crossing structures, along with short-term water diversions, could result in the following potential changes to surface water and sediment quality:

- Localized increase to the concentration of suspended solids in waterbodies as a result of increased rates of erosion–sedimentation processes during water taking and discharge activities (specific to the points of water taking and discharge in the waterbody to facilitate the diversion) or following the removal of the diversion works and / or installation or removal of waterbody crossing structures due to the disturbance of the bed and banks of the waterbody (specific to the limits of the work area, with the opportunity for sediment to be mobilized and transported downstream); and
- Localized increases to the concentrations of chemical constituents in waterbodies due to equipment leaks.

The residual effect will be direct because the relevant Project activities during the Construction Phase are expected to directly affect surface water. The residual effect was assessed as negative in direction because the relevant Project activities may result in an increase or reduction in streamflows, water levels, and erosion–sedimentation processes at the affected waterbodies depending on the specific assessment point relative to the work area, the diversion method, and construction process. It may also result in an increase to the concentrations of suspended solids and chemical constituents in affected waterbodies.

The residual effect was characterized as negligible in magnitude, given that short-term water diversions will be carried out in accordance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 301/21* under *Ontario Water Resources Act* (Government of Ontario, 1990c), while the installation, maintenance, and removal of all waterbody crossing structures and related water diversion works will follow the relevant permitting and approval conditions through Ministry of Natural Resources. As such, the plan to comply with the conditions and practices identified previously is expected to minimize opportunities for localized changes to surface water quantity and surface water quality conditions. The residual effect is expected to be short-term in duration, given that the installation / removal of waterbody crossing structures and associated use of short-term diversions will be limited to the Construction Phase of the Project. The residual effect is predicted to be reversible as the surface water quantity and quality are expected to return to existing conditions upon removal of short-term water diversions at waterbody crossings. The residual effect was assessed to be infrequent, given that the activities will be restricted to discrete events during the Construction Phase (i.e., installation and removal of crossing structures). The geographic extent of the residual effect is expected to be limited to the Construction Disturbance Area, as any increase or reduction in streamflows, water levels, and erosion–sedimentation processes and any increase to the concentrations of suspended solids and chemical constituents are likely limited to the area in the immediately vicinity of the waterbody crossings and, where applicable, largely indiscernible

a short distance (i.e., less than 120 m) upstream or downstream of the crossing. The likelihood of occurrence of the residual effect was assessed as probable (the effect is likely to occur). A summary of characterization of predicted residual effect is provided in **Table 7-8.**

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was carried forward into the cumulative effects assessment.

7.3.2.4 Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality due to Changes in Channel Hydraulics at Water Crossings

Construction

As described in **Section 7.3.1.4** and summarized in **Table 7-7**, the installation waterbody crossing structures during the Construction Phase may result in changes to channel hydraulics at the affected portion of the waterbody in the form of an increase or reduction in flow velocities, shear stresses, water levels, and erosion–sedimentation processes at locations upstream or downstream of the crossing. These changes in channel hydraulics at the waterbody crossings could result in an increase or reduction in the concentrations of suspended solids at locations downstream of the crossings (due to the corresponding changes to erosion–sedimentation processes in the vicinity of the crossing).

The waterbody crossing structure types will potentially include clear span bridges, bridges with piers and abutments, and culverts, recognizing that, in most instances, culverts would be expected to have a larger influence on channel hydraulics relative to clear span bridges.

The residual effect will be direct because the relevant Project activities during the Construction are expected to directly affect surface water. The residual effect was assessed as negative in direction because the relevant Project activities may result in changes to channel hydraulics at waterbody crossings with the potential for a localized increase or reduction in flow velocities, shear stresses, water levels, and erosion–sedimentation processes at locations upstream or downstream of the crossing. The changes to channel hydraulics at waterbody crossings have the potential for a localized increase or reduction in the concentrations of suspended solids at locations downstream of the crossings (e.g., increases to the concentrations of suspended solids where the potential for heightened sediment erosion / transport processes at the outlet of the crossing structure could result in an increase to downstream concentrations of suspended solids and reductions where the potential for augmented sedimentation processes upstream of the crossing structure could translate to a decrease in downstream concentrations of suspended solids).

The effect was assessed as negligible in magnitude because the crossings will be designed to minimize any effects on channel hydraulics under the majority of streamflow conditions. The residual effect due to construction of permanent waterbody crossing structures is expected to be long-term in duration because the effect persists during the Operation and Maintenance Phase. The residual effect was assessed to be infrequent, largely limited to infrequent, short-term runoff events (i.e., minor to major floods), rather than typical flow conditions. The residual effect is predicted to be irreversible due to permanent waterbody crossing structures as the localized changes to surface water quantity and surface water and sediment quality are likely to persist through the Operation and Maintenance Phase and it is uncertain when the waterbody crossing structures would be decommissioned. The geographic extent of the residual effect is expected to be limited to the Local Study Area, given that any changes to flow velocities, shear stresses, water levels, erosion–sedimentation processes, and concentrations of suspended solids are expected to be limited to short sections of the channel reach; however, the effect could be carried into the Local Study Area a short distance upstream or downstream of the crossing (i.e., greater than 120 m). The likelihood of occurrence of the effect was assessed as possible (the effect may occur but is not likely). A summary of characterization of predicted residual effect is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was not carried forward into the cumulative effects assessment.

Operation and Maintenance

As described in **Section 7.3.1.4** and summarized in **Table 7-7**, problems encountered during operational life and maintenance of waterbody crossings may result in changes to channel hydraulics at the affected portion of the waterbody in the form of an increase or reduction in flow velocities, shear stresses, water levels, and erosion–sedimentation processes at locations upstream or downstream of the crossing.

The residual effect will be direct because the relevant Project activities during the Operation and Maintenance Phase are expected to directly affect surface water. The residual effect was assessed as negative in direction because the relevant Project activities may result in changes to channel hydraulics at waterbody crossings with the potential for a localized increase or reduction in flow velocities, shear stresses, water levels, and erosion–sedimentation processes at locations upstream or downstream of the crossing. The effect was assessed as negligible in magnitude because the crossings will be monitored and inspected regularly and restored to design conditions immediately after identification of a problem to minimize effects on channel hydraulics. The residual effect at permanent waterbody crossing structures is expected to be short-term in duration because the effect is not expected to persist after the maintenance of the affected crossing, noting that the maintenance of affected crossing is expected to be planned immediately after identification of a problem during routine monitoring and inspection.

The residual effect was assessed to be infrequent, largely limited to infrequent, short-term runoff events (i.e., minor to major floods), rather than typical flow conditions. The residual effect is predicted to be reversible because maintenance activities are expected to restore the crossings to the design conditions. The geographic extent of the residual effect is expected to be limited to the Local Study Area, given that any changes to flow velocities, shear stresses, water levels, erosion–sedimentation processes, and concentrations of suspended solids are expected to be limited to short sections of the channel reach. The likelihood of occurrence of the effect was assessed as possible (the effect may occur but is not likely). A summary of characterization of predicted residual effect is provided in **Table 7-8.**

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was not carried forward into the cumulative effects assessment.

7.3.2.5 Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality due to Changes in Land Cover

Construction

As described in **Section 7.3.1.5** and summarized in **Table 7-7**, the potential changes in land cover during the Construction Phase could result in changes to surface water quantity in the form of local increases in runoff rates and runoff volumes and, in turn, an increase in streamflows and / or water levels and erosion–sedimentation processes at receiving waterbodies. It could also result in potential changes to surface water and sediment quality at waterbodies through increased concentrations in suspended solids.

The residual effect will be direct because the relevant Project activities during the Construction Phase are expected to directly affect surface water. The residual effect was assessed as negative in direction because the relevant Project activities may result in an increase in streamflows, water levels, and erosion–sedimentation processes and an increase to the concentrations of suspended solids at receiving waterbodies.

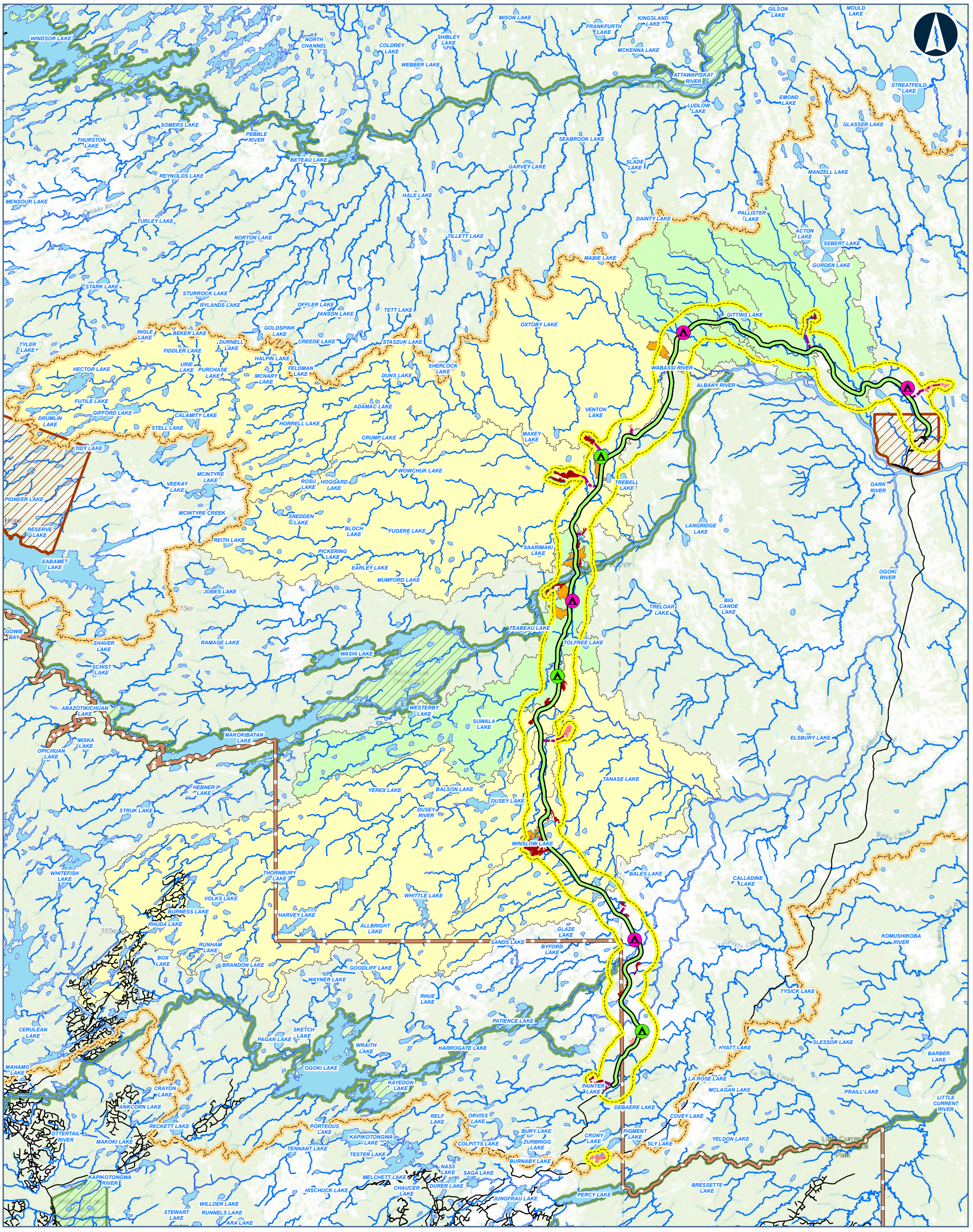
The likely magnitude of changes to surface water quantity, surface water quality, and sediment quality as a result of alterations in land cover during the Construction Phase were assessed in several of the watercourses and waterbodies crossed by the Project. An assessment, presented below, was completed by estimating the proportion of Project footprint (permanent and / or temporary disturbed land areas) relative to the overall catchment area at selected assessment points, recognizing that the approach considers drainage area as a proxy or analog for streamflow and, to a lesser extent, the potential for sediment erosion and transport (with implications on surface water quality). The Project footprint consists of potential disturbed land area (i.e., Construction Disturbance Area) over which the new Community Access Road will be built.

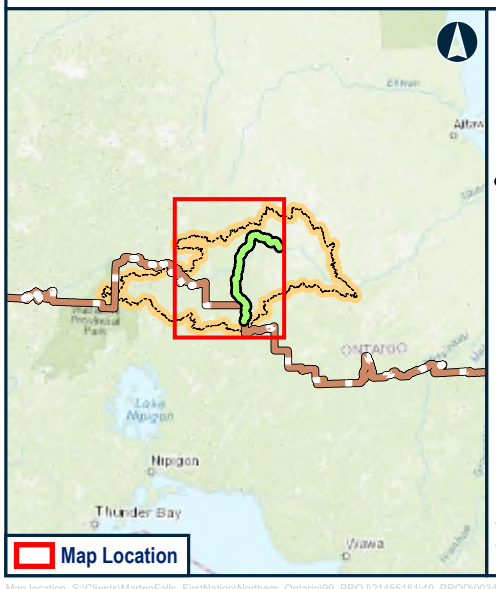
The Construction Disturbance Area includes temporary disturbed land areas (such as land area for temporary access roads and trails, temporary construction camps, turn-around areas, temporary laydown areas, and pits and quarries) that will undergo changes due to Project activities and will be reclaimed and revegetated after the completion of Construction Phase. The selection process for each assessment point was primarily based on a scaled approach, with the objective of selecting a representative number of waterbodies crossed by the Project under different categories of watershed size (i.e., large watersheds [greater than 1,000 km^2], medium watersheds [between 10 and 1,000 km^2], and small watersheds [less than 10 km^2]). In general, an assessment point was assigned to a confluence point with a mainstem channel downstream of crossing of any waterbody bisected by the Construction Disturbance Area, noting that this approach considers the total cumulative effect of Project activities / components on each relevant catchment area. Furthermore, in instances where the same waterbody was crossed at multiple locations, the catchment area of the most upstream crossing was in some cases also evaluated, given that the proportion of disturbed area relative to the total catchment area at this location would be inherently larger (compared to downstream crossing locations) and, in turn, would allow an assessment of the potentially "worst-case" scenario. Catchments within the Project boundaries, but without a waterbody crossing, were not assessed. Catchment areas at assessment points were estimated using Ontario Watershed Information Tool (Ministry of Natural Resources and Forestry, 2022)

A total of six assessment points were selected and assessed for medium and small watershed categories / size, while four assessment points were selected for large Watershed category due to a smaller Project footprint relative to size of large watersheds. Selected watersheds are shown in **Figure 7-2**. Note, the assessment also assumes that all land cover change (permanent and temporary) on a watershed will be occurring simultaneously with no concurrent reclamation and revegetation of temporary disturbed areas, thus representing the "worst-case" scenario. To note, several of the Small Watersheds assessed contain a relatively large temporary Project footprint with potential areas for aggregates resources (i.e., sand and gravel). The results of the assessment were as follows:

- **Large watersheds – greater than 1,000 km^2**
    - The permanent Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0.07% to 0.17% with a mean value of 0.1%.
    - The temporary Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0.06% to 0.44% with a mean value of 0.24%.
    - The total Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0.14% to 0.61% with a mean value of 0.34%.

- **Medium watersheds – between 10 and 1,000 km^2**
  - The permanent Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0.37% to 1.77% with a mean value of 0.70%.
  - The Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0% to 2.57% with a mean value of 0.54%.
  - The total Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0.56% to 4.34% with a mean value of 1.25%.
- **Small watersheds – less than 10 km^2**
  - The permanent Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0.32% to 4.22% with a mean value of 2.35%.
  - The temporary Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0% to 17.7% with a mean value of 6.2%.
  - The total Project footprint as a percentage of the catchment draining to the selected assessment points ranged from 0.32% to 20.2% with a mean value of 8.57%.





Legend

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- BEDROCK
- SAND AND GRAVEL
- ROAD
- WATERBODY
- WATERCOURSE
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- LOCAL STUDY AREA (2.5 KM)
- REGIONAL STUDY AREA

WATERSHEDS

CLASSIFICATION

- SMALL
- MEDIUM
- LARGE

Data Source:

Base Data: Provided by MNRF 2019; Route Infrastructure - Provided by AECOM 2019. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan
World Topographic Map: Esri Canada, Esri, © OpenStreetMap contributors, HERE, Garmin, USGS, NGA, EPA, USDA, NPS, AAFC, NRCan

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Selected Watershed for Assessment of Changes in Land Cover

0 3.25 6.5 13 19.5 26
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:550,000 * when printed 11"x17"
Rev:0	

Figure 7-2

Contains information provided by Ontario Ministry of the Environment, Conservation and Parks or by Ontario Ministry of Natural Resources and Forestry (Copyright: Queen's Printer of Ontario 2020), through a Sensitive Data License Agreement. This drawing has been prepared for use of AECOM client and may not be reproduced or relied upon by third parties, except as agreed by AECOM and its client, as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without AECOM express written consent. The use of Sensitive Data in this drawing does not constitute an endorsement by the Ministry for this drawing or by AECOM of the Sensitive Data.

The likely magnitude of changes to surface water quantity, surface water quality, and sediment quality resulting from changes in land cover during the Construction Phase is expected to be negligible where the disturbed land area represents 5% or less of the overall catchment area of the assessment point, noting that the value of ±5% is within the typical error of a streamflow measurement and output from a hydrologic / hydraulic model (Fulford, Thibodeaux, & Kaehrle, 1994; James, 2005). The likely magnitude of changes to surface water quantity and surface water and sediment quality as a result of alterations in land cover is expected to be measurable, albeit “low”, where the permanent disturbed land area lies between 5% and 15% of the overall catchment area of the assessment point. The upper limit of 15% is a conservative estimate of the amount of land disturbance that would result in noticeable changes in streamflow, water levels, and waterbody stability, recognizing that observations and inferences from relevant literature (Bosch & Hewlett, 1982; Hibbert, 1967; Swanson, Golding, Rothwell, & Bernier, 1986; Stednick, 1996; Schnorbus, Winkler, & Alila, 2004; British Columbia Ministry of Forests, 1999) show that marked changes in streamflow and channel stability as a result of land disturbance (i.e., clear-cut practices) are typically not expected if less than approximately 20% of the contributing catchment is disturbed.

For the locations where the proportion of total disturbed area to total catchment area will be higher than 5% (specific to the assessment point with the Small Watershed category and size), it is important to point out the following:

- The catchment areas for these select assessment point locations are comparatively small (as detailed previously);
- The total disturbed area is primarily dominated by temporary Project footprint that is expected to be reclaimed and revegetated during and / or after Construction;
- Most of the identified watercourses crossed by the Project have ephemeral or intermittent flow regimes, meaning that any increase in downstream flows and water levels at these waterbodies (mainly restricted to the Construction Phase only) will be limited in spatial extent and that they inherently support intermittent or ephemeral flow regimes;
- Any noticeable increase in runoff that occurs during Construction at the identified watercourses (with associated changes to downstream flows and water levels) will likely be in response to large precipitation events (of comparatively lower frequency) and will decrease once the reclamation process progresses and vegetation is re-established at the temporary disturbed areas; and
- Any increase in downstream flows and water levels at the identified watercourses (mainly restricted to the construction stage only) will be limited in spatial extent, given that the anticipated effects will be largely indiscernible a short distance downstream of the crossing (as the ephemeral or intermittent channel joins the broader surface water system and / or drains a progressively larger catchment area).

Based on the assessment presented in the previous points, the effect was characterized as negligible in magnitude, given that for most assessment points the area of disturbed land is expected to represent a small proportion of the total catchment area (i.e., 5% or less). For the locations where the proportion of total disturbed area to total catchment area will be higher than 5% primarily due to temporary disturbed areas that will be reclaimed and revegetated, it was shown that the waterbodies are generally support intermittent or ephemeral flow conditions. Further, any increase in downstream flows and water levels at these waterbodies (mainly restricted to the Construction Phase) will be limited to the Construction Disturbance Area, recognizing that the anticipated effects will be largely indiscernible a short distance downstream of the crossing (i.e., less than 120 m), as the ephemeral or intermittent channel joins the broader surface water system and / or drains a progressively larger catchment area. The residual effect is expected to be long-term in duration and largely irreversible because the effect occurring during the Construction Phase is likely to persist throughout the Operation and Maintenance Phase; however, changes in land cover related to temporary infrastructure is largely mitigated once the reclamation process progresses and vegetation is re-established at the disturbed areas. The residual effect was assessed to be frequent, given that any noticeable increase in runoff that occurs during the Construction Phase at the identified waterbodies, with associated changes to downstream flows, water levels, and sediment erosion / transport processes, and, in turn, concentrations of suspended solids will be in response to large precipitation events that occur intermittently. The residual effect is predicted to be irreversible as the effects on surface water quantity due to permanent changes to land cover related to development of permanent infrastructure (i.e., the Community Access Road) are likely to persist, noting that upon implementation of mitigation measures and reclamation plan, it is expected to be negligible in magnitude.

The residual effect is expected to be limited to the Construction Disturbance Area, because any increases to streamflows, water levels, erosion–sedimentation processes, and concentrations of suspended solids are likely limited to the area in the vicinity of the waterbody crossings and largely indiscernible a short distance downstream (i.e., less than 120 m). The likelihood of occurrence of the residual effect was assessed as probable (the effect is likely to occur) during the Construction Phase. A summary of characterization of predicted residual effects is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was carried forward into the cumulative effects assessment.

Operation and Maintenance

As described in **Section 7.3.1.5** and summarized in **Table 7-7**, the potential changes in land cover during the Operation and Maintenance Phase, although expected to be limited in scale and tied to discrete locations, could also result in changes to surface water quantity (in the form of local increases in runoff rates and runoff volumes and, in turn, an increase in streamflows and / or water levels and erosion–sedimentation processes at receiving waterbodies), surface water and sediment quality at waterbodies (through increased concentrations in suspended solids).

The residual effect will be direct because the relevant Project activities are expected to directly affect surface water. The residual effect was assessed as negative in direction because the relevant Project activities may result in an increase in streamflows, water levels, and erosion–sedimentation processes and an increase to the concentrations of suspended solids at receiving waterbodies.

The effect was characterized as negligible in magnitude, given that due to limited scale and scope, changes / disturbances to land cover during Operation and Maintenance Phase due to relevant Project activities are expected to significantly less compared to Construction Phase. The residual effect was assessed to be infrequent, given that the maintenance activities will be planned to restore the right-of-way and waterbody crossings to the design conditions immediately after problem identification to help ensure safe operation of Community Access Road and protection of environment. The residual effect is predicted to be short term in duration and reversible as the effects on surface water quantity are not expected to persist after the completion of maintenance work and upon implementation of mitigation measures. The residual effect is expected to be limited to the Construction Disturbance Area, because any increases to streamflows, water levels, erosion–sedimentation processes, and concentrations of suspended solids are likely limited to the area in the vicinity of the waterbody crossings and largely indiscernible a short distance downstream (i.e., less than 120 m).

The likelihood of occurrence of the residual effect during the Operation and Maintenance Phase was assessed as possible (the effect may occur, but is not likely). A summary of characterization of predicted residual effects is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was not carried forward into the cumulative effects assessment.

7.3.2.6 Residual Effects to Surface Water Quality from the Emission and Deposition of Airborne Particulate Matter to Nearby Waterbodies

Operation and Maintenance

As discussed in **Section 7.3.1.6** and summarized in **Table 7-7**, air emissions of particulate matter are expected due to vehicular traffic on the Community Access Road, in addition to maintenance activities and the resulting deposition of the airborne particulate matter could result in increased concentrations of chemical constituents and suspended solids in receiving waterbodies, if not mitigated.

The residual effect will be direct because the relevant Project activities are expected to directly affect surface water. The residual effect was assessed as negative in direction because deposition of fugitive dust could result in changes to surface water quality due to increased concentrations of chemical constituents and suspended solids in receiving waterbodies. The residual effect was assessed as negligible in magnitude because the proposed mitigation measures outlined in the Atmospheric Environment Technical Support Document: Existing Conditions & Effects Assessment (Dillon, 2026) and Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions for Provincial Transportation Projects (Ontario Ministry of Transportation, 2020) are expected to minimize dust generation, noting that the results of air quality modelling (Dillon, 2026) discussed in **Section 7.3.1.6** are based on the worst-case scenarios.

The residual effect is expected to be long-term in duration, given that the activities are anticipated to be persist during the Operation and Maintenance Phase of the Project. The residual effect was assessed to be continuous in occurrence, given that effects will continue to exist during the operational life of the Project. The residual effect is predicted to be irreversible as the emissions from the operations (especially the vehicular traffic) of Community Access Road will continue to occur. The residual effect is expected to be limited to the Construction Disturbance Area, however, dispersion of fugitive dust under worst-case scenarios is predicted to extend to the Local Study Area. The likelihood of occurrence of the residual effect was assessed as possible (the effect may occur but is not likely). A summary of characterization of predicted residual effects is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was not carried forward into the cumulative effects assessment.

7.3.2.7 Residual Effects to Surface Water Quality and Sediment Quality from the Wash-Off of Organic Debris to Nearby Waterbodies and / or Increased Rates of Erosion in Disturbed and Exposed Areas with Sediment Transport and Delivery to Adjacent Waterbodies

Construction

As described in **Section 7.3.1.9** and summarized in **Table 7-7**, site preparation, earthworks, and stockpiling activities during the Construction Phase could result in changes to surface water and sediment quality, recognizing that activities involving vegetation clearing and / or ground disturbance or exposure may result in increased rates of erosion, transport, and delivery of organic debris and sediments to receiving waterbodies and, in turn, increased concentrations of suspended solids.

The residual effect will be direct because the relevant Project activities are expected to directly affect surface water. The residual effect was assessed as negative in direction because activities involving vegetation removal and / or ground disturbance or exposure may result in increases to the concentrations of suspended solids in receiving waterbodies. The residual effect was assessed as negligible in magnitude because potential volumes / loads to surface water receivers are expected to be minor. Since the residual effect on the sediment quality is expected to be negligible in magnitude, the effect due to associate chemical constituents (including methylmercury) is also expected to be negligible. The residual effect is expected to be short-term in duration, given that the activities are anticipated to be isolated to the period when materials are first cleared and stockpiled during Construction. The residual effect was assessed to be frequent in occurrence, given that effects will be limited to large rainfall events (occurring intermittently). The residual effect is predicted to be reversible as the surface water quality is expected to return to existing conditions upon completion of related Construction Phase activities and implementation of mitigation measures. The residual effect is expected to be limited to the Local Study Area, because any increases to the concentrations of suspended solids are anticipated to be limited to the portion of the waterbody immediately downgradient of the point of wash-off; however, the effect could be carried into the Local Study Area a short distance downstream (i.e., greater than 120 m) due to sediment transport processes. The likelihood of occurrence of the residual effect was assessed as probable (the effect is likely to occur). A summary of characterization of predicted residual effects is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1,** the effect was carried forward into the cumulative effects assessment.

7.3.2.8 Residual Effects to Surface Water Quality and Sediment Quality from the Wash-Off of Accidental Fuel Spills and Leaks to Nearby Waterbodies

Construction

As described in **Section 7.3.1.10** and summarized in **Table 7-7**, accidental spills and leaks from the transportation, storage, and handling of hazardous materials during the Construction Phase and the operation of vehicles and equipment during the Construction Phase, could be washed off into nearby waterbodies during a runoff event or when using winter access roads and, if occurring in high enough volumes, could change the chemical constituents in receiving waters and affect surface water and sediment quality.

The residual effect will be direct because the relevant Project activities during the Construction Phase are expected to directly affect surface water. The residual effect was assessed as negative in direction because accidental spills and leaks may result in an increase to the concentrations of chemical constituents in receiving waterbodies. The residual effect was characterized as negligible in magnitude because potential volumes / loads to waterbody receivers are expected to be minor. The residual effect is expected to be short-term in duration, given that spills and leaks will be contained and cleaned up as soon as possible following incidents. The residual effect was assessed to be infrequent (i.e., limited to upset conditions that are not part of the normal or typical operation of the Project). The residual effect is predicted to be reversible as the surface water quality is expected to return to existing conditions, after any infrequent limited scale upset conditions and upon implementation of spill mitigation measures. The geographic extent of the residual effect is expected to be limited to the Construction Disturbance Area, because any increases to the concentrations of chemical constituents are anticipated to be limited to the portion of the waterbody immediately downgradient of the point of wash-off and largely indiscernible a short distance downstream (i.e., less than 120 m). The likelihood of occurrence of the residual effect was assessed as possible (the effect may occur but is not likely), given that the implementation of the detailed Spill Prevention and Emergency Response Plan, which will be developed with consideration for applicable regulations and guidelines for spill management and clean-up, is expected to minimize opportunities for the wash-off of spills and leaks from relevant Project activities to enter nearby waterbodies. A summary of characterization of predicted residual effects is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was not carried forward into the cumulative effects assessment.

Operation and Maintenance

As described in **Section 7.3.1.10** and summarized in **Table 7-7**, accidental spills and leaks from vehicle accidents, mechanical failure and improper handling and transportation of hazardous material as well as the transportation, storage, and handling of hazardous materials and the operation of vehicles and equipment for maintenance activities, could be washed off into nearby waterbodies, if occurring in high enough volumes or during a runoff event, and could change the chemical constituents in receiving waters and affect surface water and sediment quality.

The residual effect will be direct because the relevant Project activities during the Operation and Maintenance Phase are expected to directly affect surface water. The residual effect was assessed as negative in direction because accidental spills and leaks may result in an increase to the concentrations of chemical constituents in receiving waterbodies. The residual effect was characterized as negligible in magnitude because potential volumes / loads to waterbody receivers are expected to be minor, given that the possibility of spills due to road accidents, vehicle mechanical failure and improper handling and transportation will be largely mitigated through enforcement of relevant highway and vehicle safety regulations. The residual effect is expected to be short-term in duration, given that spills and leaks will be contained and cleaned up as soon as possible following incidents. The residual effect was assessed to be infrequent (i.e., limited to upset conditions that are not part of the normal or typical operation of the Project). The residual effect is predicted to be reversible as the surface water quality is expected to return to existing conditions, after any infrequent limited scale upset conditions and upon implementation of spill mitigation measures. The geographic extent of the residual effect is expected to be limited to the Construction Disturbance Area, because any increases to the concentrations of chemical constituents are anticipated to be limited to the portion of the waterbody immediately downgradient of the point of wash-off and largely indiscernible a short distance downstream (i.e., less than 120 m). The likelihood of occurrence of the residual effect was assessed as possible (the effect may occur but is not likely), given that the Spill Prevention and Emergency Response Plan for maintenance activities will be developed and implementation to minimize opportunities for the wash-off of spills and leaks to enter nearby waterbodies. A summary of characterization of predicted residual effects is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was not carried forward into the cumulative effects assessment.

7.3.2.9 Residual Effects to Surface Water Quality and Sediment Quality from the Wash-Off of Explosives Spills and Residues from Blasting Activities to Nearby Waterbodies

Construction

As described in **Section 7.3.1.11** and summarized in **Table 7-7**, blasting activities may result in changes to surface water and sediment quality, recognizing that explosives spills and residues could be washed off into nearby waterbodies during a runoff event and, if occurring in high enough volumes, may result in an increase to the concentrations of chemical constituents in receiving waters. A waterbody may be influenced by these potential effects only if there is need to employ blasting in close proximity to the feature. Therefore, it is anticipated that only a limited number of waterbodies may be affected.

The residual effect will be direct because the relevant Project activities are expected to directly affect surface water. The residual effect was assessed as negative in direction because blasting activities may result in an increase to the concentrations of chemical constituents in receiving waterbodies. The residual effect was characterized as negligible in magnitude because potential volumes / loads to waterbody receivers are expected to be minor. The residual effect is expected to be short-term in duration and reversible, given that blasting activities will be limited to the anticipated timeline of the construction activities. The residual effect was assessed to be frequent (i.e., limited to discrete construction activities), noting that some quarries and pits may be used during construction operations. The residual effect is predicted to be reversible as the surface water quality and sediment quality is expected to return to existing conditions upon completion of blasting activities and implementation of mitigation measures. The geographic extent of the residual effect is expected to be limited to the Construction Disturbance Area because any increases to the concentrations of chemical constituents are anticipated to be limited to the portion of the waterbody immediately downgradient of the point of wash-off and largely indiscernible a short distance downstream (i.e., less than 120 m). The likelihood of occurrence of the effect was assessed as possible (the effect may occur but is not likely), given that the implementation of the detailed Blasting Management Plan, which will be developed with consideration for applicable regulations and guidelines for transportation, handling, storage, and use of explosives, is expected to minimize opportunities for the wash-off of explosives spills and residues from blasting activities to enter nearby waterbodies. A summary of characterization of predicted residual effects is provided in **Table 7-8**.

Based on the criteria discussed in **Section 4.4.3.1.1**, the effect was not carried forward into the cumulative effects assessment.

7.3.3 Assessment of Significance

The assessment of significance of residual effects of the Project is informed by the interaction between the significance factors, previously discussed in **Section 4.4.2.6**, with magnitude and geographic extent being the most important factors. Consideration is also given to context, which includes ecological context (i.e., the sensitivity and resilience of the Valued Component surface water and sediment quantity and quality) and social context (i.e., concerns of Indigenous communities, interested agencies, groups, and individuals raised during consultation and engagement and through review comments on the Environmental Assessment reports). Implementation of proven mitigation measures is expected to aid in the avoidance or reduction of the magnitude, geographic extent, and / or duration of residual effects on surface water and sediment features.

The magnitude of the predicted residual effects on surface water and sediment features are negligible in magnitude, range from short-term to long-term in duration, and range from confined to the Construction Disturbance Area to Local Study Area in geographic extent.

Residual effects on the surface water and sediment Valued Component were considered **not significant** as the residual effects were assessed negligible in magnitude and they do not represent a substantial management concern. There is the potential for management concerns through an increased use of public access leading to changes in navigable waterways; however, the resources are expected to continue to be managed through Ministry of Natural Resources and local communities for recreational activities, respectively. The residual effects were predicted to be in accordance with federal and provincial guidelines.

Overall, the predicted residual effects on surface water were assessed as **not significant** because the predicted residual effects on surface water were not anticipated to result in a change beyond a manageable level. The significance level of each potential residual effect, assessed based on the method discussed in **Section 4.4.2.6**, is summarized in **Table 7-8**.

7.3.4 Prediction Confidence and Uncertainty

Scientific inference is associated with uncertainty, and prediction confidence (i.e., the level of confidence in assessment results) depends on the level of uncertainty and the way this uncertainty is addressed. Primary factors affecting confidence in the predictions made in the surface water effects assessment include:

- Availability and accuracy of baseline data;
- Level of understanding of baseline surface water conditions, hydrologic and hydraulic environment, natural variation in surface water quantity, and surface water and sediment quality;

- Understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space (e.g., exactly how the Project would influence surface water Valued Component);
- Assessment methods (qualitative and quantitative methods) to assess the effects directly or indirectly on surface water due to Project activities; and
- Level of certainty associated with the effectiveness of proposed mitigations, where applicable.

Uncertainty was managed by:

- Reviewing baseline studies and other relevant information related to surface water baseline / existing conditions in the Local Study Area and Regional Study Area;
- Where appropriate, uncertainty may be addressed by additional mitigations as required, or through monitoring programs designed to verify the effects predictions and / or the effectiveness of mitigation;
- Completing quality assurance and quality control of baseline data;
- Applying conservative assumptions regarding the Project footprint area and the related Project activities that may affect surface water to increase confidence that the effects were not underestimated;
- Comparing assessment results to relevant published scientific literature; and
- Planning implementation of known effective mitigation and monitoring measures and using available adaptive management measures to address unforeseen circumstances should they arise.

Overall, confidence levels were considered to be moderate (given in **Table 7-8**) for a majority of predicted surface-water-related residual effects because baseline data were available for a majority of the sites, the Project-related effects are mostly understood, and the level of certainty associated with the effectiveness of proposed mitigation strategies range from moderate to high certainty. The effects during the Construction and Operation and Maintenance Phases are well understood and are based on previous experience with similar types of developments. There is a high degree of confidence associated with the predicted changes to the surface water quantity and surface water and sediment quality due to Project–environment interactions, noting that due to large scale of the Project surface water environment was assessed from a largely qualitative standpoint. Mitigation measures would be implemented to reduce effects on the surface water Valued Components.

7.3.5 Summary

Table 7-8 provides a summary of the characterization of predicted residual effects and determination of significance by residual effect for surface water Valued Components.

Table 7-8: Characterization of Predicted Residual Effects and Determination of Significance for Surface Water

Valued Component	Predicted Residual Effect	Project Phase	Context	Direct / Indirect	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Likelihood / Probability of Occurrence	Significance	Uncertainty
Surface Water Quantity	■ Residual effects to surface water quantity from short-term water taking	Construction	Ecological	Direct	Negative	Negligible	Local Study Area	Short term	Frequent	Reversible	Probable	Not Significant	Moderate
Surface Water Quantity Surface Water Quality Sediment Quality	■ Residual effects to surface water quantity, surface water quality, and sediment quality from short-term water discharges	Construction	Ecological	Direct	Negative	Negligible	Local Study Areal	Short term	Frequent	Reversible	Probable	Not Significant	Moderate
Surface Water Quantity Surface Water Quality Sediment Quality	■ Residual effects to surface water quantity, surface water quality, and sediment quality during short-term water diversions at waterbody crossings	Construction	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Short term	Infrequent	Reversible	Probable	Not Significant	Moderate
Surface Water Quantity Surface Water Quality Sediment Quality	■ Residual effects to surface water quantity, surface water quality, and sediment quality due to changes in channel hydraulics at waterbody crossings	Construction	Ecological	Direct	Negative	Negligible	Local Study Area	Long term	Infrequent	Irreversible	Possible	Not Significant	Moderate
Surface Water Quantity Surface Water Quality Sediment Quality	■ Residual effects to surface water quantity, surface water quality, and sediment quality due to changes in channel hydraulics at waterbody crossings	Operation and Maintenance	Ecological	Direct	Negative	Negligible	Local Study Area	Short term	Infrequent	Reversible	Possible	Not Significant	Moderate
Surface Water Quantity Surface Water Quality Sediment Quality	■ Residual effects to surface water quantity, surface water quality, and sediment quality due to changes in land cover	Construction	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Long term	Frequent	Irreversible	Probable	Not Significant	Moderate
Surface Water Quantity Surface Water Quality Sediment Quality	■ Residual effects to surface water quantity, surface water quality, and sediment quality due to changes in land cover	Operation and Maintenance	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Short term	Infrequent	Reversible	Possible	Not Significant	Moderate
Surface Water Quality	■ Residual effects to Surface Water Quality from the Emission and Deposition of Airborne Particulate Matter to Nearby Waterbodies	Operation and Maintenance	Ecological	Direct	Negative	Negligible	Local Study Area	Long term	Continuous	Irreversible	Possible	Not Significant	Moderate
Surface Water Quality Sediment Quality	■ Residual effects to surface water quality and sediment quality from the wash-off of organic debris to nearby waterbodies and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies	Construction	Ecological	Direct	Negative	Negligible	Local Study Area	Short term	Frequent	Reversible	Probable	Not Significant	Moderate
Surface Water Quality Sediment Quality	■ Residual effects to surface water quality and sediment quality from the wash-off of accidental spills and leaks to nearby waterbodies	Construction	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Short term	Infrequent	Reversible	Possible	Not Significant	Moderate
Surface Water Quality Sediment Quality	■ Residual effects to surface water quality and sediment quality from the wash-off of accidental spills and leaks to nearby waterbodies	Operation and Maintenance	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Short term	Infrequent	Reversible	Possible	Not Significant	Moderate
Surface Water Quality Sediment Quality	■ Residual effects to surface water quality and sediment quality from the wash-off of explosives spills and residues from blasting activities to nearby waterbodies	Construction	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Short term	Frequent	Reversible	Possible, where proposed work is below the high-water mark (e.g., installation of a culvert) and / or where spills occur <30 m away from the high watermark	Not Significant	Moderate

< = less than; m = metre.

8 Cumulative Effects Assessment

The *Canadian Environmental Assessment Act, 2012* (Government of Canada, 2019a) requires that each Environmental Assessment of a project consider any cumulative environmental effects that are likely to result from the project in combination with the environmental effects of other physical activities that have been or will be carried out.

This section presents the assessment of potential cumulative effects completed as part of the Project. The effects of past and present activities on the Study Area and Valued Components identified for the Project were assessed and results are described in the following sections.

8.1 Cumulative Effects Scoping

8.1.1 Valued Components with Residual Effects

The cumulative effects assessment builds on the results of the effects assessment presented in **Section 7** and provides the incremental changes that are predicted to have a likely residual adverse effect on a Valued Component. Where residual effects identified in **Section 7** were of negligible magnitude and unlikely or possible to occur, or positive in direction, were not carried forward into the cumulative effects assessment. The likely residual effects that have been carried forward for assessment are described in **Table 8-1**.

Table 8-1: Valued Components and Residual Effects

Valued Component	Phase	Residual Effect
Surface Water Quantity	Construction	■ Residual effects to surface water quantity from short-term water taking ■ Residual effects to surface water quantity from short-term water discharges ■ Residual effects to surface water quantity during short-term water diversions at waterbody crossings ■ Residual effects to surface water quantity due to changes in land cover
Surface Water Quality	Construction	■ Residual effects to surface water quality from short-term water discharges ■ Residual effects to surface water quality during short-term water diversions at waterbody crossings ■ Residual effects to surface water quality due to changes in land cover ■ Residual effects to surface water quality from the wash-off of organic debris to nearby waterbodies and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies
Sediment Quality	Construction	■ Residual effects to sediment quality from short-term water discharges ■ Residual effects to sediment quality during short-term water diversions at waterbody crossings ■ Residual effects to sediment quality due to changes in land cover ■ Residual effects sediment quality from the wash-off of organic debris to nearby waterbodies and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies

8.1.2 Spatial and Temporal Boundaries

The spatial boundary for the cumulative effects assessment corresponds to the geographic extent that the likely residual adverse effects of the Project are predicted to occur. The study area used in the cumulative effects assessment is the same as the aquatics effects assessment Regional Study Area used for the residual effects assessment (**Section 7**), as seen in **Table 8-2**.

Temporal boundaries for the cumulative effects assessment correspond to the duration that the likely residual adverse effects of the Project are predicted to occur. There are currently no plans to decommission the Community Access Road as there is no expected / known end date for its need. Therefore, future suspension, decommissioning, and eventual abandonment was not considered in this report. It will be considered if and when a decommissioning or abandonment application is made for the Community Access Road. As no residual effects occurring during the Operation and Maintenance Phase, identified in **Section 7,** were carried over for the cumulative effects assessment, the only temporal boundary noted for the cumulative effects assessment relates to the Construction Phase, being the time from start of Construction, including site preparation activities, to the start of Operation and Maintenance of the Community Access Road. Decommissioning of construction works is also included in the Construction Phase. The Construction Phase is anticipated to take approximately three to ten years to complete.

Table 8-2: Spatial and Temporal Boundaries

Valued Component	Spatial Boundary	Temporal Boundary
Surface Water Quantity **Surface Water Quality** **Sediment Quality**	Includes the three tertiary watersheds (4GD Upper Albany – Makokibatan, 4GE Lower Ogoki, and 4GF Upper Albany – Muswabik) that are intersected by the centreline of the Preferred Route. The Regional Study Area was extended to include areas where the Local Study Area falls outside of these tertiary watersheds. Tertiary watersheds are based on the federal "Drainage Area" reporting framework and represent third level subdivisions of Canada into suitably sized areas based on drainage for administrative purposes (Ministry of Natural Resources and Forestry, 2015b).	■ Construction

8.1.3 Physical Activities Inclusion List

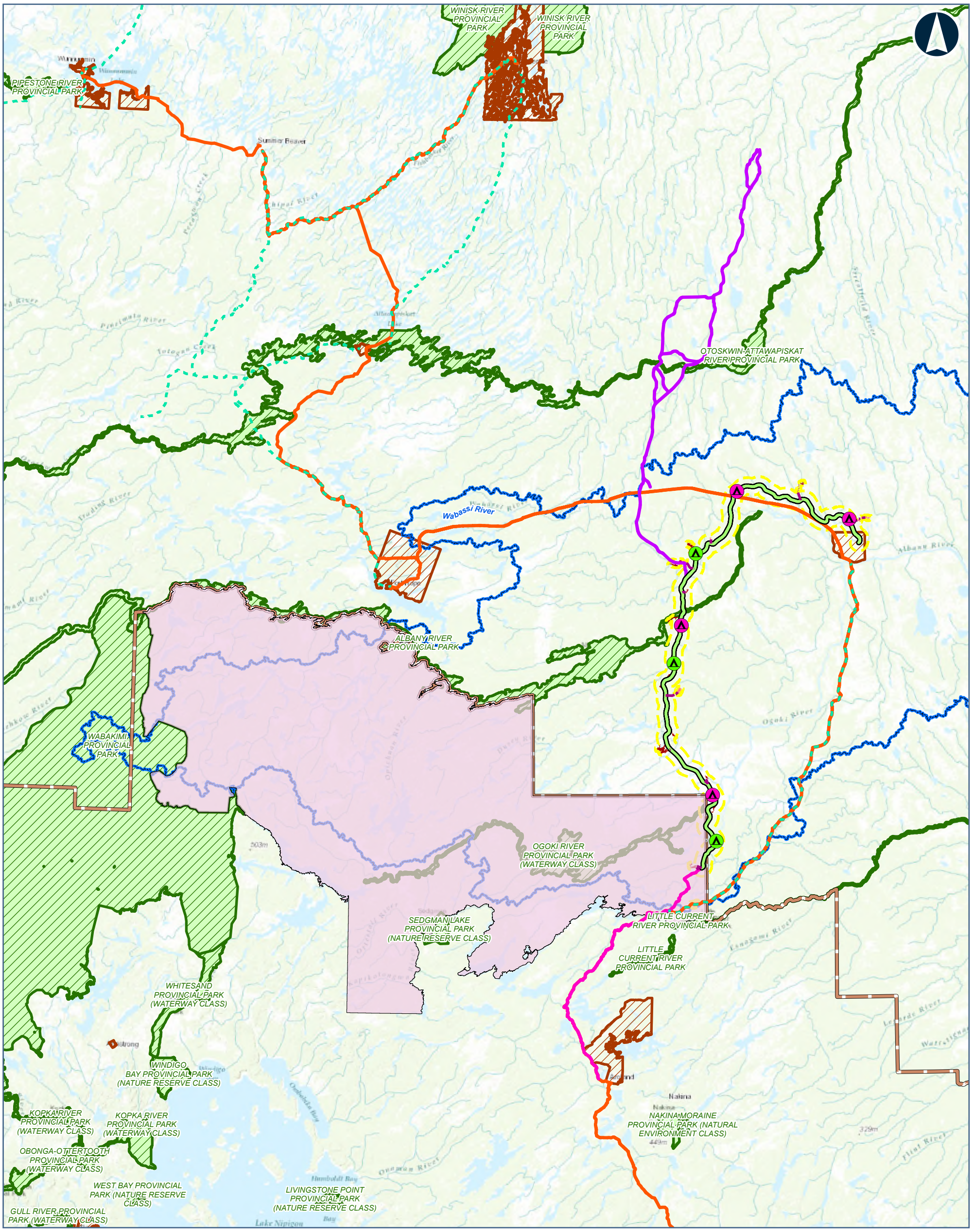
To determine the spatial boundaries of potential cumulative effects, three related projects within the aquatics effects assessment Regional Study Area were considered for the cumulative effects assessment (**Table 8-3**; **Figure 8-1**).

Table 8-3: Project and Physical Activity Inclusion List for Surface Water

Project	Identified in *Tailored Impact Statement Guidelines* (Y / N)	Location	Status	Distance (km) and Direction from the Project	Developer / Company	Project Start Date	Project Duration	Project Completion Date	Assumed Temporal Overlap with Community Access Road Activities (Y / N)	Project Description	Surface Water Valued Components Temporal Overlap with Project (Y / N)	Surface Water Valued Components Spatial Overlap with Project (Y / N)	Included in Cumulative Effects Assessment (Y / N)
Northern Road Link	Yes	Between Marten Falls First Nation Community Access Road and Webequie Supply Road, northwestern Ontario	Impact Assessment ongoing	0 (adjacent or overlapping)	Webequie First Nation Marten Falls First Nation	Impact Assessment initiated in August 2023 Construction start date unknown	Unknown	Unknown	Yes – construction and operation will overlap with Community Access Road construction (expected for Northern Road Link to begin construction during construction of northern portion of Community Access Road.	■ Marten Falls First Nation and Webequie First Nation are proposing to build, operate and maintain an all-season multi-use road and associated infrastructure between the Community Access Road that has been proposed by Marten Falls First Nation (the Project) and the supply road that has been proposed by Webequie First Nation. ■ *Terms of Reference* for the preparation of an Environmental Assessment were approved March 3, 2023.	Yes	Local Study Area – Yes Regional Study Area – Yes	Yes
Anaconda and Painter Lake Road Upgrades	Yes	James Bay Lowlands	Unknown	0 (adjacent or overlapping)	In discussions: Ministry of Transportation, Ontario and Aroland First Nation	Not Started	2-5 years	Unknown	Yes –operation expected to overlap with Community Access Road construction	■ Upgrades to existing road will be required for heavy vehicles accessing the Community Access Road route during construction and operations. ■ Currently discussions on proponency and scope of work are underway. ■ Potential scope of work is expected to include roadway widening, culvert and bridge replacements / rehabilitations to accommodate higher weight vehicles, and road base improvements. ■ This project will be completed prior to the start of the construction of the Community Access Road and therefore the upgrades to these roads is not expected to overlap with the construction of the Community Access Road.	No (i.e., no residual construction effects overlap with MFCAR)	Local Study Area – No Regional Study Area – Yes	No

Project	Identified in *Tailored Impact Statement Guidelines* (Y / N)	Location	Status	Distance (km) and Direction from the Project	Developer / Company	Project Start Date	Project Duration	Project Completion Date	Assumed Temporal Overlap with Community Access Road Activities (Y / N)	Project Description	Surface Water Valued Components Temporal Overlap with Project (Y / N)	Surface Water Valued Components Spatial Overlap with Project (Y / N)	Included in Cumulative Effects Assessment (Y / N)
Rapid Lynx Broadband	Yes	Matawa First Nation communities	Phase 1: 70% complete, with remaining sections targeted for September 2024 completion; section near the Project is complete Phase 2: targeted completion September	Phase 1 – 0 (adjacent or overlapping) Phase 2 – 57.69	Rapid Lynx	February 2020	Unknown	Unknown	Yes –construction of Phase 2 and operations of Phase 1 and 2 expected to overlap with Community Access Road construction	■ Approximately 810 km of fibre-optic cables, providing reliable high-speed internet service to 5 Matawa First Nation communities: Eabametoong, Marten Falls, Neskantage, Nibinamik and Webequie with an interconnection at Aroland.	Yes	Local Study Area – Yes Regional Study Area – Yes	Yes
Ogoki Forest Management Plans: Ogoki-Armstrong Primary Roads	Yes	Ogoki Forest, Ontario	Roads are constructed and operating	Ogoki Primary Roads: 6.24 km	GreenForest Management Inc. and Geraldton Area Natural Resources Advisory Committee	2020	10 years	2030	Yes – existing road operations overlap with Community Access Road construction and operations	■ Ogoki-Armstrong Primary Roads are existing and currently being used for forest management.	Yes	Local Study Area – No Regional Study Area – Yes	No; the roads are included in the landcover for existing conditions
Winter Road Realignment Project	No	Various	Ongoing	0	Ministry of Northern Economic Development and Growth	2025	Unknown	Unknown	Yes – construction and operations will overlap with Community Access Road construction (expected to occur concurrently)	■ Funding to remote northern communities for projects involving installation of water crossing infrastructure, such as pre-engineered bridges and culverts, and repairs to existing structures. ■ Funding for approximately 3,200 kilometres of winter roads in Northern Ontario.	Yes	Yes	No; the winter roads are included in the landcover for existing conditions

km = kilometre; Y = yes; N = no; % = percent.



Legend

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

PREFERRED ROUTE

APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE

APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTION CAMP

BEDROCK

SAND AND GRAVEL

FAR NORTH BOUNDARY

WATERCOURSE

FIRST NATION COMMUNITY

PROVINCIAL PARK

AQUATICS LSA

AQUATICS RSA

PHYSICAL ACTIVITIY PROJECT INCLUSION
- ANACONDA AND PAINTER LAKE FORESTRY ACCESS ROAD UPGRADES
- NORTHERN ROAD LINK
- RAPID LYNX BROADBAND PROJECT
- OGOKI FOREST MANAGEMENT PLANS
- WINTER ROAD REALIGNMENT PROJECT

Data Source:
Base Data: Provided by MNRF 2019; Route Infrastructure - Provided by AECOM 2019. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: World Topographic Map: Esri, © OpenStreetMap contributors, HERE, Garmin, FAO, USGS, NGA, EPA, NPS, AAFC, NRCan
World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Physical Activities Inclusions in the Aquatics Regional Study Area

0 5 10 20 30 40
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:1,100,000 * when printed 11"x17"
Rev:0	

Figure 8-1

Contains information provided by Ontario Ministry of the Environment, Conservation and Parks or by Ontario Ministry of Natural Resources and Forestry (Copyright: King's Printer of Ontario 2023), through a Sensitive Data License Agreement. This drawing has been prepared for use of AECOM client and may not be reproduced or relied upon by third parties, except as agreed by AECOM and its client, as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without AECOM express written consent. The use of Sensitive Data in this drawing does not constitute an endorsement by the Ministry for this drawing or by AECOM of the Sensitive Data.

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Date Saved: 2/10/2026 2:36 PM User Name: INRR172702

8.1.4 Summary of Outcome

The predicted residual effects identified in **Table 8-1** are applicable to the surface water quantity, surface water quality and sediment quality Valued Components. The two projects identified within **Table 8-3** have the potential for residual effects to overlap with the spatial and temporal boundaries of the surface water quantity, surface water quality and sediment quality Valued Components (**Table 8-2**). **Table 8-4** summarizes the outcome of the cumulative effects scoping.

Table 8-4: Summary of Outcome

Past, Existing and Future Physical Activities / Projects	Valued Component Carried Forward	Results of Scoping
Northern Road Link	■ Surface Water Quantity ■ Surface Water Quality ■ Sediment Quality	Both the Marten Falls Community Access Road Project and Northern Road Link project have the potential for residual effects on the surface water quantity, surface water quality and sediment quality Valued Components through physical alteration of waterbodies, project work that may conducted at water crossings and quarry operation locations and associated roadway works including short-term water taking, short-term water discharges, short-term water diversions, changes in land cover, and wash-off of organic debris. The residual effects from both projects may overlap temporally during the Construction Phase. Spatially, residual effects from the Northern Road link project may overlap with the residual effects from the Marten Falls Community Access Road project within the Local and Regional Study Areas, specifically in the northern section of the Project footprint.
Anaconda and Painter Lake Road Upgrades	■ Not applicable	The current alignment of the Anaconda and Painter Lake Road upgrades do not appear to spatially overlap with the Marten Falls Community Access Road project within the Local Study Areas. Additionally, the Anaconda and Painter Lake Road upgrades project is expected to be completed prior to the start of the construction of the Community Access Road and therefore the upgrade to these roads is not expected to overlap with the construction of the Community Access Road. Therefore, additional assessment of the cumulative effects of the Anaconda and Painter Lake Road upgrades project is not required. If there are delays to the Anaconda and Painter Lake Road upgrades, causing the construction of both projects to be completed during similar time periods, the cumulative assessment interactions may need to be revised.
Rapid Lynx Broadband	■ Surface Water Quantity ■ Surface Water Quality ■ Sediment Quality	Both the Marten Falls Community Access Road Project and Rapid Lynx Broadband project have the potential for residual effects on the surface water quantity, surface water quality and sediment quality Valued Components through physical alteration of waterbodies, project work that may conducted at water crossings and quarry operation locations and associated roadway works including short-term water taking, short-term water discharges, short-term water diversions, changes in land cover, and wash-off of organic debris. The residual effects from both projects may overlap temporally during the Construction Phase. Spatially, residual effects from the Rapid Lynx Broadband project would overlap with the residual effects from the Marten Falls Community Access Road project within the Local and Regional Study Areas. Given the uncertainty regarding the Rapid Lynx Broadband project (e.g., start and end dates, details of a maintenance plan or decommissioning activities) and to be conservative in the assessment, water residual effects that may occur during the Construction Phase are considered to overlap with Project activities for the purposes of the Cumulative Effects Assessment.
Ogoki Forest Management Plans: Ogoki-Armstrong Primary Roads	■ Not applicable	The Ogoki-Armstrong Primary Roads associated with this project for forest management are existing roads and are considered in the existing environment. Therefore, additional assessment of the cumulative effects of the Winter Road Realignment project is not required.
Winter Road Realignment Project	■ Not applicable	Winter roads are included in the landcover for existing conditions and their effects have been incorporated in residual effects assessment of the Project. Therefore, additional assessment of the cumulative effects of the Winter Road Realignment project is not required.

8.2 Cumulative Effects Assessment

8.2.1 Residual Effects to Surface Water Quantity from Short-term Water Taking During Construction

8.2.1.1 Potential Cumulative Effects

As discussed in **Section 8.1**, the construction of the Northern Road Link and Rapid Lynx Broadband projects, along with the Marten Falls Community Access Road Project, have the potential for cumulative effects on surface water quantity from short-term water taking during the Construction Phase. In terms of project timing, no road construction is expected as part of the Rapid Lynx Broadband project, but water taking activities as part of that project may still be required for drilling activities.

As described in **Section 7.3.1.1**, short-term water takings during the Construction Phase of the Project may affect surface water quantity including reductions in streamflows and / or water levels at nearby waterbodies, which are also applicable to the Northern Road Link project. Direct effects of short-term water takings during construction of these projects can affect surface water quantity through the following, but are not limited to:

- Dewatering of excavations for road construction and waterbody crossing structure foundations (e.g., bridges and culverts), if required;
- Dewatering for quarry operations, if required;
- Water diversion to create and maintain a dry work area for the construction of waterbody crossings;
- Water for drilling;
- Water for on-site concrete mixing and earthworks (compaction);
- Water for dust suppression at work sites and along access roads;
- Water for construction of temporary access roads, trails, and winter roads (i.e., snow fills, ice bridges, and maintenance);
- Water for washing concrete mixing equipment, concrete delivery systems, vehicles, and equipment as well as for work sites, temporary construction camps, and temporary laydown areas; and
- Water for drinking and sanitation at construction offices, temporary construction camps, temporary laydown areas, and other work areas.

That said, based on the alignments of the Northern Road Link in relation to the current alignment of the Project, the only potential for spatial overlap with the Project appears towards the north of the Project in the Upper Albany - Makokibatan watershed.

Two crossings have been identified for the Northern Road Link (**Figure 8-1**) that are on the same waterbodies crossed by the Project, with one crossing on Gourlie Creek and the other crossing on the Wabassi River (3.8 and 46 km away from the Project, respectively). The Project currently proposes to cross Gourlie Creek and the Wabassi River using a multi-span bridge (**Section 7.1**). Due to the size of these waterbodies, it is likely that the crossings for the Northern Road Link would also use bridges (clear span or multi-span) and that these projects will have similar water taking requirements.

Given the uncertainty regarding the Rapid Lynx Broadband project (e.g., start and end dates, details of a maintenance plan or decommissioning activities) and to be conservative in the assessment, water takings during the Construction Phase are considered to overlap with Project activities for the purposes of the Cumulative Effects Assessment. Spatial overlap with the alignments of the Rapid Lynx Broadband project in relation to the Project occurs in the Upper Albany - Makokibatan watershed. Specifically, five crossings have been identified for the Rapid Lynx Broadband project (**Figure 8-1**) that appear to be on the same waterbodies crossed by the Project: one crossing on the Buffaloskin River and four unnamed crossing locations.

8.2.1.2 Mitigation Measures

It is anticipated that mitigation and enhancement measures will be, or have been, implemented to limit the effects of short-term water takings during the Construction Phase of the Northern Road Link and Rapid Lynx Broadband projects and that these mitigation and enhancement measures will be similar to those implemented for the Project (**Section 7.3.1.1.2**). Mitigations and enhancement measures for short-term water taking during construction would be expected to follow and be in accordance with respective guidelines and regulations, including *Ontario Regulation 387/04*, *Ontario Regulation 64/16*, *Revised Regulations of Ontario, 1990 (Regulation 903: Wells)*, *Ontario Water Resources Act* (Government of Ontario, 1990c), and industry best standards. That said, the specific requirements for short-term water taking activities for the Project will be determined during the permitting and detailed design stage of the Project.

The alignments for each project do not appear to cross the same waterbodies, except for the Gourlie Creek and Wabassi River crossing locations for the Northern Road Link project and five additional crossing locations spatially overlapped by the Rapid Lynx Broadband project. It is expected that the Northern Road Link project, Rapid Lynx Broadband project, and the Project would follow mitigation and enhancement measures as outlined in **Section 7.3.1.1.2** at the noted crossing locations, including following all Ministry of Natural Resources permit conditions. As a result, the effects from each project from short-term water takings for construction activities would be expected to be localized to the selected water taking locations (i.e., surface water locations) and to result in minimal change to overall surface water quantity reporting back into the receiving systems.

In order to limit potential cumulative effects due to changes to surface water quantity from short-term water taking during the Construction Phase, coordination between both the projects could be initiated to help ensure that any sizable water takings do not occur during the same time period when, or if, construction for these two locations coincide at the same time. As a best practice, it is suggested that the monitoring programs of the Project, including monitoring of water takings and any past, existing and future physical activities / projects share relevant monitoring data collected during short-term water takings for the two areas where predicted effects overlap, as well as share the timing of such construction activities. Additional timing and monitoring data of related works, such as short-term water discharges or diversions, should be shared between projects as these potential effects on surface water quantity (including surface water quality and sediment quality) could lead to compounding cumulative effects if the works occur during the same construction periods in the same spatial overlapping project areas.

8.2.1.3 Characterization of Predicted Cumulative Effects

Based on the assessment above, the predicted cumulative effects are negligible and are not significantly greater than the predicted residual effects for the Project. Changes in surface water quantity during short-term water takings during the Construction Phase will be minimized by effective implementation of the mitigation and enhancement measures. Cumulative effects from short-term water takings have the potential to occur due to work conducted at the same two crossing locations within proximity to one another as part of the Project and the Northern Road Link project. The effects from each project for short-term water takings for the purpose of construction would be expected to be localized to the selected water taking locations (i.e., surface water locations) and to result in minimal change to overall surface water quantity reporting back into the receiving systems. Coordination between both the Project and Northern Road Link project for any takings required at select water crossing locations could mitigate any potential cumulative effects.

As there is limited spatial overlap of the Local Study Area and the predicted similar road construction requirements and residual effects of the Project and for other construction areas of the Northern Road Link project, additional cumulative effects are not anticipated if coordination between projects is enacted. The limited spatial and temporal overlaps of the Project and the Rapid Lynx Broadband project also suggest cumulative effects between the projects may be limited and remain at the same characterization levels described for the residual effect. Additional information regarding the project works of the Rapid Lynx Broadband project would be required to determine whether cumulative effects can be limited between projects. The cumulative effects characterization is summarized in **Section 8.2.7**.

8.2.2 Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality from Short-term Water Discharges During Construction

8.2.2.1 Potential Cumulative Effects

As discussed in **Section 8.1**, the construction of the Northern Road Link and Rapid Lynx Broadband projects, along with the Project, have the potential for cumulative effects on surface water quantity, surface water quality, and sediment quality from short-term water discharges during the Construction Phase. It is assumed that the Northern Road Link may require similar amounts of short-term water discharges per segment of road as the Project. There are no short-term discharges as part of construction activities expected as part of the Rapid Lynx Broadband project and therefore no changes to surface water quantity, surface water quality, and sediment quality due to construction short-term water discharges cumulative effects are carried over into the assessed for this particular project.

As described in **Section 7.3.1.2**, effects on water quantity, surface water quality, and sediment quality can occur from short-term discharges during the Construction Phase for the noted projects, including the discharge of the following, but are not limited to:

- Construction water from dewatering activities during excavations for road construction and waterbody crossing structure foundations;
- Water from dewatering activities during operation of pits and quarries;
- Water from aggregate and concrete batch plants;
- Wash water from cleaning concrete mixing equipment and concrete delivery systems on work sites;
- Wash water from vehicle and equipment wash facilities on work sites, at temporary construction camps, and at temporary laydown areas; and
- Domestic wastewater and grey water from temporary construction camps and construction offices.

It is expected that the frequency of short-term discharges for the Northern Road Link project would be similar to or slightly less than those required for the Project and that, based on the similar designs between each project, there would not be any additional short-term water discharges where the projects overlap. The only potential for spatial overlap with the Project is towards the north of the Project in the Upper Albany - Makokibatan watershed. Two crossings have been identified for the Northern Road Link (**Figure 8-1**) that are on the same waterbodies crossed by the Project with one on Gourlie Creek and one on the Wabassi River.

8.2.2.2 Mitigation Measures

It is anticipated that mitigation and enhancement measures will be, or have been, implemented to limit the effects of short-term water discharges during the Construction Phase of the Northern Road Link project and that these mitigation and enhancement measures will be similar to those implemented for the Project (**Section 7.3.1.2.2**). Mitigation and enhancement measures for short-term water discharges during the Construction Phase of each project would be expected to be followed including short-term discharges being in accordance with respective guidelines and regulations including *Ontario Regulation 387/04* as amended by *Ontario Regulation 64/16* under the *Ontario Water Resources Act* or *Ontario Regulation 63/16* under the *Environmental Protection Act*, where applicable. The specific requirements for short-term water discharge activities for the Project will be determined during the permitting and detailed design stage of the Project.

That said, the alignments for each project do not appear to cross the same waterbodies, except for the Northern Road Link project where Gourlie Creek and Wabassi River are crossed by the Project as well. As a result, the effects from each project from short-term water takings for construction activities would be expected to be localized to the selected water taking locations (i.e., surface water locations) and to result in minimal change to overall surface water quantity reporting back into the receiving systems. That said, in order to limit potential cumulative effects due to changes to surface water quantity from short-term discharges during construction, coordination between both the Project and Northern Road Link project could be initiated to make sure that sizable short-term water discharges do not occur at the same time during construction for these two crossing locations. As a best practice, it is suggested that the monitoring programs of the Project, including monitoring of short-term discharges and any past, existing and future physical activities / projects share relevant monitoring data for areas where predicted effects may overlap, as well as share the timing of such construction activities. Additional timing and monitoring data of related works, such as short-term water takings or diversions, should be shared between projects as these potential effects on surface water quantity, surface water quality and sediment quality could lead to compounding cumulative effects if the works occur during the same construction periods in the same spatial overlapping project areas.

8.2.2.3 Characterization of Predicted Cumulative Effects

Based on the assessment above, the predicted cumulative effects are negligible and not significantly greater than the predicted residual effects already outlined for the Project. Residual effects on surface water quantity (increase in streamflows and / or water levels at receiving waterbodies) and surface water quality (increase to the concentrations of suspended solids and chemical constituents in receiving waterbodies) are predicted to occur as a result of short-term water discharges during the Construction Phase of the Project.

These changes will be minimized by effective implementation of the mitigation and enhancement measures and in compliance with governing permits where applicable; however, cumulative effects from short-term discharges do have the potential to occur because work may be conducted at water crossing locations where the Northern Road Link project that spatially overlaps. The effects from each project for short-term water discharges required by construction activities would be expected to be localized to the selected water taking locations (i.e., surface water locations) and to result in minimal change to overall surface water quantity reporting back into the receiving systems. Coordination between both the Project and Northern Road Link project for any takings required at Gourlie Creek of the Wabassi River could mitigate any potential cumulative effects. The cumulative effects characterization is summarized in **Section 8.2.7**.

8.2.3 Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality During Short-Term Water Diversions at Waterbody Crossings During Construction

8.2.3.1 Potential Cumulative Effects

As discussed in **Section 8.1**, the construction of the Northern Road Link and Rapid Lynx Broadband projects, along with the Project, have the potential for cumulative effects on surface water quantity, surface water quality, and sediment quality during short-term water diversions at waterbody crossings during the Construction Phase. It is assumed that the Northern Road Link may require similar amounts of short-term water diversions per segment of road as the Project. Additionally, there is no short-term diversions anticipated as part of construction activities expected as part of the Rapid Lynx Broadband project and therefore no changes to surface water quantity, surface water quality, and sediment quality due to construction short-term water diversions cumulative effects are carried over into the assessed for this particular project.

As described in **Section 7.3.1.3**, direct effects from short-term water diversions during construction on surface water quantity, surface water quality, and sediment quality for the projects may include the following, but are not limited to:

- Localized changes to streamflows and / or water levels and erosion–sedimentation processes within or immediately upstream and downstream of the work area, depending on the dewatering method and dewatering controls chosen (e.g., pumping rates that exceed streamflow conditions could result in a decrease in water levels upstream of the diversion works and, in turn, a slight increase downstream);

- Increases to the concentrations of suspended solids in waterbodies as a result of increased rates of erosion–sedimentation processes during water taking and discharge activities (specific to the points of water taking and discharge in the waterbody) or following the removal of the diversion works and / or installation or removal of temporary waterbody crossing structures due to the disturbance of the bed and banks of the waterbody (specific to the limits of the work area, with the opportunity for sediment to be mobilized and transported downstream); and
- Increases to the concentrations of chemical constituents in waterbodies due to equipment leaks.

Similar to the short-term water takings and short-term water discharges cumulative effects assessments, based on the alignment of the Northern Road Link in relation to the Project, the only potential for spatial overlap with the Project is towards the north of the Project in the Upper Albany - Makokibatan watershed. Two crossings have been identified for the Northern Road Link (**Figure 8-1**) that are on the same waterbodies crossed by the Project: one crossing on Gourlie Creek and one on the Wabassi River (3.8 and 46 km away from the Project, respectively). The Project currently proposes to cross Gourlie Creek and the Wabassi River using a multi-span bridge (**Section 7.1**); due to the size of these waterbodies, it is likely that the crossings for the Northern Road Link would also use bridges (clear span or multi-span). The use of short-term water diversions to create and maintain a dewatered area to support installation of temporary and permanent waterbody crossings and removal of temporary waterbody crossing structures, may result in a measurable increase or reduction in streamflows, water levels, and erosion sedimentation processes at discrete locations upstream or downstream of the waterbody crossing, resulting in an increase to the concentrations of suspended solids and chemical constituents in waterbodies during these short-term water diversions.

8.2.3.2 Mitigation Measures

It is anticipated that mitigation and enhancement measures will be, or have been, implemented to limit the effects of short-term water diversions during the Construction Phase of the Northern Road Link project and that these mitigation and enhancement measures will be similar to those implemented for the Project (**Section 7.3.1.3.2**). Mitigation and enhancement measures for short-term water diversions during Construction would be expected to be followed including short-term water diversions (active or passive) being carried out in accordance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 301/21* under the *Ontario Water Resources Act* (Government of Ontario, 1990c), *Ontario Regulation 454/96*, and *Lakes and Rivers Improvement Act* (Government of Ontario, 1990f), as applicable.

The alignments for each project do not appear to cross the same waterbodies, except for Gourlie Creek and the Wabassi River that are crossed by both the Northern Road Link and Project. As a result, the effects from each project from short-term water diversions for construction activities would be expected to be localized to those select water crossing locations (i.e., surface water locations).

To limit potential cumulative effects caused by diversions, specifically due to changes to surface water quality from short-term water diversions during construction, coordination between both the Project and Northern Road Link project could be initiated to help ensure that water diversions do not occur at the same time during construction at the two noted crossing locations. Environmental monitoring (including water quality sampling / testing noted in **Section 9.2**) will be conducted during the Construction Phase for the Project to verify the performance and effectiveness of the planned mitigation implemented at these locations. An Adaptive Management Plan will be developed in the event of an unexpected change to water quantity or quality (i.e., increase in turbidity in accordance with Canadian Council of Ministers of the Environment standards). Monitoring will occur during installation works, including all in-water activities, will continue through the duration of the Construction Phase, including the removal of temporary crossing structures as part of construction decommissioning activities. As a best practice, it is suggested that the monitoring programs of the Project, including monitoring of short-term water diversions and any past, existing and future physical activities / projects share relevant monitoring data for areas where predicted effects may overlap, as well as share the timing of such construction activities. Additional timing and monitoring data of related works, such as short-term water takings or discharges, should be shared between projects as these potential effects on surface water quantity, surface water quality and sediment quality could lead to compounding cumulative effects if the works occur during the same construction periods in the same spatial overlapping project areas.

Overall, the mitigation measures and commitments identified previously are expected to minimize opportunities for increased concentrations of suspended solids and chemical constituents (due to any associated changes to erosion–sedimentation processes) where projects spatially overlap. Water quantity and quality monitoring will be monitored, where appropriate, to confirm the effectiveness of the diversion works and any associated mitigation measures as well as to maintain compliance with regulatory permits / approvals.

8.2.3.3 Characterization of Predicted Cumulative Effects

Based on the assessment above, the predicted cumulative effects are negligible and are not expected to be significantly greater than the predicted residual effects for the Project. Residual effects on surface water quantity, surface water quality, and sediment quality include the use of short-term water diversions to create and maintain a dewatered area to support installation of temporary and permanent waterbody crossings and removal of temporary waterbody crossing structures may result in a measurable increase or reduction in streamflows, water levels, and erosion–sedimentation processes at locations upstream or downstream of the waterbody crossing and an increase to the concentrations of suspended solids and chemical constituents in waterbodies. These changes will be minimized by effective implementation of the mitigation and enhancement measures; however, cumulative effects from short-term diversions have the potential to occur because work may be conducted at water crossing locations for the Northern Road Link project.

Potential effects from each project on surface water quantity, surface water quality and sediment quality during short-term water diversions during the Construction Phase would be expected to be localized to crossing locations and construction areas and have limited potential for cumulative effects on the surface water quantity Valued Component, as long as coordination between projects is properly planned and communicated. The cumulative effects characterization is summarized in **Section 8.2.7**.

8.2.4 Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality due to Changes in Land Cover during Construction

8.2.4.1 Potential Cumulative Effects

As discussed in **Section 8.1**, the construction of the Northern Road Link and Rapid Lynx Broadband projects, along with the Project, have the potential for cumulative effects on surface water quantity, surface water quality, and sediment quality due to changes in land cover during the Construction Phase.

Additionally, land cover changes as a result of the Rapid Lynx Broadband project may be minimal over the long term as the cable will be primarily buried with some aerial sections; however, given the uncertainty about the project (e.g., start and end dates, details of a maintenance plan or decommissioning activities) and to be conservative in the assessment, land cover change is considered permanent in the Construction Phase and through the Operation and Maintenance Phase of the Rapid Lynx Broadband project for the purposes of the Cumulative Effects Assessment. Spatial overlap with the alignments of the Rapid Lynx Broadband project in relation to the Project is in the Upper Albany - Makokibatan watershed. Five crossings have been identified for the Rapid Lynx Broadband project (**Figure 8-1**) that appear to be on the same waterbodies crossed by the Project: one crossing on Buffaloskin River and four unnamed crossing locations.

The potential for spatial overlap for changes in land cover during construction with the alignment of the Northern Road Link in relation to the Project is in the Upper Albany - Makokibatan watershed. Two crossings have been identified for the Northern Road Link (**Figure 8-1**) that are on the same waterbodies crossed by the Project, with one crossing located on Gourlie Creek and the second on the Wabassi River (3.8 and 46 km away from the Project, respectively). Disturbances that may affect surface water quantity, surface water quality, and sediment quality due to changes in land cover during the Construction Phase may include a local increase in runoff rates and / or runoff volumes from the various Project components and, in turn, an increase in streamflows, water levels, and erosion / sedimentation processes at nearby waterbodies (i.e., downstream receivers), as described in **Section 7.3.1.5**. By extension, the identified increase in streamflows with the potential for higher rates of sediment erosion / transport (all of which are tied to surface water quantity) may result in an associated increase to the concentrations of suspended solids and metal leaching (surface water quality and sediment quality) in these respective waterbodies shared by both projects.

8.2.4.2 Mitigation Measures

It is anticipated that mitigation and enhancement measures will be, or have been, implemented to limit the effects of changes to land cover during the Construction Phase of the Northern Road Link and Rapid Lynx Broadband projects and that these mitigation and enhancement measures will be similar to those implemented for the Project (**Section 7.3.1.5.2**).

That said, the alignments for each project do not appear to cross the same waterbodies, except for two watercourse crossing locations for the Northern Road Link and five crossing locations for the Rapid Lynx Broadband projects in relation to the Project. It is expected that the Northern Road Link, Rapid Lynx Broadband and the Project would follow mitigation and enhancement measures as outlined in **Section 7.3.1.5.2** at the crossing locations, including enacting erosion and sediment control plans. The effects from each project from short-term construction activities result in changes to land cover would be expected to be localized particularly to the roadway corridor. In order to limit potential cumulative effects on surface water quantity, surface water quality, and sediment quality due to changes in land cover during the Construction Phase, coordination between projects could be initiated to help ensure that mitigation measures are instigated for all projects, such as limiting the use of off-road vehicles during construction activities. As a best practice, it is suggested that the monitoring programs and timing of construction works, including monitoring of erosion and sediment controls, share relevant information and data collected during construction activities for the areas where predicted effects overlap (such as notifying if turbidity exceedances are observed, if applicable).

Overall, the mitigation measures and commitments identified previously are expected to minimize opportunities for increased concentrations of suspended solids and chemical constituents (due to any associated changes to erosion–sedimentation processes) where projects spatially overlap. Water quantity and quality monitoring will be monitored, where appropriate, to confirm the potential changes to land cover as a result of construction works and any associated mitigation measures as well as to maintain compliance with regulatory permits / approvals.

8.2.4.3 Characterization of Predicted Cumulative Effects

Based on the assessment above, the predicted cumulative effects are negligible and are not significantly greater than the predicted residual effects for the Project. Cumulative effects for surface water quantity, surface water quality, and sediment quality due to changes in land cover during the Construction Phase may result include a local increase in runoff rates and / or runoff volumes from the various Project components and, in turn, an increase in streamflows, water levels, and erosion / sedimentation processes at nearby waterbodies (i.e., downstream receivers) as part of the Northern Road Link, Rapid Lynx Broadband and the Project.

These changes will be minimized by effective implementation of the mitigation and enhancement measures expected for these projects, such as sharing and coordination of construction monitoring and timing of project works. Characterization of the predicted cumulative effect due to changes to land cover due to construction is the same as the characterization of the predicted residual effect described in **Section 7.3.2.5**. The similarity in characterization is due to the limited spatial overlap of the Local Study Area and the predicted similar construction requirements and residual effects of the Project and the Northern Road Link project. The cumulative effects characterization is summarized in **Section 8.2.7**.

8.2.5 Residual Effects to Surface Water Quality and Sediment Quality from the Wash-off of Organic Debris to Nearby Waterbodies, and / or Increased Rates of Erosion in Disturbed and Exposed Areas with Sediment Transport and Delivery to Adjacent Waterbodies during Construction

8.2.5.1 Potential Cumulative Effects

As discussed in **Section 8.1**, the construction of the Northern Road Link and Rapid Lynx Broadband projects, along with the Project, have the potential for cumulative effects on surface water quality and sediment quality from the wash-off of organic debris to nearby waterbodies, and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies during the Construction Phase.

Additionally, wash-off of organic debris as a result of the Rapid Lynx Broadband project may be minimal over the long term as the cable will be primarily buried with some aerial sections; however as stated previously, given the uncertainty about the project (e.g., start and end dates, details of a maintenance plan or decommissioning activities, or whether stockpiles of organic material will be necessary during the drilling process) and to be conservative in the assessment, the wash-off of organic debris has been included in the assessment of Construction Phase of the Project for the purposes of the Cumulative Effects Assessment.

Similar to changes in land cover during construction cumulative effect identified above (i.e., **Section 8.2.4)**, based on the alignment of the Northern Road Link in relation to the Project, the potential for spatial overlap with the Project is located towards the northern end of the Project in the Upper Albany - Makokibatan watershed. Two crossings have been identified for the Northern Road Link project (**Figure 8-1**) that are on the same waterbodies crossed by the Project, including one crossing on Gourlie Creek and one on the Wabassi River. The Project currently proposes to cross Gourlie Creek and the Wabassi River using a multi-span bridge (**Section 7.1**).

Due to the size of these waterbodies, it is likely that the crossings for the Northern Road Link would also use bridges (clear span or multi-span) and that these projects will have similar residual effects of potential wash-off of organic debris to nearby waterbodies. Disturbances that may affect surface water quantity, surface water quality, and sediment quality due to wash-off of organic debris to nearby waterbodies during the Construction Phase may include a local increase in runoff rates and / or runoff volumes of organic debris from the various Project components and, in turn, an increase in erosion / sedimentation processes at nearby waterbodies (i.e., downstream receivers), as described in **Section 7.3.1.9**. By extension, the identified increase in streamflows (compounded by changes to land cover presented in **Section 8.2.4**) with the potential for higher rates of sediment erosion / transport (all of which are tied to surface water quantity) may result in an associated increase to the concentrations of suspended solids in these respective waterbodies.

8.2.5.2 Mitigation Measures

It is anticipated that mitigation and enhancement measures will be, or have been, implemented to limit the effects of the wash-off of organic debris to nearby waterbodies, and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies during the Construction Phase of the Northern Road Link and Rapid Lynx Broadband projects and that these mitigation and enhancement measures will be similar to those implemented for the Project (**Section 7.3.1.9.2**).

That said, the alignments for each project do not appear to cross the same waterbodies, except for two watercourse crossing locations for the Northern Road Link and five crossing locations for the Rapid Lynx Broadband projects in relation to the Project. It is expected that the Northern Road Link, Rapid Lynx Broadband and the Project would follow mitigation and enhancement measures as outlined in **Section 7.3.1.9.2** at these crossing locations, including enacting erosion and sediment control plans to mitigate the removal of vegetation and earthwork activities. The effects from each project from short-term construction activities result in changes from the wash-off of organic debris would be expected to be localized particularly to the roadway corridor. In order to limit potential cumulative effects on surface water quality and sediment quality from the wash-off of organic debris to nearby waterbodies, and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies during the Construction Phase, coordination between projects could be initiated to help ensure that mitigation measures are instigated for all projects, such as storing organic debris outside of the buffer zone and above the high-water mark of nearby waterbodies during construction activities. As a best practice, it is suggested that the monitoring programs and timing of construction activities for project works, including monitoring of erosion and sediment controls and monitoring areas after heavy storm events, share relevant monitoring data collected during construction activities for the areas where predicted effects overlap (such as notifying if turbidity exceedances observed during monitoring are noted, if applicable).

Overall, the mitigation measures and commitments identified previously are expected to minimize opportunities for increased concentrations of suspended solids and chemical constituents (due to any associated changes to erosion–sedimentation processes) where projects spatially overlap. Water quantity and quality monitoring will be monitored, where appropriate, to confirm the potential changes to land cover as a result of construction works and any associated mitigation measures as well as to maintain compliance with regulatory permits / approvals.

8.2.5.3 Characterization of Predicted Cumulative Effects

The predicted cumulative effects are negligible and do not appear to be significantly greater than the predicted residual effects for the Project. Measurable changes (i.e., residual effects) to surface water quality and sediment quality (i.e., residual effects) may occur due to the wash-off of organic debris and / or increased rates of sediment erosion / transport to nearby waterbodies as part of site preparation, earthworks, stockpiling activities as part of the Northern Road Link, Rapid Lynx Broadband and the Project. These changes will be minimized by effective implementation of the mitigation and enhancement measures; however, cumulative effects from the wash-off of organic debris have the potential to occur because work may be conducted at water crossings, road works, and quarry operation locations for the Northern Road Link project or has been conducted for the Rapid Lynx Broadband project. The characterization of the predicted cumulative effect due to potential cumulative effects as a result of wash-off of organic debris to construction is the same as the characterization of the predicted residual effect described in **Section 7.3.2.7**. The similarity in characterization is due to the limited spatial overlap of the Local Study Area and the predicted similar construction requirements and residual effects of the Project and the Northern Road Link project. The cumulative effects characterization is summarized in **Section 8.2.7**.

8.2.6 Prediction Confidence

Within a cumulative effects assessment, there is inherently a level of uncertainty due to the level of information available regarding other projects, including reasonably foreseeable developments. However, this uncertainty is managed by making conservative assumptions regarding these projects' design or activities. There is a good understanding of the effects on surface water quantity, quality and sediment quality related to permanent roads, road upgrades, and fibre-optic cable installation projects. Similarly, the mitigation and enhancement measures for these types of projects are standard, routinely and effectively implemented across Canada, and required as part of permit conditions.

There is also a good understanding of the surface water quantity, quality and sediment quality conditions within the Regional Study Area and the resilience and adaptability of received waterbodies.

Overall, confidence levels for the cumulative effects assessment were considered to be moderate, as the Project-related effects are mostly understood, there is a level of certainty associated with the effectiveness of proposed mitigations, and conservative assumptions were applied.

With global climate change, the local climatic conditions along the Marten Falls Community Access Road are also changing. Climate models that provide projections of future climatic conditions show change in rainfall pattern, among other changes to local climate, which will lead to heavier and more frequent rainfalls events. Extreme rainfall amounts over short periods can lead to flooding due to runoff (AECOM, 2024). Climate change effects are uncertain but probable to occur and may affect surface water quantity and quality. Proposed mitigation and enhancement measures integrated with climate change considerations are expected to mitigate climate change effects (due to heavy rainfalls and flood events) at waterbody crossings and other Project infrastructure and associated natural environment. While the climate change effects extend beyond the Regional Study Area, they are not expected to substantially affect developed conditions compared to the existing conditions. Climate projections show that the climate change is expected regardless of the Project or other foreseeable developments, however, considering implementation of proposed mitigation measures, it does not alter the assessment of not significant cumulative residual effects from the Project and other reasonably foreseeable development.

8.2.7 Summary

Table 8-5: Characterization of Predicted Cumulative Effects for Surface Water Valued Components

Cumulative Effect	Project Phase	Context	Direct / Indirect	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Probability of Occurrence	Significance	Uncertainty
Residual Effects to Surface Water Quantity from Short Term Water Taking	Construction	Ecological	Direct	Negative	Negligible	Local Study Area	Short term	Frequent	Reversible	Probable	Significance of the cumulative effects not determined for this Valued Component	Moderate
Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality from Short Term Water Discharges	Construction	Ecological	Direct	Negative	Negligible	Local Study Areal	Short term	Frequent	Reversible	Probable	Significance of the cumulative effects not determined for this Valued Component	Moderate
Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality During Short Term Water Diversions at Waterbody Crossings	Construction	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Short term	Infrequent	Reversible	Probable	Significance of the cumulative effects not determined for this Valued Component	Moderate
Residual Effects to Surface Water Quantity, Surface Water Quality, and Sediment Quality due to Changes in Land Cover	Construction	Ecological	Direct	Negative	Negligible	Construction Disturbance Area	Long term	Frequent	Irreversible for permanent structures	Probable	Significance of the cumulative effects not determined for this Valued Component	Moderate
Residual Effects to Surface Water Quality and Sediment Quality from the Wash Off of Organic Debris to Nearby Waterbodies, and / or Increased Rates of Erosion in Disturbed and Exposed Areas with Sediment Transport and Delivery to Adjacent Waterbodies	Construction	Ecological	Direct	Negative	Negligible	Local Study Area	Short term	Frequent	Reversible	Probable	Significance of the cumulative effects not determined for this Valued Component	Moderate

9 Monitoring Programs and Future Commitments

A monitoring program verifies the accuracy of the effects assessment and evaluates the effectiveness of mitigation measures. Monitoring programs also include future commitments related to mitigating residual effects and addressing uncertainty. Indigenous communities have explicitly noted support for an ongoing monitoring program of waterways impacted by road development, suggesting continued community engagement throughout the entire Project life cycle for follow-up and monitoring programs (MNP LPP, 2024a). A Project-specific Environmental Monitoring Program will be developed and implemented that includes the monitoring commitments related to surface water Valued Components presented in this section. Project-specific Environmental Monitoring Program will be provided for review by regulatory agencies in advance of any construction activities, as needed. Project-specific Environmental Monitoring Program will be incorporated into site-wide Project-specific Environmental Protection Plan.

9.1 Pre-construction Monitoring Program

Prior to Construction, the following monitoring programs will be required:

- Surface water surveys using methods similar to those outlined in **Section 4.3** for ground-based surveys (during high and low stream flow conditions, where possible) at any waterbody crossing location that has not already been assessed as part of the field investigations and at water crossings where work is proposed below the high-water mark to meet additional permitting requirements; and
- If new waterbodies are identified, an Aquatics Specialist will be required to assess the new waterbody. Depending on the nature of the waterbody, recommendations for construction methods, appropriate mitigation measures, and permitting requirements will be made by the Aquatics Specialist and local First Nation communities and appropriate regulatory agencies including Fisheries and Oceans Canada and Ministry of Natural Resources will be engaged. This will allow for the appropriate mitigation measures to be implemented during construction at each waterbody crossing at a site-specific level, which will reduce or avoid potential effects on surface water quantity, surface water quality and sediment quality.

9.2 Construction Monitoring Program

During Construction, the following monitoring programs will be required for surface water in the Local Study Area:

- In-situ monitoring of one or more surface water quantity and quality parameters (including but not limited to water taking and discharge rates, pH, temperature, dissolved oxygen, turbidity, conductivity, and other contaminants of concerns as required) and sampling for laboratory analysis of surface water quality parameters (including but not limited to hardness, alkalinity, total suspended solids, total dissolved solids, dissolved organic carbon, biochemical oxygen demand, major and minor ions (including sulphate), total metals, nutrients (total phosphorus, total ammonia, total Kjeldahl nitrogen), total and dissolved organic carbon, and other contaminants of concerns as required) will be conducted at water taking and / or discharge locations to satisfy the conditions / requirements of Water Taking and Discharge Plans related to applicable permits and approvals (e.g., Permit to Take Water, Environmental Compliance Approval and / or Environmental Activity and Sector Registry), and to confirm the effectiveness of the Water Taking and Discharge Plans and associated mitigation and enhancement measures. Qualified environmental personnel (with expertise in surface water and water quality such as a water resources engineer) will be retained for monitoring program to help confirm that the proposed environmental safeguards are in place, and effectively utilized in protecting the environment;
- Monitoring / inspecting all erosion and sediment management measures, bank stabilization features, and cofferdams during Construction Phase to verify the performance and effectiveness of mitigation and enhancement measures; and
- Monitoring of total suspended solids and / or turbidity (instrumented measurements and / or visual observations), as well as visual inspections to confirm the presence or absence of oil or sheen, will be coupled with monitoring of streamflow rates and / or water levels, as required to meet regulatory or permitting requirements, at all water crossings targeted for in-stream works during Construction Phase to verify effectiveness of construction procedures and mitigation measures including dam and pump / diversion activities associated with the removal and / or installation of temporary or permanent crossing structures. An Adaptive Management Plan will be developed in the event of an unexpected change to water quantity or quality (i.e., increase in turbidity in accordance with Canadian Council of Ministers of the Environment standards). Adaptive Management Plan will be provided in permit/approval application for review by regulatory authorities in advance of any construction activities, as applicable.

9.3 Operations Monitoring Program

During Operation and Maintenance, the following monitoring programs will be required for surface water in the Local Study Area:

- Monitoring / inspections of all new permanent water crossing structures (culverts and bridges) and roadside drainage features for physical function and condition in accordance with the Ministry of Transportation inspection guide and manual (Ministry of Transportation, 2018; 2022); and
- Monitoring of water quality, sediment quality, and streamflow conditions at waterbodies that include greater sensitivity or implication to change from the standpoint of fish habitat, species at risk, channel stability, drainage pattern, or other environmental considerations. The specific monitoring locations will be determined during the permitting and design stages of the Project; however, it is expected that waterbodies of varying size (small, medium, large) would be captured, recognizing that this would allow the performance / effectiveness of mitigation and enhancement measures to be evaluated at a range of scales.

9.4 Future Commitments

Table 9-1: Summary of Future Commitments

Valued Component	Commitment	Phase	Section Reference
Surface Water Quantity **Surface Water Quality** **Sediment Quality**	Complete site-specific surface water surveys to support engineering and permitting at waterbody crossings where work below high-water mark is proposed. Submit designs of waterbody crossings as required for permit applications to Fisheries and Oceans Canada and Ministry of Natural Resources.	Detailed Design	**Section 7.3.1.12**

9.5 Future Permits and Approvals

To facilitate the construction of the Community Access Road, including construction activities and temporary infrastructure, permits and approvals from provincial, federal government and other jurisdictional agencies will need to be acquired.

The pits and quarries that are proposed through the Community Access Road Project will be subject to permitting requirements outlined within the *Aggregate Resources Act* and its regulations. For a permit to be issued, additional studies, mitigation plans, consultation and monitoring commitments may be required. In addition to permitting requirements under *the Aggregate Resources Act*, permitting and approvals under other pieces of legislation may also be required for pit and quarry development, including:

- *Ontario Planning Act;*
- *Ontario Water Resources Act;*
- *Ontario Environmental Protection Act;*
- *Ontario Endangered Species Act*; and
- Federal *Species at Risk Act.*

10 Summary and Recommendations

The potential effects summary and recommendations for surface water quantity, quality and sediment quality Valued Components is provided in **Table 10-1.** As part of the permitting stage of the Project, a Project-specific Environmental Protection Plan and Environmental Monitoring Plan will need to be developed and implemented that includes an implementation plan for the mitigation and monitoring commitments related to the surface water quantity, quality and sediment quality Valued Components presented in **Table 10-1**.

Table 10-1: Potential Effects Summary and Recommendations

ID	Valued Component	Environmental Concern and Potential Effect	Project Phase	Concerned Agencies	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Detailed Design	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Construction / Operation and Maintenance
SW-01	Surface Water Quantity Surface Water Quality	Changes to surface water quantity and surface water quality from short-term water taking	■ Construction	■ Ministry of the Environment, Conservation and Parks	■ Water taking will be in compliance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 64/16* under the *Ontario Water Resources Act* (Government of Ontario, 1990c) (pertaining to permits, data and reporting, and water transfers), where applicable, and best industry practices. ■ Eligible activities will be registered on the Environmental Activity and Sector Registry. If an activity does not meet these criteria, a Permit to Take Water will be obtained. ■ Site specific water flow and/or levels triggers will be developed for sensitive water sources that may be affected by water takings, if needed. ■ Drilling of groundwater wells at the temporary construction camps, if necessary as a last resort, will be in accordance with the *Revised Regulations of Ontario (Regulation 903: Wells)*, under the *Ontario Water Resources Act* (Government of Ontario, 1990c).	■ Water taking activities and water taking will be in compliance with the applicable legislation, regulations, permit requirements, and best industry practices. ■ Potable water for work sites, temporary construction camps, and temporary laydown areas will be obtained from surface water sources (with appropriate treatment as needed), bottled sources, and groundwater wells (only if necessary).
SW-02	Surface Water Quantity Surface Water Quality	Changes to surface water quantity and quality from short-term water discharges	■ Construction	■ Ministry of the Environment, Conservation and Parks	■ The plans and / or systems to collect, store, and dispose construction water will be designed / prepared in compliance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 64/16* and / or *Ontario Regulation 63/16* (Government of Ontario, 1990c), where applicable, and best industry practices. ■ Wastewater associated with discharges from Project will be characterised and, in some cases, assimilative capacity study will be conducted, where necessary. ■ Sewage disposal systems such as leaching beds will be designed, constructed, and operated according to Ontario Building Code 2012 (*Ontario Regulation 332/12: Building Code)* under *Building Code Act* (Government of Ontario, 1992). ■ Marten Falls First Nation with the Owner/Operator will review discharge sites / locations to avoid discharging to sensitive areas, including areas identified through the Indigenous Knowledge Program.	■ Collection, storage, and disposal of construction water, domestic sewage, and wash water will follow applicable permits, approvals, and best industry practices. ■ The wash-out site will be monitored regularly to verify that runoff from the area does not report to a waterbody. ■ Construction water / wastewater (not requiring approvals) will be directed, at a minimum, to low-lying vegetated areas for infiltration, and measures such as filter fabric or straw bales will be utilized to minimize sediment transport during dewatering. ■ Following the Construction Phase, all temporary wash-out sites will be capped with local backfill and regraded prior to construction crews departing the site. ■ If required and when feasible, domestic wastewater will be removed by approved disposal trucks and disposed of at wastewater treatment plants with authorization and capacity to accept this wastewater.
SW-03	Surface Water Quantity Surface Water Quality Sediment Quality	Changes to surface water quantity, surface water quality, and sediment quality during short-term water diversions at waterbody crossings	■ Construction	■ Ministry of Natural Resources ■ Fisheries and Oceans Canada	■ The design of waterbody crossings, construction, and diversion plans will be prepared in compliance with applicable regulations and guidelines including *Ontario Regulation 387/04* as amended by *Ontario Regulation 301/21* (Government of Ontario, 1990c), *Ontario Regulation 454/96* of the *Lakes and Rivers Improvement Act* (Government of Ontario, 1990f) and Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990) as well as *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (Ministry of Natural Resources, 2010) and *Technical Guide River & Stream Systems:*	■ The construction of waterbody crossings and removal of temporary works will be in compliance with applicable regulations and permitting requirements (e.g., *Ontario Regulation 454/96* [Government of Ontario, 1990f], and Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* [Ministry of Natural Resources, 1990]). ■ Short-term water diversions (active or passive) will be carried out in accordance with *Ontario Regulation 387/04* as amended by *Ontario Regulation 63/16* and *64/16* under the *Ontario Water Resources Act* (Government of Ontario, 1990c). ■ Waterbody crossings will be constructed in accordance with Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990).

ID	Valued Component	Environmental Concern and Potential Effect	Project Phase	Concerned Agencies	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Detailed Design	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Construction / Operation and Maintenance
					Flooding Hazard Limit (Ministry of Natural Resources, 2002), as applicable. ■ An Adaptive Management Plan will be developed in the event of an unexpected change to water quantity or quality (i.e., increase in turbidity in accordance with Canadian Council of Ministers of the Environment standards).	■ To account for climate change effects, mitigation measures as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024) will be implemented. ■ Environmental monitoring (including water quality sampling / testing noted in **Section 9.2** will be conducted during Construction Phase to verify the performance and effectiveness of the planned mitigation. The monitoring program will be under the direction of the Environmental Monitor and Indigenous Environmental Monitor. ■ An Adaptive Management Plan will be implemented in the event of an unexpected change to water quantity or quality. ■ Temporary waterbody crossings will be remediated at the end of the Construction Phase.
SW-04	Surface Water Quantity Surface Water Quality Sediment Quality	Changes to surface water quantity, surface water quality, and sediment quality due to changes in channel hydraulics at waterbody crossings	■ Construction ■ Operation and Maintenance	■ Ministry of Natural Resources ■ Fisheries and Oceans Canada	■ The design of waterbody crossings, construction, and diversion plans will be prepared in compliance with applicable regulations and guidelines including *Ontario Regulation 239/13* (Government of Ontario, 1990h) and *Ontario Regulation 454/96* (Government of Ontario, 1990f) and Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990) as well as *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (Ministry of Natural Resources, 2010) and *Technical Guide River & Stream Systems: Flooding Hazard Limit* (Ministry of Natural Resources, 2002), as applicable. ■ In case site-specific changes to water crossing would be required, engagement with Ministry of Natural Resources, Fisheries and Oceans Canada and stakeholders will occur prior to any instream construction activities, where appropriate (e.g., placement of additional fill, regrading, and / or stabilization of bed or banks). ■ Waterbody crossing will be designed to maintain the characteristic channel width, depths, slopes, and substrate in the event that a channel realignment is required. ■ Design of waterbody crossing structures (culverts and bridges) will consider climate change factors.	■ Waterbody crossings will be constructed in accordance with permits and approvals through Fisheries and Oceans Canada and Ministry of Natural Resources under *Ontario Regulation 239/13* (Government of Ontario, 1990h) and *Ontario Regulation 454/96* (Government of Ontario, 1990f), as applicable. ■ Mitigation measures as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024) will be implemented. ■ Each waterbody crossing will be visited ahead of construction by qualified environmental personnel and fisheries biologists and / or technicians (i.e., Aquatics Specialist) to verify that the crossing location is conducive to the planned crossing structure installation, such that any changes in site conditions can be addressed through necessary design adjustments. During pre-construction site visits, surface water surveys at any waterbody crossing location that has not already been assessed as part of the field investigations will be conducted. Refer to **Section 9.1** for details about pre-construction surveys. ■ Prior to commencing construction work, the Owner/Operator will implement erosion and sediment control measures. ■ At some locations where it is determined that spring-melt or storm runoff needs to pass from one side of the right-of-way to the other to prevent flooding and / or erosion, equalization culverts will be installed. ■ Upon completion of construction work, watercourse banks will be returned to their original profile, disturbed areas will be stabilized as necessary to prevent soil erosion and temporary waterbody crossings will be reclaimed. ■ Maintenance of waterbody crossings will be carried out in accordance with permits and approvals through Fisheries and Oceans Canada and Ministry of Natural Resources, as applicable. ■ Monitoring of permanent culverts will be in accordance with the Culvert Inspection Guide (Ministry of Transportation, 2022) to identify and remove blockages (e.g., ice, woody debris), as needed, that could otherwise lead to scouring and effects on channel morphology and fish habitat and potentially interfere with fish passage. ■ Monitoring and inspection of new permanent waterbody crossing structures (bridges), and roadside drainage features for physical function and condition will be carried out in accordance with the Ontario Structure Inspection Manual (Ministry of Transportation, 2018). ■ Inspection and monitoring frequency will be increased during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024).

ID	Valued Component	Environmental Concern and Potential Effect	Project Phase	Concerned Agencies	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Detailed Design	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Construction / Operation and Maintenance
						■ Problems identified during monitoring and inspection will be fixed immediately to prevent any further damage to the channel hydraulics, aquatic habitat and the fisheries resources. ■ Repair work will be carried out in a manner that would minimize disturbance to waterbodies and aquatic environment. ■ Prior to commencement of repair work, appropriate erosion and sediment control measures will be implemented in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805). ■ Upon completion of maintenance work, disturbed areas will be restored and revegetated to mitigate erosion and sediment entry to waterbodies.
SW-05	Surface Water Quantity Surface Water Quality Sediment Quality	Changes to surface water quantity, surface water quality, and sediment quality due to changes in land cover	■ Construction ■ Operation and Maintenance	■ Ministry of Natural Resources ■ Fisheries and Oceans Canada	■ The Community Access Road will be designed in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990). ■ The use of off-road vehicles will be planned in accordance with Fisheries and Oceans Canada's *Code of Practice for Fording* (Fisheries and Oceans Canada, 2022), Fisheries and Oceans Canada's *All Terrain Vehicle Guidance* (Fisheries and Oceans Canada, 2010) and *Ontario Regulation 316/03* under *Highway Traffic Act* (Government of Ontario, 1990g). ■ Erosion and Sediment Control Plan for Construction Phase will be prepared in accordance with Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV.804, OPSS.MUNI 182 and OPSS.MUNI.805) and provided in approval/permit applications for review by regulatory agencies, as applicable.	■ The right-of-way and roads and trails (existing and new) will be used for access, to the extent practicable, to minimize changes in land cover. ■ The Community Access Road will be constructed in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990). ■ Temporary construction camps, temporary laydown areas, and other Project activities will be located a minimum of 30 m away from the ordinary high-water mark of a waterbody. ■ Erosion and Sediment Control Plan will be implemented during Construction Phase in accordance with Ontario Provincial Standard Specifications OPSS.PROV.804 and OPSS.MUNI.805. ■ Progressive revegetation of the right-of-way will be implemented. Temporary access roads and trails, temporary construction camps, turn-around areas, waterbody crossings, and temporary laydown areas will be reclaimed progressively through the Construction. Seeding will follow as close as possible to final cleanup and topsoil material replacement pending seasonal or weather conditions. ■ Only materials cleared for acid rock drainage (i.e., non-potentially acid generating rock) by a geochemical verification process will be used for the road surface to avoid acid rock drainage or associated metal leaching. ■ The use of off-road vehicles by the Owner/Operator during Construction and Operation and Maintenance (where applicable) Phases will be limited and follow Fisheries and Oceans Canada's guidelines. ■ Off-road vehicles to be used construction and maintenance activities (where applicable) will be inspected and cleaned before and after each use to prevent the spread of invasive species and to identify any fuel leaks or equipment damage. ■ Prior to commencement of maintenance work, appropriate erosion and sediment control measures will be implemented in accordance with the Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV 804, OPSS.MUNI 182 and OPSS.MUNI 805), where applicable. ■ During maintenance works, disturbance to existing land cover will be kept to a minimum level and disturbed areas will be restored and revegetated including natural revegetation. ■ Climate change factors will be considered in the selection and implementation of site-specific mitigation and enhancement measures, and increasing the inspection and monitoring frequency during and after the heavy rainfall and flooding events as outlined in the Climate Adaption and Resiliency Technical Support Document (AECOM, 2024).

ID	Valued Component	Environmental Concern and Potential Effect	Project Phase	Concerned Agencies	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Detailed Design	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Construction / Operation and Maintenance
SW-06	Surface Water Quality Sediment Quality	Changes to surface water quality and sediment quality from the wash-off of organic to nearby waterbodies, and / or increased rates of erosion in disturbed and exposed areas with sediment transport and delivery to adjacent waterbodies	■ Construction	■ Ministry of Natural Resources ■ Ontario Parks/Ministry of the Environment Conservation and Parks	■ The new Community Access Road and waterbody crossings will be designed in accordance with the Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* (Ministry of Natural Resources, 1990). ■ Water crossings will follow *Ontario Regulation 239/13* under *Public Lands Act* (Government of Ontario, 1990h) and / or *Ontario Regulation 454/96* under the *Lakes and Rivers Improvement Act* (Government of Ontario, 1990f), as applicable. ■ The reuse and / or disposal of slash and debris will follow provincial *Forest Fires Prevention Act* and in compliance with *Ontario Regulation 207/96* (Government of Ontario, 1990e). ■ Erosion and Sediment Control Plans will be prepared. ■ The aggregate pits will follow the guidelines and associated conditions / requirements of the approved permits, including development of a rehabilitation plan, outlined in the *Aggregate Permits on Crown Lands for Pits and Quarries above Water* (Ministry of Natural Resources and Forestry, 2014) and the *Forest Management Planning Manual* (Ministry of Natural Resources and Forestry, 2017). ■ Climate change factors will be considered in design of Community Access Road, waterbody crossings, and stormwater management works.	■ Temporary laydown areas and temporary construction camps will be constructed on existing disturbed areas and / or at reasonably flat areas with stable soil, where possible. ■ The Community Access Road and waterbody crossings will be constructed in accordance with the applicable guidelines, regulation, and approvals (e.g., Ministry of Natural Resources' *Environmental Guidelines for Access Roads and Water Crossings* [Ministry of Natural Resources, 1990], *Ontario Regulation 239/13* [Government of Ontario, 1990h] and / or *Ontario Regulation 454/96* [Government of Ontario, 1990f]). ■ Buffer zones of 30 m will be maintained around waterbodies and clearing of riparian vegetation will be limited to the extent practicable and to the requirement of the access road and alignment clearing width only. Clearing at waterbody crossings along the Community Access Road right-of-way will generally be limited to a 10 m wide right-of-way for equipment access to waterbody crossing structures (e.g., temporary bridges). ■ Removed vegetation will be immediately transported outside a waterbody buffer zone and above its high-water mark to minimize disturbance to the bed and banks. ■ Marten Falls First Nation with the Owner/Operator will work with both Indigenous communities and forest management units to manage merchantable timber cleared by the Project. ■ Slash and debris will be chipped and spread over the right-of-way or will be burned in accordance with provincial *Forest Fires Prevention Act* and in compliance with *Ontario Regulation 207/96* (Government of Ontario, 1990e). ■ Erosion and Sediment Control Plan will be implemented. The Owner/Operator will install, monitor, and manage appropriate erosion and sedimentation control measures in accordance with Ontario Provincial Standard Specifications for erosion and sediment control measures (OPSS.PROV.804, OPSS.MUNI 182 and OPSS.MUNI.805) to minimize or avoid sediment mobilization to drainages, or waterbodies. Adequate and appropriate erosion and sedimentation control materials shall be on site and available prior to commencement of Construction. ■ Additional contingency measures will be implemented as appropriate in the event of excessive rain, wet weather, or flood-like conditions. ■ Progressive reclamation of disturbed areas will be practiced. Natural recovery will be the preferred method over seeding of reclamation on level terrain where erosion is not expected. ■ All aggregate pits will be located a minimum of 120 m away from the ordinary high-water mark of a waterbody, where possible. The aggregate pits will follow the guidelines and associated conditions / requirements of the approved permits, including development of a rehabilitation plan. ■ Climate change factors will be incorporated in the implementation of proposed mitigation and enhancement measures (including measures outlined in the Climate Adaption and Resiliency Technical Support Document [AECOM, 2024]).

ID	Valued Component	Environmental Concern and Potential Effect	Project Phase	Concerned Agencies	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Detailed Design	Mitigation, Protection, Monitoring, and Study Commitments to be Carried Forward to Construction / Operation and Maintenance
SW-07	Surface Water Quality Sediment Quality	Changes to surface water quality and sediment quality from the wash-off of accidental spills and leaks to nearby waterbodies	■ Construction ■ Operation and Maintenance	■ Transport Canada ■ Ministry of the Environment, Conservation and Parks ■ Ministry of Natural Resources	■ The transportation, storage, and handling will be planned in compliance with the Canada's *Transportation of Dangerous Goods Act* (Government of Canada, 1992) and the *Technical Standards and Safety Act* (Government of Ontario, 2000). ■ The aboveground storage tanks will be designed to meet the requirements of the Canadian Council of Ministers of the Environment (2003). ■ The Owner/Operator will prepare Waste Management Plans that describe the appropriate management of solid, liquid, and hazardous waste. ■ The Owner/Operator will prepare a Spill Prevention and Emergency Response Plan in accordance with Part X of the *Environmental Protection Act* and *Ontario Regulation 675/98* under *Environmental Protection Act* (Government of Ontario, 1990d). ■ Spill Prevention and Emergency Response Plan will be provided in permit/approval applications for review by regulatory agencies, as applicable, in advance of construction activities.	■ During Construction Phase, fuel and hazardous materials will be transported, stored, and handled in approved containers in licensed vehicles. ■ Transportation of fuel on winter roads during Construction will only take place in safe ice conditions. ■ Vehicles used for transportation will be licensed and maintained according to safety requirements. Vehicles and equipment used for construction activities will be regularly serviced, maintained and inspected for leaks. ■ The Owner/Operator will implement Waste Management Plans during construction. ■ The Owner/Operator will implement a Spill Prevention and Emergency Response Plan during construction. ■ Refuelling, service, and maintenance of vehicles and equipment during construction will generally be carried out in designated areas with specific measures to collect and contain leaks and spills, if occurred. ■ Spill response kits will be provided in fuel and hazardous materials storage and handling facilities at temporary construction camps and temporary laydown areas, in on-site work areas, and / or in vehicles and equipment, and personnel will be trained in spill response practices and procedures. ■ During the winter periods, sand will be used on the Community Access Road for de-icing instead of road salt. ■ During Operation and Maintenance Phase, vehicles used for transportation will be licensed and maintained according to safety requirements. Vehicles and equipment will be regularly serviced, maintained and inspected for leaks. ■ Hazardous materials to be used for maintenance activities, will be stored in designated areas designed and constructed to collect and contain minor leaks and spills. ■ Spill Prevention and Emergency Response Plan for maintenance activities will be developed and implemented.
SW-08	Surface Water Quality Sediment Quality	Changes to surface water quality and sediment quality from the wash-off of explosives spills and residues from blasting activities to nearby waterbodies	■ Construction	■ Transport Canada	■ The transportation and storage of explosives will be in compliance with the *Explosives Act* (Government of Canada, 1985) and the *Transportation of Dangerous Goods Act* (Government of Canada, 1992), where applicable. ■ The Owner/Operator will prepare a Blasting and Communication Management Plan that describes specific measures that would be implemented if blasting is required.	■ Blasting activities will also be in accordance with aggregate permit / licence issued under *Aggregate Resources Act* (Government of Ontario, 1990i). ■ Ammonium nitrate and fuel oil will not be used. ■ The Owner/Operator will implement a Blasting and Communication Management Plan. ■ The Owner/Operator will use explosives only if excavation to remove bed rock is found not feasible. ■ The Environmental Inspector will monitor blasting operations for adherence to the Blasting and Communication Management Plan. ■ Discarded explosives will either be detonated on site or temporarily stored in the explosives magazine and returned to the explosives' distributor.

m = metre; OPSS = Ontario Provincial Standard Specifications.

11 References

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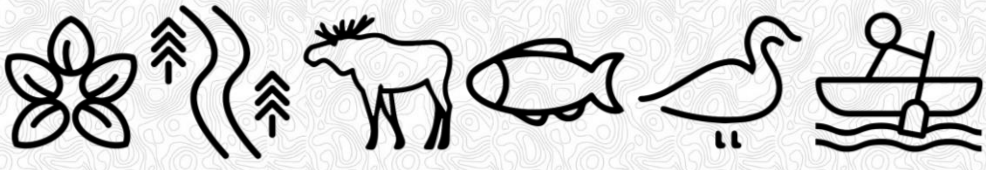
Attachment A - Draft Study Plan, Work Plan, and Regulator Comments

MARTEN FALLS FIRST NATION
ALL SEASON COMMUNITY ACCESS ROAD

FINAL

Surface Water Study Plan

May 2021



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Revision History

Rev #	Date	Revision Description
Draft	June 2020	Submitted “Study Plan – Surface Water DRAFT FOR DISCUSSION” to the Agency.
Final	May 2021	Revised to address federal and provincial agency comments.

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Appendices

Appendix A. Preliminary List of Data Sources
Appendix B. Agency Comments on the Draft Study Plans

Acronyms and Abbreviations

Agency, the ... Impact Assessment Agency of Canada
CAR ..... Community Access Road
CCME ..... Canadian Council of Ministers of the Environment
CWQG ..... Canadian Water Quality Guidelines
EA ..... Environmental Assessment
IA ..... Impact Assessment
IAA ..... *Impact Assessment Act*
IS ..... Impact Statement
km ..... kilometre
LiDAR ..... Light Detection and Ranging
LSA ..... Local Study Area
MECP ..... Ontario Ministry of the Environment, Conservation and Parks
MFFN ..... Marten Falls First Nation
ODWQS ..... Ontario Drinking Water Quality Standards
PDA ..... Project Development Area
RSA ..... Regional Study Area
SAR ..... Species at Risk
TISG ..... Tailored Impact Statement Guidelines
ToR ..... Terms of Reference
VC ..... Valued Component

1. Introduction

The Proponent of the Community Access Road (CAR or the Project) is Marten Falls First Nation (MFFN), a remote First Nation community in northern Ontario located at the junction of the Albany and Ogoki rivers, approximately 430 kilometres (km) from Thunder Bay, Ontario. The MFFN community is proposing an all-season Community Access Road that will connect the MFFN community to Ontario's provincial highway network (Highway 643) to the south via the existing Painter Lake Road. MFFN, as the Proponent of the Project, has formed a MFFN CAR Project Team that includes MFFN CAR Community Member Advisors and MFFN CAR Project Consultants who act with input, guidance and direction from the MFFN Chief and Council.

This document outlines the Study Plan for Surface Water to support a coordinated Impact Assessment (IA) required for Project review by the Impact Assessment Agency of Canada (the Agency) under the federal *Impact Assessment Act* (IAA) and Environmental Assessment (EA) required for Project review by the Ontario Ministry of the Environment, Conservation and Parks (MECP) under the Ontario *Environmental Assessment Act*.

1.1 Federal and Provincial Terminology

The study plans have been prepared using federal terminology, however, the respective provincial terminology has been provided in **Table 1-1** for reference. The terms can be used interchangeably.

Table 1-1: Equivalent Federal and Provincial Terms

Provincial Term	Federal Term
Criteria	Valued Component
Impact Management Measure	Mitigation Measure
Net Effects	Residual Effects
Record of Consultation	Record of Engagement

1.2 Project Study Plans

This Study Plan is one of a group of study plans created for the Project. **Table 1-2** includes the study plans for each environmental[1] discipline currently planned for the Project and the valued components (VCs) covered by the study plans where applicable.

Table 1-2: Project Study Plans and Valued Components

Environmental Discipline	Study Plan Name	Valued Component(s)
Aboriginal and Treaty Rights and Interests	■ Aboriginal and Treaty Rights and Interests Study Plan	■ Indigenous Current Use of Lands and Resources for Traditional Purposes ■ Cultural Continuity (ability to practice and transmit cultural traditions)
Atmospheric Environment	■ Atmospheric Environment and Greenhouse Gases Study Plan	■ Air Quality ■ Greenhouse Gas Emissions
Climate Change	■ Climate Adaptation and Resiliency Study Plan	■ Climate Change
Acoustic and Vibration Environment	■ Acoustic and Vibration Environment Study Plan	■ Noise ■ Vibration
Physiography, Geology, Terrain and Soils	■ Physiography, Terrain and Soils Study Plan	■ Physiography, Terrain and Soils
Surface Water	■ Surface Water Study Plan	■ Surface Water
Groundwater and Geochemistry	■ Groundwater and Geochemistry Study Plan	■ Groundwater
Vegetation	■ Vegetation Study Plan	■ Wetland and Riparian Ecosystems ■ Upland Ecosystems ■ Designated Areas (Areas of Natural and Scientific Interest, Environmentally Significant Areas, Significant Woodlands, Critical Landform / Vegetation Associations) ■ Traditional Use Plants and SAR Plant Populations (including species with special conservation status or rarity in the province)
	■ Peatlands Study Plan	■ Peatland Ecosystems (bogs and fens)
Wildlife	■ Wildlife Study Plan	■ Bats (including SAR-bats such as: Little Brown Myotis [*Myotis lucifugus*], Northern Myotis [*Myotis septentrionalis*] and Tricolored Bat [*Perimyotis subflavus*]) ■ Fur Bearers (proxy VC[2] American Marten [*Martes americana*], Beaver [*Castor canadensis*] and Wolverine [*Gulo gulo*])

1. *The use of the term environment in this document is inclusive of the components of the environment that are included in the Ontario Environmental Assessment Act definition, which includes a general description of the social, cultural, built and natural environments.*
2. *A proxy VC is used when looking at the effects of one species that represents many others.*

Environmental Discipline	Study Plan Name	Valued Component(s)
		■ Amphibians and Reptiles ■ Pollinating Insects
	■ Ungulates (Moose and Caribou) Study Plan	■ Moose (*Alces alces*) ■ Caribou, boreal population (*Rangifer tarandus*)
	■ Bird Study Plan	■ Forest Birds (proxy VC of Red-eyed Vireo [*Vireo olivaceus*] for deciduous forest, Ovenbird [*Seirus aurocapilla*] for mixedwood forest, Dark-eyed Junco [*Junco hyemalis*] for coniferous forest and disturbed forest ■ Raptors (proxy VC of Osprey [*Pandion haliaetus*] for diurnal raptors and Boreal Owl [*Aegolius funereus*] for nocturnal raptors ■ Shorebirds (proxy VC of Wilson's Snipe [*Gallingo delicata*]) ■ Waterfowl (proxy VC of Mallard [*Anas platyrhynchos*]) ■ Bog / Fen Birds and Other Wetland Birds (proxy VC of Palm Warbler [*Setophaga palmarum*] for bogs, Common Yellowthroat [*Geothlypis trichas*] for fens; and Northern Waterthrush [*Parkesia noveboracensis*] for swamps. ■ SAR birds: Canada Warbler (*Cardellina canadensis*), Chimney Swift (*Chaetura pelagica*), Common Nighthawk (*Chordeiles minor*), Eastern Whip-poor-will (*Antrostomus vociferous*), Eastern Wood-Pewee (*Contopus virens*), Evening Grosbeak (*Coccothraustes vespertinus*), Olive-sided Flycatcher (*Contopus cooperi*), Bald Eagle (*Haliaeetus leucocephalus)*, Peregrine Falcon (*Falco peregrinus*), Short-eared Owl (*Asio flammeus)*, Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Black Tern (*Childonias niger*), Rusty Blackbird (*Euphagus carolinus*), Yellow Rail (*Coturnicops noveboracensis*)
Fish and Fish Habitat	■ Fish and Fish Habitat Study Plan	■ Lake Sturgeon (*Acipenser fulvescens*) ■ Walleye (*Sander vitreus*) ■ Brook Trout (*Salvelinus fontinalis*) ■ Northern Pike (*Esox lucius*) ■ Lake Whitefish (*Coregonus clupeaformis*) ■ Chain Pickerel (*Esox niger*) ■ Yellow Perch (*Perca flavescens*) ■ Cisco (*Coregonus artedii*) ■ Burbot (*Lota lota*) ■ Longnose Sucker (*Catostomus catostomus*) ■ White Sucker (*Catostomus commersonii*) ■ Forage / Prey Species (including species such as Lake Chub [*Couesius plumbeus*]) ■ Lower Trophic Organisms (e.g., benthic invertebrates)
Social	■ Social Study Plan	■ Housing and Accommodation ■ Community Service and Infrastructure ■ Transportation ■ Community Well-being ■ Populations and Demographics

Environmental Discipline	Study Plan Name	Valued Component(s)
Economy	■ Economic Study Plan	■ Regional Economy ■ Labour Force and Employment ■ Government Finances
Land and Resource Use	■ Land and Resource Use Study Plan	■ Land Use Compatibility ■ Parks and Protected Areas ■ Extractive Industry ■ Forestry Industry ■ Energy and Linear Infrastructure ■ Recreation and Tourism
Human Health and Community Safety	■ Human Health and Community Safety Study Plan	■ Public Safety ■ Public Health ■ Diet ■ Environmental Factors Influencing Health
Visual Aesthetics	■ Visual Aesthetics Study Plan	■ Visual Contrast / Character ■ Visibility ■ Visual Sensitivity
Archaeological and Cultural Heritage	■ Cultural Heritage Study Plan	■ Archaeological Sites and Resources ■ Built Heritage Resources and Cultural Heritage Landscapes

It should be noted that while there is not a consultation study plan, the Project has developed the *Consultation and Engagement Plan to Support the Environmental Assessment / Impact Statement* (AECOM 2020) (referred to as the Impact Statement [IS] / EA Consultation Plan).

2. Purpose and Objectives

The key objectives of conducting an IA / EA are to describe the existing environment, gather sufficient information to predict Project-related effects (positive and negative, direct and indirect) of the Project and alternatives on the environment, determine measures needed to avoid or minimize adverse Project effects, and enhance beneficial Project effects where feasible, and to undertake consultation and engagement throughout. The purpose of this Study Plan is to explain:

- A baseline[3] study methodology that will result in a comprehensive description of the existing environment potentially impacted by the Project;
- How efficient and transparent data management and analysis will be undertaken;
- Effects assessment scoping inputs specific to Surface Water that will allow for potential effects of the Project on the existing environment to be appropriately assessed in the IS / EA Report; and
- How the Study Plan aligns with federal and provincial requirements and guidance, including the Agency's Tailored Impact Statement Guidelines (TISG), dated February 24, 2020 (the Agency 2020c), for this Project and applicable provincial agency comments on the Draft Terms of Reference (ToR)[4].

As required by the IAA and referenced in TISG Section 7.3 (the Agency 2020c), work plans will also be developed for disciplines as required. It is anticipated the work plans will include further details on how to action the study plans; for example, they would contain such information as location of sampling sites, scheduling, and sequencing.

For the purposes of establishing appropriate context, the Study Plan begins with background and relevant information on:

- Study Plan related discussions with the Agency, the MECP and applicable agencies to date (**Section 3**);
- The approach to Project consultation and engagement (**Section 4**);
- How Indigenous Knowledge will be collected and used in the IA / EA (**Section 5**); and
- The spatial and temporal boundaries that will be used for the IA / EA (**Section 6**).

3. *Baseline refers to the current conditions of the environment potentially impacted by the Project. Baseline conditions serve as a reference against which changes due the Project are measured.*
4. *If necessary, the Study Plan will be updated to reflect the approved ToR if approval is obtained.*

2.1 Approach to Handling Confidential Information

2.1.1 Indigenous Knowledge

Permission from the Indigenous community will be sought before including Indigenous Knowledge in the IS / EA Report, regardless of the source of the Indigenous Knowledge. Sensitive and / or confidential information will be specifically collected through the Indigenous Knowledge Program to inform the IS / EA Report, and its use and publication will be governed by Indigenous community-specific Indigenous Knowledge Sharing Agreements. Sensitive and / or confidential information collected through Indigenous Knowledge Sharing Agreements will be protected from public or third-party disclosure and will be established between the Proponent and Indigenous communities participating in the Indigenous Knowledge Program prior to the sharing and use of any sensitive information. Instances where Indigenous Knowledge sharing has taken place during consultation activities (e.g., meetings) will be recorded in the Record of Consultation and Engagement, including where Indigenous Knowledge was incorporated into Project decisions and into the IS / EA Report (i.e., specifics will not be included in the Record of Consultation and Engagement given the potential sensitivity and / or confidentiality of the information shared).

3. Study Plan Technical Discussions

To facilitate the development of satisfactory study plans and eventually a satisfactory IS / EA Report, MFFN previously submitted draft study plans in an effort to hold technical discussions with the Agency, the MECP and applicable agencies. A summary of technical discussions and correspondence held to date on this Study Plan has been provided in **Table 3-1**.

Table 3-1: Study Plan Technical Review

Attendees / Responsible Party	Correspondence	Discussion Point	Solution
■ **The Agency**	■ Comments received following submission and review of draft Study Plan.	■ **23-July-2020:** Comments and clarification questions received, including editorial comments, additional information requirements regarding the Study Plan, assessment and desktop analysis.	■ Additional details and clarification are provided within this Study Plan and responses to these comments can be found in **Appendix B.**
■ **MECP**	■ Comments received following submission and review of draft Study Plan.	■ **23-July-2020:** Comments and clarification questions received, including editorial comments, additional information requirements regarding the Study Plan, assessment and desktop analysis.	■ Additional details and clarification are provided within this Study Plan and responses to these comments can be found in **Appendix B.**
■ **The Agency** ■ **MECP** ■ **Ministry of Energy, Northern Development and Mines** ■ **Environment and Climate Change Canada** ■ **Health Canada** ■ **Natural Resources Canada** ■ **Transport Canada** ■ **MFFN CAR Project Team**	■ Technical discussion of comments received following agency review of draft Study Plan.	■ **1-November-2020:** Comment and technical discussion pertaining to proposed deviations from the TISG, i.e., requesting that baseline water quality conditions be established using two years of monitoring data vs. the draft Study Plan proposing a single year of monitoring water quality over multiple seasons (fall of 2020 and the spring and summer of 2021) to be evaluated along with existing baseline water quality results from the Noront Cliffs project (obtained in 2011-2012), to define the characteristic range of natural variability in water quality conditions on an intra- and inter-annual basis.	■ The MFFN CAR Project Team will follow-up with Environment and Climate Change Canada following the future summer sampling round to share the complete raw dataset and determine if an additional year of sampling is required by Environment and Climate Change Canada to further define the range of natural variability in water quality conditions.

4. IS / EA Report Consultation and Engagement Process

4.1 Interested Persons and Government Agencies

The Proponent will provide Project notices and advise of opportunities for consultation and engagement with interested persons[5] which includes, at a minimum, members of the public outlined in the *Public Participation Plan for the Marten Falls Community Access Road Project Impact Assessment* (the Agency 2020) (referred to as the Public Participation Plan). This will include the opportunity to provide input on the existing environment, VCs, effects assessment methods, effects assessment results, and mitigation and follow-up program measures as applicable. A variety of activities will be offered so that members of the public are informed of the IS / EA Report as it progresses and are aware of the opportunities and means to provide their input. The study plans have recognized public and agency input received on the Project to date. Government agencies and interested persons will have the opportunity to comment on components of the study plans throughout the IS / EA Report consultation and engagement process. The Project's approach to handling confidential and sensitive information is outlined in **Section 2.1**.

4.2 Indigenous Communities

The Proponent will provide Project notices and opportunities for consultation and engagement with Indigenous communities identified in **Table 4-1**, which is inclusive of all Indigenous communities identified in the *Indigenous Partnership and Engagement Plan for the Marten Falls Community Access Road Project Impact Assessment* (the Agency 2020a) (referred to as the Indigenous Engagement and Partnership Plan).

Indigenous communities will be provided the opportunity to be involved at critical decision-making points throughout the IS / EA Report so that the Proponent can consider and incorporate, where appropriate Indigenous Knowledge and Indigenous land and resource use information into the Project as it pertains to the existing environment, VCs, effects assessment methods, effects assessment results, and mitigation and follow-up program measures. A variety of activities will be offered so that Indigenous communities are

5. *Interested persons, as defined in the IS / EA Consultation Plan, are individuals and groups (e.g., associations, non-governmental organizations, industry and academia) who could have an interest in the Project, including but not limited to communities in the region, those with commercial interests (e.g., forestry, trappers, outfitters, other mineral tenure holders in the area) and recreational users or those with recreational interest (e.g., campers, hunters and environmental groups).*

informed of the IS / EA Report as it progresses and are aware of the opportunities, means and timelines to provide their input. The study plans have recognized Indigenous community input received on the Project to date. Indigenous communities will have the opportunity to comment on components of the study plans throughout the IS / EA Report consultation and engagement process.

Table 4-1: Identified Neighbouring Indigenous Communities, including their Provincial Territorial Organizations and / or Tribal Council Affiliations

Tribal Council Affiliation	Indigenous Community or Organization
Matawa First Nations Management *(Nishnawbe Aski Nation)*	■ **Marten Falls First Nation** (Proponent and potentially affected Indigenous community) ■ Aroland First Nation ■ Constance Lake First Nation ■ Eabametoong First Nation ■ Ginoogaming First Nation ■ Neskantaga First Nation ■ Nibinamik First Nation ■ Webequie First Nation
Matawa First Nations Management and the Union of Ontario Indians / Nishnawbe Aski Nation	■ Long Lake #58 First Nation**
Mushkegowuk Council *(Nishnawbe Aski Nation)*	■ Attawapiskat First Nation ■ Fort Albany First Nation ■ Kashechewan First Nation
Shibogama First Nations Council *(Nishnawbe Aski Nation)*	■ Kasabonika Lake First Nation ■ Kingfisher Lake First Nation ■ Wapekeka First Nation ■ Wawakapewin First Nation ■ Wunnumin Lake First Nation
Independent First Nations Alliance *(Nishnawbe Aski Nation)*	■ Kitchenuhmaykoosib Inninuwug First Nation
Independent First Nations *(Nishnawbe Aski Nation)*	■ Mishkeegogamang First Nation ■ Weenusk First Nation
Nokiiwin Tribal Council	■ Animbiigoo Zaagi'igan Anishinaabek First Nation*
Métis Nation of Ontario	■ Métis Nation of Ontario; Region 2*
Independent Métis Nation	■ Red Sky Independent Métis Nation*

*Notes: * Indigenous communities or organizations identified by the MECP who should be consulted on the basis that they may be interested in the Community Access Road.*
*** The MECP indicated in a letter to MFFN that Long Lake #58 First Nation was moved from interest-based to rights-based.*

4.3 Consideration of Identity and Gender-Based Analysis Plus in Engagement

To fulfill requirements of the IAA, the Consultation and Engagement Program will consider a diverse range of perspectives from interested persons and interested Indigenous communities and their members identified in the Agency's Indigenous Engagement and Partnership Plan and the Public Participation Plan. This will include at a minimum providing ongoing opportunities for engagement to:

- **Neighbouring Indigenous communities, including relevant subpopulations:**
  - Women;
  - Youth; and
  - Elders.
- **Non-Indigenous communities including:**
  - Women;
  - Youth; and
  - Activity-based subgroups (e.g., recreationalists, snowmobilers, tourism establishment operators).

The Proponent will also consult and engage with other subpopulations identified by communities during consultation and engagement. The information from these activities and any additional identity groups identified by communities through consultation and engagement will be considered by applicable environmental disciplines for the purposes of data collection and considering disproportionate effects.

During consultation and engagement, these aforementioned groups will be consulted and engaged with on targeted input**.** Specialized knowledge will be gathered through other disciplines such as Social, Economic, Land and Resource Use and Aboriginal and Treaty Rights and Interests. The socio-economic Data Collection Program is expected to include targeted interviews, focus groups, questionnaires and other niche tools to gather information from diverse populations to resolve gaps in socio-economic secondary data. These diverse populations include the aforementioned identity groups, which are also referenced in the IS / EA Consultation Plan, and those identified by communities during consultation and engagement. The importance of soliciting inputs and perspectives from diverse subgroups has also been factored into the Indigenous Knowledge Program and associated materials (see **Section 5**).

When feedback is received from interested persons and Indigenous communities, issues, comments and questions will be tracked, which is consistent with the process described in the IS / EA Consultation Plan.

Specific to Gender-Based Analysis Plus objectives, this will include efforts to engage with diverse populations. It is expected this will include activities specific to subgroups and tabulation of consultation and engagement participation with respect to identity factors. This will provide summary statistics to demonstrate the diversity achieved in consultation and engagement.

5. Consideration of Indigenous Knowledge in the IS / EA Report

The following provides a general description of how Indigenous Knowledge will be considered in the IA / EA process. The extent to which Indigenous Knowledge is considered by each specific VC will vary depending on the nature of the VC, the potential for Project effects on the VC and whether Indigenous knowledge that relates to a VC is provided / obtained. As such, not all aspects of the general approach described below may apply to all VCs / study plans.

There are two concurrent and complementary avenues for Indigenous communities and groups to be engaged with and provide input on the Project: the Indigenous Knowledge Program and the Consultation and Engagement Program. Both programs serve to support the collection of Indigenous perspectives, values, and input on the Project, including Aboriginal and Treaty Rights and how they may be impacted by the Project, to be integrated throughout the IA / EA process. However, the Indigenous Knowledge Program specifically aims to solicit and incorporate information that is considered sensitive and may have confidentiality requirements, including Indigenous Knowledge and information on Indigenous land and resource use. Indigenous Knowledge Sharing Agreements will be established between the Proponent and Indigenous communities participating in the Indigenous Knowledge Program prior to the sharing and use of any sensitive information.

All Indigenous communities and groups identified by the MECP and the Agency through the Indigenous Engagement and Partnership Plan have the opportunity to participate in the Indigenous Knowledge Program. The Indigenous Knowledge Program provides interested Indigenous communities an opportunity to: share existing Indigenous Knowledge and information on Indigenous land and resource use and cultural values that may be relevant to the Project, and / or complete Project-specific studies to collect and share Indigenous Knowledge and information on Indigenous land and resource use and cultural values. The Indigenous Knowledge Program includes opportunities for Indigenous communities and groups to meet with the Proponent to discuss the program, ask questions, and share concerns and interests. In support of this, the Proponent has created an Indigenous Knowledge Program Guidance Document (the Guidance Document) that provides:

- An overview of the Indigenous Knowledge Program and information on how Indigenous Knowledge, Indigenous land and resource use, and cultural values and practices can be collected and / or shared;

- Information on how Indigenous Knowledge and information on Indigenous land and resource use and cultural values and practices may be used in the planning and design processes; and
- A suite of guidance materials that were developed based on the information requirements of both the federal and provincial assessment processes, including: question guides to support the collection of information on historical and current community context; Indigenous Knowledge that may be relevant to the various technical disciplines; information on Indigenous land and resource use, cultural values and practices and associated spatial data, and perspective on potential Project-related effects and associated mitigation and / or enhancement measures.

The Guidance Document will also support participating Indigenous communities in providing Project-specific information in a manner that facilitates meaningful incorporation into the IS / EA Report.

The IS / EA Consultation Plan outlines the process for obtaining information and feedback about the Project from Indigenous communities (i.e., the Consultation and Engagement Program). All Indigenous communities identified by the MECP and the Agency have the opportunity to participate in the Consultation and Engagement Program through community-specific meetings, Public Information Centres, web conferences, and other formats. All Indigenous communities identified by the MECP and the Agency will be provided information related to the Project and invited to participate at various points throughout the IA / EA process.

There are also opportunities for the MFFN CAR Project Consultant Team to engage with Indigenous communities to solicit perspectives and information relevant to the Project, including information related to collection of existing information and the development of the IS / EA Report. The Proponent also invites feedback and inputs throughout the Project via the Project website and ongoing communications with the Proponent.

The Indigenous Knowledge and Consultation and Engagement programs are designed to be complementary and provide multiple opportunities for communities to offer feedback and information, including perspectives on Aboriginal and Treaty Rights and interests and how these may be impacted by the proposed Project. Relevant information collected through both the Indigenous Knowledge and Consultation and Engagement programs, including potential effect pathways on Aboriginal and Treaty Rights and interests, will be shared with each of the relevant disciplines throughout the IA / EA to: guide and inform VCs; support characterization of the existing environment; identify the potential effects of the Project on VCs; help identify mitigation measures and potential monitoring programs; and ultimately guide Project planning. The nature of how the Indigenous Knowledge becomes integrated into the IS / EA Report will be dictated by the specific information provided by each Indigenous community and the parameters set out in

the Indigenous Knowledge Sharing Agreements. A description of how Indigenous Knowledge was considered in the IA / EA and in each of the technical discipline areas will be included in the IS / EA Report.

It is also important to note that information collected through the various activities (e.g., field studies and programs, effects assessments) of each discipline area (e.g., wildlife, vegetation, cultural heritage) will be shared with the Indigenous Knowledge Program leads. This will support the establishment of the existing environment and the effects assessment for the Aboriginal and Treaty Rights and Interests environmental discipline, as well as the identification of potential mitigation measures and monitoring programs, given the interrelated nature of Indigenous peoples and other environmental disciplines.

The Proponent will strive to respectfully collaborate with Indigenous communities on how Indigenous Knowledge and information on Indigenous land and resource use and cultural values will become part of the IS / EA Report, and how potential effects to Aboriginal and Treaty Rights and interests will be assessed. It is expected that measures to support this may include but are not limited to: engaging Indigenous communities to solicit information on Indigenous Knowledge and Indigenous land and resource use and cultural values to inform baseline conditions; providing Indigenous communities with draft sections of the IS / EA Report to illustrate how Indigenous Knowledge and information on Indigenous land and resource use and cultural values has been integrated and to confirm it has been presented appropriately, and completing collaborative working sessions with Indigenous communities for the effects assessment on Aboriginal and Treaty Rights and Interests. Further information on how potential effects on Indigenous rights will be assessed is provided in the Aboriginal and Treaty Rights and Interests Study Plan.

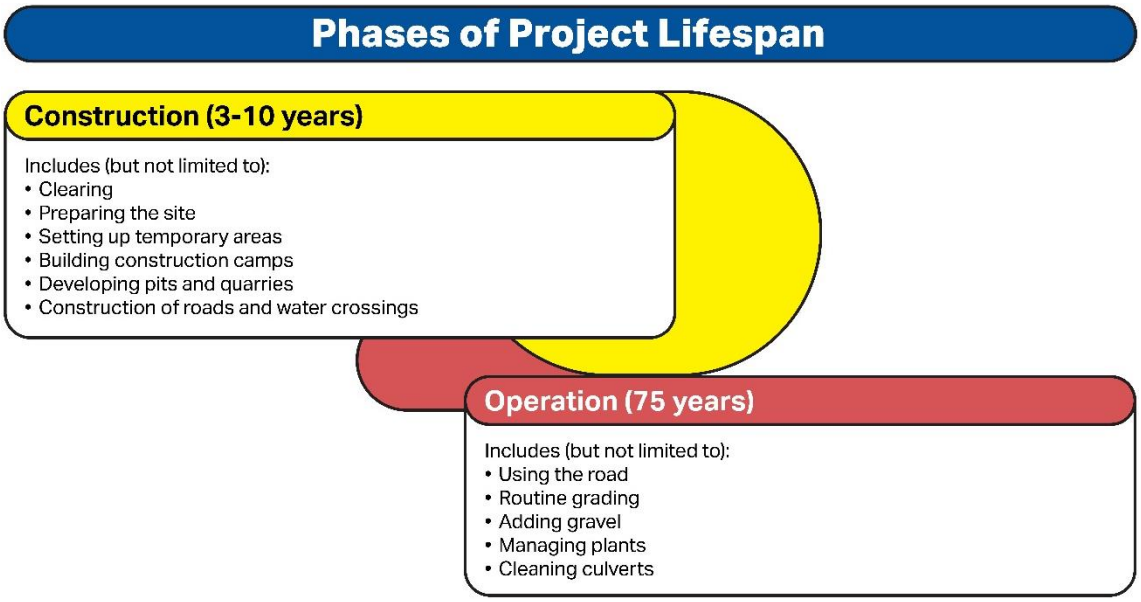
6. Assessment Boundaries

6.1 Temporal Boundaries: Project Phases

Project phases, which are temporal boundaries, are developed to establish the timeframes within which potential effects of the Project will be considered in the IS / EA Report. The Project is planned to occur in two phases, which are briefly described below and shown in **Figure 6-1**.

- **Construction Phase:**
  The time from start of construction, including site preparation activities, to the start of operations and maintenance of the CAR. Decommissioning of construction works is included in the construction phase. The construction phase is anticipated to take approximately 3 to 10 years to complete.
- **Operations and Maintenance Phase:**
  The operations and maintenance phase starts once construction activities are complete and lasts for the life of the Project. The operations and maintenance phase of the Project is considered to be 75 years based on the expected timeline for when major refurbishment of road components (e.g., bridges), is anticipated.

Figure 6-1: Project Schedule



There are currently no plans to decommission the CAR as there is no expected / known end date for its need. Therefore, future suspension, decommissioning and eventual abandonment of the CAR will not be considered in the IS / EA Report. It will be considered if and when a decommissioning or abandonment application is made for the road.

In determining the temporal boundaries, in particular the long operations and maintenance phase, consideration was given to the long-term effects on the well-being of present and future generations (Sustainability Principle #2[6]). The final temporal boundaries to be used in the IS / EA Report will be based on regulatory agency guidance, professional judgement and input received through the Project consultation process.

6.2 Spatial Boundaries: Study Areas

6.2.1 General Information

Study areas identify the geographic extents within which potential effects of the Project are likely to occur and will be considered in the IS / EA Report. The existing conditions and potential effects are documented for three study areas selected for the Project:

- **Project Development Area (PDA):** area of direct disturbance;
- **Local Study Area (LSA):** the area where most of the direct effects of the Project are likely to occur; and
- **Regional Study Area (RSA):** the area where indirect effects of the Project are likely to occur.

The PDA encompasses the 100 metre-wide CAR right-of-way (ROW), temporary construction access roads, work areas, worker camps, and pits, quarries and associated access roads. The preliminary LSA currently being considered within the scope of the ongoing provincial regulatory review process generally includes the area within 2.5 km of the centreline of Alternative 1 and Alternative 4. The preliminary study area generally allows for the documentation of existing conditions and prediction of potential environmental effects for the Project. A 5 km wide study area also allows for route refinements during development of Project design (e.g., adjustment of the alignment to avoid sensitive features).

6. *Sustainability Principles #2 is one of four sustainability principles included in Section 25 of the Project's TISG as further elaborated on Section 9.7.*

The specific location of Project components, including the roadway, quarries, pits and temporary infrastructure, are not yet known and will be included in the IS / EA Report. While most of the Project components are expected to be located within the preliminary 5 km wide study area, benefits (e.g., reduced environmental disturbance, avoidance of sensitive features, technical considerations, concerns received through consultation) for locating Project components on lands outside of the 5 km wide study area may become known during the IA / EA process. If the need to locate Project components outside the 5 km wide study area is determined to be required or of benefit to the Project, the study area would be adjusted.

The study area for each environmental discipline may vary from the above-described general study area based on the potential for the Project to directly or indirectly affect each environmental discipline; therefore, discipline-specific LSAs and RSAs have been defined for the Project. In defining the final LSAs and RSAs, each environmental discipline will consider:

- Location and other characteristics of the environmental discipline relative to the Project;
- The anticipated extent of the potential Project effects;
- Federal, provincial, regional, and local government administrative boundaries;
- Indigenous groups listed in **Table 4-1**;
- Community knowledge and Indigenous Knowledge;
- Current or traditional land and resource use by Indigenous communities;
- Exercise of Aboriginal and Treaty Rights of Indigenous peoples, including cultural and spiritual practices; and
- Physical, ecological, technical, social, health, economic and cultural considerations.

The study areas included in this document are preliminary, covering the extent to which readily available information suggests the Project may have noticeable effects on the environment. The size, nature and location of past, present and reasonably foreseeable projects will be taken into consideration in the development of the cumulative effects assessment study area(s). The appropriate study area(s) to assess cumulative effects are dependent on the VCs predicted to have direct residual adverse effects as a result of the Project, and therefore, cannot be defined until the IS / EA Report has sufficiently advanced.

As further detailed in **Section 4**, the Proponent will continue to provide opportunities for neighbouring Indigenous communities and interested persons to provide input and inform the effects assessment, including the LSAs and RSAs.

6.2.2 Surface Water Study Areas

The LSA and RSA boundaries for Surface Water are detailed in **Table 6-1** and shown on **Figure 6-2**.

Table 6-1: Surface Water Study Areas

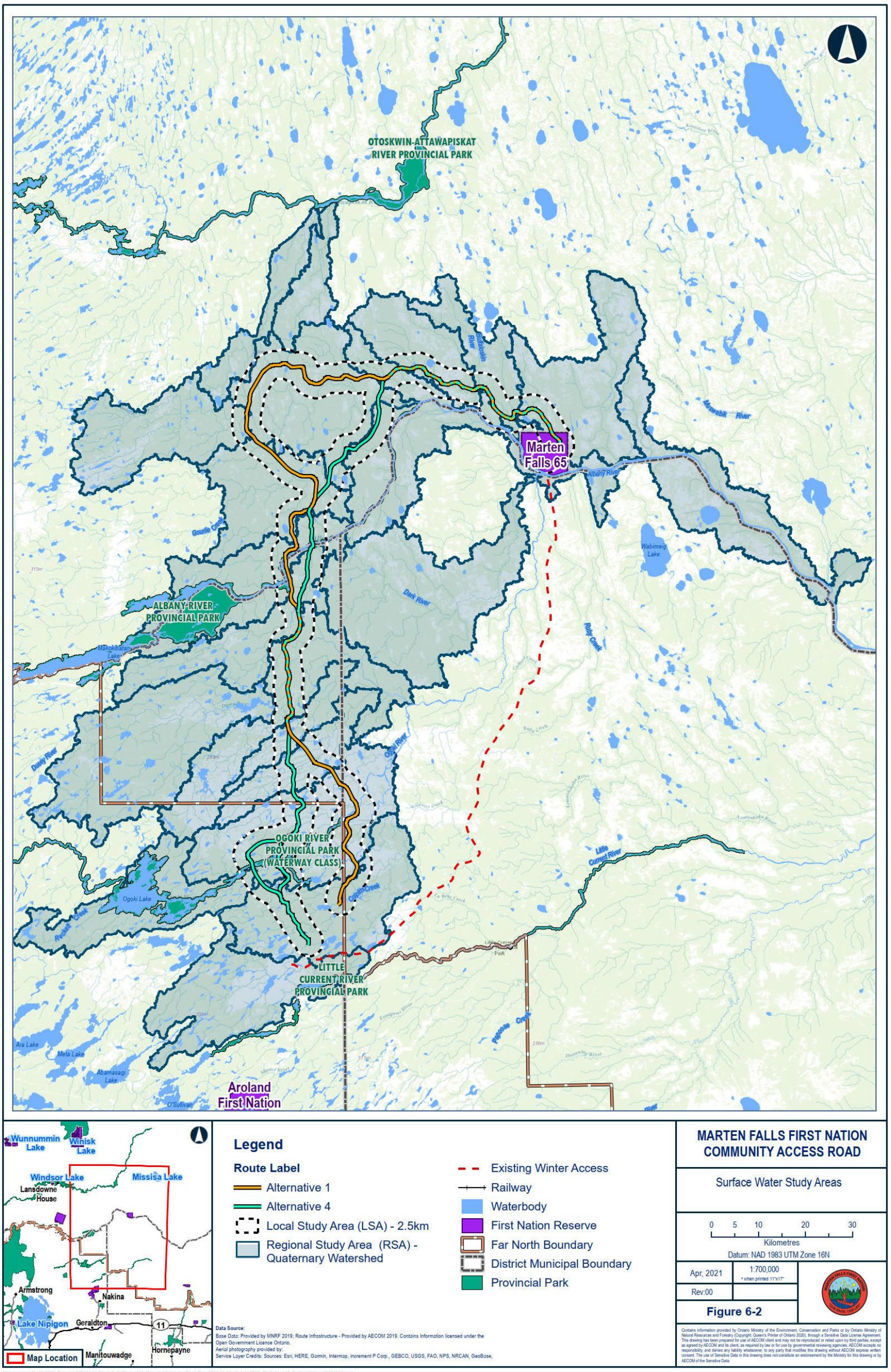
Study Area	Geographic Extent	Rationale
Local Study Area	■ 2.5 km buffer surrounding the PDA ■ May be refined following desktop analysis and input from other VCs that may indirectly affect Surface Water	■ To consider areas outside of the PDA where direct or indirect Project effects on surface water can occur (e.g., erosion and sedimentation, spills, leaching or deposition of blasting residue) ■ To account for potential shifts in route alignment or positioning of temporary infrastructure ■ To encompass the LSAs of other VCs that may affect surface water
Regional Study Area	■ Quaternary watersheds crossed by the LSA ■ May be refined following desktop analysis and input from other VCs that may indirectly affect Surface Water	■ To consider potential regional-scale Project effects to surface water outside of the PDA and LSA, accounting for hydrological connectivity at the Quaternary subwatershed scale ■ To encompass areas of the LSAs of other VCs that may affect surface water

The LSA for Surface Water is consistent with the general LSA considered for the Project that generally includes the area within 2.5 km of the PDAs of Alternative 1 and Alternative 4, but is expanded to include a 2.5 km buffer around temporary infrastructure (e.g., pits and quarries, work camps). The buffer will account for waterbodies where direct interaction with Project components are not proposed, but where there is the potential for off-site direct or indirect Project effects that are measurable. The LSA for Surface Water encompasses the LSA for the other VCs that may affect surface water (see **Section 9.3**).

The RSA for Surface Water encompasses 21 quaternary watersheds crossed by the LSA. This area includes the area where surface water could potentially be affected by Project effects within the PDA and LSA as water flows downstream, and by regional indirect Project effects (e.g., potential regional-scale changes in groundwater-surface water interactions, changes to wetlands and peatland that could affect surface water, air quality changes resulting in long-distance transport and deposition of pollutants; see **Section 9.3**).

The boundaries of the LSA and RSA will be confirmed and refined based on findings of the Baseline Study to consider flows in rivers and dilution and assimilation in water bodies, as well as the potential extent of Project effects on other VCs that may indirectly affect Surface Water, as may be required for the Effects Assessment (**Section 9**).

Figure 6-2: Surface Water Local and Regional Study Areas



7. Baseline Study Design

7.1 Desktop Assessment

A desktop review of existing information will be completed to support the baseline characterization of surface water conditions and identify information gaps that will need to be addressed through further study. A preliminary list of applicable information sources is included in **Appendix A** and reflects federal and provincial guidance received to date. The information will include extensive field records that were obtained from the Cliffs Chromite Project Environmental Assessment project in 2011-2012 (Golder 2014), publicly available sources, new high resolution imagery for the study area (i.e., LiDAR that was flown for the Project in the spring of 2019), and the results of an aerial reconnaissance survey completed in September 2019 along the full extent of the route alternatives. Based on a preliminary review of the 2019 LiDAR and field reconnaissance surveys, the Project route alternatives cross approximately 100 to 120 waterbodies (i.e., approximately 50 to 60 waterbodies per alternative).

The desktop review will include descriptions of the data sources, data collection, sampling, survey and research protocols and methods for the existing relevant information sources as they relate to baseline conditions of surface water. The desktop analyses will also involve the delineation of watersheds for each of the relevant water body crossing locations. These watershed areas will be delineated using GIS mapping with available contour and digital elevation model information.

Potable surface water sources within the local and regional study areas will be identified and characterized as part of the background review for the surface water component (including a description of their current use, potential for future use, and whether their consumption has Indigenous cultural importance), with the understanding that Project-related effects on potable surface water sources will be assessed as part of the Human Health and Community Safety VC. Identification and characterization of springs is included in the assessment for the Groundwater VC.

This Study Plan focuses on the additional studies that are anticipated to be required to gather information beyond what is currently available through existing information sources including those as described in Section 7.2 ‘Sources of baseline information’ in the Agency’s TISG for this Project (the Agency 2020c). However, all relevant sources of information will be reviewed and data will be compiled and analyzed to develop the baseline characterization for the Surface Water VC.

7.2 Field Monitoring Activities

Field surveys will be completed at select waterbody crossings along the Project route to further define the characteristic surface water conditions in the LSA and RSA. This will include assessments of surface water quantity (e.g., flows, drainage patterns, channel morphology, hydraulics) and surface water and sediment quality. The results of the field surveys will be combined with the associated results from the desktop assessment to support the baseline characterization of the surface water environment.

7.2.1 Site Selection and Multi-Season Field Campaigns

The sites for field monitoring will be selected based on the findings of the desktop assessment, including the results of the aerial survey and the reconnaissance survey. Further to this, site selection will be informed by the preliminary waterbody crossing list (to be developed as part of the desktop analysis).

The site selection process will be based primarily on a 'scaled approach', with the objective of selecting a representative number of waterbody crossings under different categories of watershed size (i.e., four categories for watersheds: greater than 500 km^2, between 50 and 500 km^2, between 2 and 50 km^2, and less than 2 km^2). The selection of sites will also consider:

- mapped and unmapped waterbody crossing locations;
- locations previously surveyed for the Noront Cliffs Project (i.e., sections of the route alternatives that overlap with the alignment of the Noront Cliffs Project route;
- distribution along the length of Alternative 1 and Alternative 4;
- distribution among the quaternary watersheds crossed by the PDA to the extent possible / practical;
- different types of waterbodies, ranging from large rivers (e.g., Albany River, Ogoki River) to small wadable streams;
- important features such as fish and fish habitat, areas of groundwater and surface water interactions, and areas of Indigenous cultural importance for consumption; and
- access (e.g., safety, suitability for aircraft landing, ice cover).

Future field monitoring is anticipated to be completed at 35% to 40% of the waterbody crossings identified during the desktop assessment. This ratio of crossing locations aligns with recent planning experience and regulator feedback on other EAs in northwestern Ontario. It also considers that the site-specific data would be used, to the extent possible, to extrapolate results from surveyed locations to non-surveyed sites. It is understood that, for permitting purposes, site-specific ground-based surveys will be required at all waterbody crossings where work

is anticipated to occur below the highwater mark during construction. Ultimately, the approach to the field data collection program for surface water has been tailored to the objectives of each stage of the Project. Ground-based field information will be initially obtained at a subset of waterbody crossings to advance the alternatives assessment and the EA, recognizing that data obtained from this subset of crossing locations over multiple seasons and years is expected to be more than sufficient to characterize baseline conditions and complete the effects assessment. Upon selection of a preferred alternative, supplemental surveys will be conducted at waterbody crossing locations that were not surveyed as part of the EA to support the preparation and submission of permit applications, where required. To this end, every waterbody crossing location where work is to occur below the highwater mark, will have site-specific ground-based surveys completed, either as part of initial investigations in support of the EA or during the supplemental surveys.

Waterbody crossings will be sampled and monitored in the spring and summer to characterize the seasonal patterns in flow and water quality, with the understanding that the spring field survey will be targeted during a period of high flow, while the summer field survey will be timed with a period of low flow. The existing field survey results from 2019 and 2020 (i.e., field data from 11 waterbody crossing locations in the summer of 2019 and 30 waterbody crossing locations in the fall of 2020), coupled with the previous field monitoring records from the Cliffs Chromite Project, will be relied on to further define the characteristic variability in surface water quantity and quality conditions.

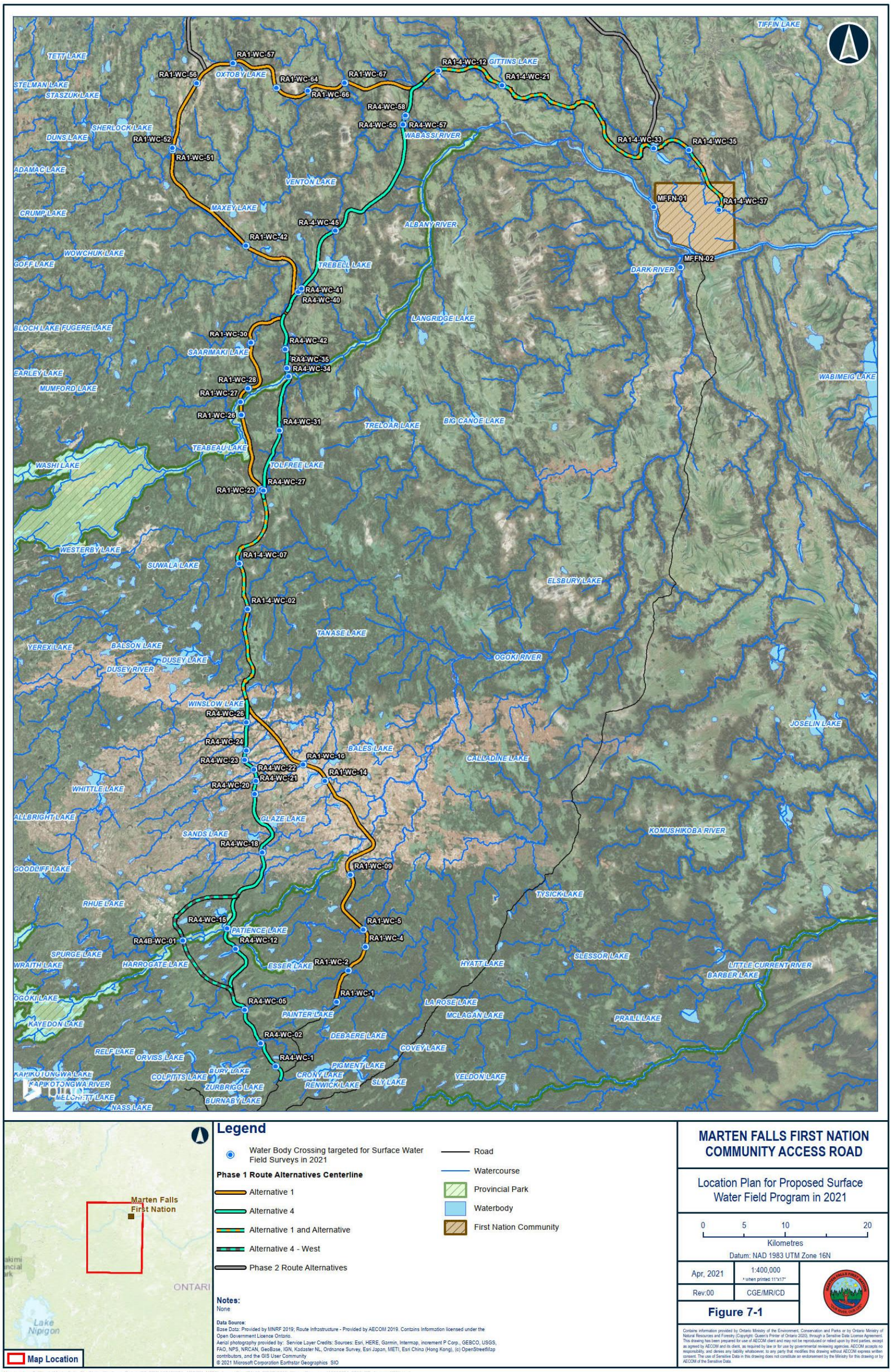
Proposed locations for surface water field surveys and monitoring are listed in **Table 7-1** and illustrated on **Figure 7-1**.

Table 7-1: List of Surface Water Field Monitoring Locations

Water Body Crossings Targeted for Future Surface Water Field Surveys	Waterbody Name	Route	UTM Zone 16U		Mapped or Unmapped Water Body	Category of Water Body Size (Small, Medium, or Large)	Surveyed by Cliff's Team (Yes or No (-))
			Easting	Northing			
RA1-WC-1	-	Alternative-1	530917	5629153	Mapped	S	-
RA1-WC-2	-	Alternative-1	532382	5632976	Mapped	S	-
RA1-WC-4	-	Alternative-1	534432	5635846	Unmapped	S	-
RA1-WC-5	Ogoki River	Alternative-1	534174	5637961	Mapped	L	-
RA1-WC-09	-	Alternative-1	532606	5644605	Mapped	S	-
RA1-WC-14	-	Alternative-1	529515	5656013	Mapped	S	-
RA1-WC-16	-	Alternative-1	526864	5658007	Mapped	M	-
RA1-WC-23	Albany River	Alternative-1	521732	5691515	Mapped	S	Y
RA1-WC-26	-	Alternative-1	519376	5700621	Mapped	S	-
RA1-WC-27	-	Alternative-1	519244	5702193	Unmapped	L	Y
RA1-WC-28	-	Alternative-1	520172	5703819	Unmapped	S	-
RA1-WC-30	-	Alternative-1	520534	5709379	Mapped	S	-
RA1-WC-42	-	Alternative-1	519909	5721171	Mapped	S	-
RA1-WC-51	Wabassi River	Alternative-1	510970	5732829	Unmapped	L	Y

Water Body Crossings Targeted for Future Surface Water Field Surveys	Waterbody Name	Route	UTM Zone 16U		Mapped or Unmapped Water Body	Category of Water Body Size (Small, Medium, or Large)	Surveyed by Cliff's Team (Yes or No (-))
			Easting	Northing			
RA1-WC-52	-	Alternative-1	510968	5733080	Unmapped	M	-
RA1-WC-56	-	Alternative-1	513924	5740981	Unmapped	S	-
RA1-WC-57	-	Alternative-1	518320	5743418	Mapped	M	-
RA1-WC-64	-	Alternative-1	523623	5740411	Unmapped	S	-
RA1-WC-66	-	Alternative-1	527414	5740047	Mapped	M	-
RA1-WC-67	-	Alternative-1	531917	5741009	Unmapped	S	-
RA4-WC-1	-	Alternative-4	523540	5621345	Unmapped	S	-
RA4B-WC-01	Ogoki River	Alternative-4	512247	5636612	Mapped	L	-
RA4-WC-02	Colpitts Creek	Alternative-4	521688	5624119	Mapped	L	Y
RA4-WC-05	-	Alternative-4	519747	5628176	Mapped	L	Y
RA4-WC-12	-	Alternative-4	518647	5635591	Mapped	M	Y
RA4-WC-15	Patience Lake	Alternative-4	517655	5638092	Mapped	L	Y
RA4-WC-18	-	Alternative-4	521894	5647392	Mapped	M	Y
RA4-WC-20	-	Alternative-4	520992	5654446	Unmapped	M	Y
RA4-WC-21	-	Alternative-4	521131	5656047	Unmapped	M	Y
RA4-WC-22	-	Alternative-4	520890	5657391	Mapped	L	Y
RA4-WC-23	-	Alternative-4	519751	5658577	Unmapped	M	Y
RA4-WC-24	-	Alternative-4	519967	5659797	Unmapped	S	Y
RA4-WC-26	-	Alternative-4	519974	5663183	Mapped	L	Y
RA4-WC-27	-	Alternative-4	522053	5691380	Mapped	L	-
RA4-WC-31	-	Alternative-4	523972	5698738	Mapped	S	-
RA4-WC-34	Albany River	Alternative-4	525100	5705282	Mapped	L	-
RA4-WC-35	-	Alternative-4	524911	5706281	Unmapped	S	-
RA4-WC-37	-	Alternative-4	524696	5708582	Unmapped	M	-
RA4-WC-40	-	Alternative-4	526271	5715544	Unmapped	S	-
RA4-WC-41	Gourlie Creek	Alternative-4	526664	5715962	Mapped	L	-
RA4-WC-42	-	Alternative-4	526664	5708581	Mapped	M	-
RA-4-WC-45	-	Alternative-4	530801	5722972	Mapped	S	-
RA4-WC-55	Wabassi River	Alternative-4	539004	5735928	Mapped	L	-
RA4-WC-57	-	Alternative-4	539258	5736888	Unmapped	S	-
RA4-WC-58	-	Alternative-4	539324	5737051	Mapped	M	-
RA1-4-WC-02	Dusey River	Alternative-1-and-Alternative-4	520105	5676979	Mapped	L	Y
RA1-4-WC-07	-	Alternative-1-and-Alternative-4	519091	5682476	Mapped	L	Y
RA1-4-WC-12	-	Alternative-1-and-Alternative-4	543279	5742500	Unmapped	S	-
RA1-4-WC-21	-	Alternative-1-and-Alternative-4	551025	5740733	Unmapped	M	-
RA1-4-WC-33	-	Alternative-1-and-Alternative-4	569502	5733028	Mapped	S	-
RA1-4-WC-35	-	Alternative-1-and-Alternative-4	573750	5732816	Mapped	S	-
RA1-4-WC-37	-	Alternative-1-and-Alternative-4	577418	5725568	Mapped	S	-
MFFN-01	Albany River	N/A	569470	5725937	Mapped	L	-
MFFN-02	Ogoki River	N/A	572725	5718562	Mapped	L	-

Figure 7-1: Surface Water Field Monitoring Locations



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7.2.2 Surface Water Quantity

The planned field surveys at the select waterbody crossing locations will include the following tasks to assess surface water quantity conditions, with the understanding that the assessments will be completed along a 100 m stretch of the waterbody (i.e., 50 m upstream and downstream of the crossing location):

- **General Waterbody Conditions and Channel Morphology** – A walkover will be completed along the full length of the study section to broadly define channel and flow characteristics. Visual inspections will be completed in the vicinity of the proposed crossing location to assess and document the characteristic bed and bank morphology including any erosion / deposition features, channel substrate, and riparian vegetation. The conditions at the water body will be documented every 25 m in photographs looking upstream and downstream with full view of the channel and the surrounding floodplain.
- **Channel Stability** – A Rapid Geomorphic Assessment will be completed at the channel site in accordance with the Ministry of Environment (MOE 2003) to provide a preliminary assessment of channel stability based on the presence or absence of various indicators of channel degradation, aggradation, widening, and planform adjustment. Instances of channel instability will be documented via photographs and field notes.
- **Channel Geometry** – Basic measurements of channel geometry will be taken at the proposed crossing, 50 m upstream of the crossing, and 50 m downstream of the crossing. The measurements will include estimates of bankfull width and depth, wetted width and depth, and side and channel slopes.
- **Instantaneous Streamflow** – Instantaneous streamflow will be estimated at a single cross-section of the waterbody in the vicinity of the crossing location using the velocity-area method. A tape measure will be extended across the length of the cross-section and streamflow velocities and corresponding water depths will be measured at discrete intervals along the cross-section using an electromagnetic or impeller flow meter and a wading rod. The intervals will be spaced to allow for approximately 20 water current velocity and depth readings with a minimal interval width of 0.1 m. Current velocities will be measured at 60% of the total water depth for water depths less than 0.50 m and at 20% and 80% of the total water depth for water depths greater than 0.50 m.
- **Basic Channel Topography and Bathymetry** – A basic topographic channel survey will be completed to provide data for coarse level hydraulic calculations at the planned crossing structures, as well as to define bathymetric conditions at the larger waterbody crossings that have

been targeted for bridge installations. Survey measurements will be taken using Real Time Kinematic level survey equipment and tied to a local benchmark installed and marked in the vicinity of the waterbody crossing location. The survey will target the proposed crossing location and include a few bed elevation shots at locations upstream and downstream of the crossing to define the characteristic channel slope and significant controls. Elevations within the channel will be surveyed at intervals of approximately 0.25 m to 0.5 m extending from the top of bank on each side of the stream. A higher level of detail (i.e., intervals of 0.25 m or less) will be used where bed or bank topography is noticeably more variable. Elevations within the channel will also be collected for the edge of water on each side of the water body. Elevations at the floodplain will be surveyed at intervals of approximately 5 m to 10 m. Prominent topographic high points along the length of the channel (e.g., riffles, beaver dam, existing crossing structures) will also be surveyed.

7.2.3 Surface Water and Sediment Quality

Surface water and sediment quality monitoring will be conducted to support baseline characterization and the assessment of potential Project effects on surface water quality.

The surface water quality monitoring will include field measurements of physicochemical parameters (i.e., temperature, pH, electrical conductivity, dissolved oxygen, turbidity) and the collection of surface water grab samples for laboratory analysis of relevant constituents identified in the TISG including pH, electrical conductivity, turbidity, alkalinity, hardness, total suspended solids, cations (H^+, Mg^{2+}, Na^+, Ca^{2+}, K^+, NH_4^+, CH_3Hg^+), anions (Cl^-, SO_4^{2-}, F^-, NO_3^-, HCO_3^-, CO_3^{2-}, PO_4^{3-}), total metals, oil and grease, nutrients (total phosphorus, total Kjeldahl nitrogen), and total and dissolved organic carbon (the Agency 2020c). Dissolved metals will not be included in the parameter list as total metals are used for direct assessment against water quality guidelines. Organic contaminants (i.e., volatile organic contaminants and poly-aromatic hydrocarbons) and radionuclides will be added to the parameter list at a limited set of waterbody crossing locations that are identified as an existing source of potable water as concentrations of these parameters are expected to be generally low in the subject environment. Monitoring parameters may be added or removed from the parameter list over the program based on a review of data (e.g., to remove parameters that are consistently below detection limits).

The sediment quality sampling will involve the collection of triplicate sediment samples for laboratory analysis of grain size, total metals and nutrients (total organic carbon, total phosphorus, total Kjeldahl nitrogen) on a single sampling event (in the spring or the summer). Seasonal or multi-year sampling for sediments is not proposed as sediment quality conditions are unlikely to change significantly over short timescales.

Field monitoring protocols will follow the Protocols Manual for Water Quality Sampling in Canada (Canadian Council of the Ministers of the Environment 2011) and the sample collection methods will be adjusted on a site-specific basis to consider the characteristics of the water body being sampled and to help ensure safety of the sampling crew. Wadable streams and ponds will be sampled by wading into the stream or pond, or by using an extension rod to sample from shore. Non-wadable rivers and lakes may be sampled by boat / watercraft. The sampling location within the waterbodies will be located as near to the centreline of the crossing as possible, provided that it is safe to do so. For larger rivers that require substantial water crossings, additional locations may be sampled along the width of the river to account for spatial variability.

The results from the three field campaigns are expected to provide a means of characterizing the baseline water quality and quantity parameters over varying climatic conditions to define the range of natural variability on a seasonal basis. It is anticipated that the Noront Cliffs data from 2011-2012 will help to further define the range of natural variability in surface water quantity and quality between seasons and years given that the Noront Cliffs project occurred in a similar geographic context as this Project.

7.2.4 Desktop Analyses for Hydrology

A desktop assessment will be completed for surface water quantity aspects of the baseline study. This desktop assessment will be used to define typical freeze / thaw cycles, ice cover, and ice conditions for the waterbody crossing locations, as well as to determine the characteristic climate conditions on a watershed basis. The desktop efforts will also be used to advance additional hydrologic and hydraulic analyses to support the environmental effects assessment and preliminary design for the Project. These hydrologic and hydraulic analyses are outlined in **Section 8.2**.

8. Data Management and Analysis

8.1 Data Management

Data management including quality assurance / quality control (QA / QC) will be employed to minimize potential for data entry and analysis errors, prepare data sets for analysis and limit sensitive data distribution in accordance to established agreements.

QC procedures will adhere to recommendations of CCME (2011) for sample collection. For surface water quality, QC samples will be collected to include travel blanks, field blanks and duplicate samples. For sediment quality, QC samples will be collected to include duplicate samples only. The total number of QC samples will represent a minimum of 10% of the total samples collected during the program. The QC samples will be submitted “blind” to the laboratory for analysis of the full suite of water quality parameters being analyzed for the program.

Water and sediment samples will be analyzed at a Canadian Association for Laboratory Accreditation certified laboratory, where possible, and using the lowest feasible method detection limit.

A standard spreadsheet software package, such as MS-Excel, will be used to manage and analyze surface water data collected for the Project. Field sheets and laboratory-issued data files including Laboratory Certificates of Analysis and original electronic data files will be archived as reference materials.

8.2 Data Analysis

8.2.1 Surface Water Quantity

The data analysis for hydrology will include preliminary sizing of hydraulic structures to support design. These sizing estimates will be based on provincial and federal design criteria including freeboard, velocity, and navigation criteria as required. Where possible, one-dimensional modelling tools (i.e., CulvertMaster, HEC-RAS) or basis calculations (Mannings or equivalent) will be used to determine the appropriate preliminary hydraulic structure type and size at each crossing location. Data collected during the future field campaigns will be used to inform calculations and modelling exercises during the detailed design and permitting phases of the Project.

The data analysis for hydrology will also involve the derivation of design flows / floods at each waterbody crossing to inform the preliminary sizing estimates for the crossing structures, as well as to build on the

baseline studies for surface water. Provincially accepted hydrologic methods will be used to determine the design flows. The hydrologic method chosen is based on the size and complexity of the specific watershed (e.g., Rational Method or Northern Ontario Hydrology Method for small crossings, gauging streams for large crossings). Un-gauged watersheds may be estimated by using regional index stream methods where data from nearby gauged watersheds with similar runoff characteristics can be used to estimate the design flows in the un-gauged watershed.

The results from the data analysis for hydrology will be used to develop a preliminary design report. This report will include details on the preliminary sizing estimates for the waterbody crossing structures (e.g., design flows, structure type, structure size) The information will be updated as part of the detailed design phase of the Project.

8.2.2 Surface Water and Sediment Quality

Surface water quality data will be summarized by crossing location, season, and year using descriptive statistics. Where applicable, water quality parameters will be compared to Provincial Water Quality Objectives (PWQO; Province of Ontario 1994) and Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life (CCME 1999a), and the more stringent of the two will be acknowledged. Water quality parameters will also be compared to Ontario Drinking Water Quality Standards (ODWQS; O. reg. 169/03 under the *Safe Drinking Water Act*, 2002, S.O. 2002, c. 32) and Guidelines for Canadian Drinking Water Quality (Health Canada 2019) for water bodies used or potentially used as a source of potable water (including sources of Indigenous cultural importance for consumption), and the more stringent of the two criteria will be acknowledged.

Sediment quality data will be summarized by site using descriptive statistics. Where applicable, sediment quality parameters will be compared to Provincial Sediment Quality Guidelines (MOE 1993) and Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME 1999b), and the more stringent of the two criteria will be acknowledged.

Surrogate baseline data from reference sites may be used to characterize water and sediment quality conditions at sites with no site-specific data. The reference site or sites will be selected based on a comparison of physical water body characteristics that influence water and sediment quality (e.g., catchment area, flows, land cover and soil types; waterbody type and geographic location) and the representativeness of the surrogate data will be described. If baseline data are extrapolated or otherwise manipulated to depict surface or sediment quality conditions within the study area for water bodies that were not directly monitored, data extraction and manipulation methods will be described and include assumptions, calculations of margins of error and other relevant statistical information.

9. Effects Assessment

The following sections provide discipline-specific input and considerations as they pertain to the methodology for the effects assessment. The Project is in the early stage of the IS / EA Report preparation and it is expected that the effects assessment methodology will be refined iteratively based on regulatory agency guidance, professional judgment and input received through the Project consultation and engagement process.

9.1 Project-Environment Interactions

The Project activities that may result in changes to the environment are described within the identified temporal and spatial boundaries (**Section 6**). This includes identification of both direct and indirect changes by comparing the existing setting to the conditions anticipated to occur as a result of the Project. For each environmental discipline, the likely Project-environment interactions will be identified based on professional judgment, activities listed in TISG Section 3.2 (the Agency 2020c) as well as projects of similar magnitude and / or location.

A preliminary analysis of Project-environment interactions for Surface Water is provided in **Table 9-1** and will be confirmed during the IA / EA process to identify the Project-environment interactions that are likely to have a potential effect, and to identify measures to avoid or minimize potential negative effects and enhance benefits.

Table 9-1: Project – Environment Interactions

Project Phases	Project Activities	Surface Water
Construction Phase	*Mobilization of Equipment and Supplies*	
	Temporary Construction Staging Areas[1]	x
	Temporary Access Roads and Trails[1]	x
	Temporary Construction Camps[1]	x
	ROW Clearing and Grubbing	x
	Brush and Timber Disposal	
	Pits and Quarries[1]	x
	Drilling / Blasting / Aggregate Production	x
	Road Construction (stripping, subgrade excavation, embankment fill placement, grading, ditching)	x
	Bridge and Culvert Installation (approach embankments, foundations, substructures, superstructures, traffic protection, erosion controls)	x
	Construction Site Restoration	x
Construction Phase: Decommissioning	*Pits and Quarries*	x
	Temporary Camps, Roads / Trails and Staging Areas	x

Project Phases	Project Activities	Surface Water
Operations Phase	*Road Usage*	**x**
	Maintenance[2]	**x**

Notes: 1. Includes construction and use of
2. Includes General Maintenance (e.g., grading, erosion control, quarrying, borrow pits), Seasonal Maintenance (e.g., snow clearing, bridge and culvert maintenance), and Special Maintenance (e.g., slope failures, road settlement / break-up).

9.2 Valued Components and Indicators

VCs are the environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties (the Agency 2020b). Indicators represent the resource, feature, or issue related to the VC that, if changed, may demonstrate an effect on the environment. The indicators and rationale for selection and measurement of potential effects, to be used to assess and evaluate the alternative routes in the IS / EA Report are provided in **Table 9-2**. The table includes both quantitative and qualitative indicators. The final list of VCs and indicators to be used in the IS / EA Report will be based on regulatory agency guidance, professional judgement and input received through the Project consultation and engagement process.

The Surface Water VC has been determined through consideration of the following factors listed in the TISG[7]:

- VC presence in the study area;
- the extent to which the VC is linked to the interests or exercise of Aboriginal and Treaty Rights of Indigenous peoples, and whether an Indigenous group has requested the VC;
- the extent to which the effects (real or perceived) of the Project and related activities have the potential to interact with the VC;
- the extent to which the VC may be under cumulative stress from other past, existing or future undertakings in combination with other human activities and natural processes;
- the extent to which the VC is linked to federal, provincial, territorial or municipal government priorities (e.g., legislation, programs, policies);

7. *The TISG also states that information from ongoing and completed regional assessments in the proposed area of the Project should be used to inform VCs for the Project. In February 2020 a regional assessment of the Ring of Fire region commenced; however, it is not sufficiently advanced at this time to inform the Project VCs. The VCs will be consulted and engaged on early in the IA/ EA process and finalized taking into consideration the input received. Therefore, only information relevant to the Project that arises from the regional assessment of the Ring of Fire within an appropriate timeline will inform the VCs for the Project.*

- the possibility that adverse or positive effects on the VC would be of particular concern to Indigenous groups, the public, or federal, provincial, territorial, municipal or Indigenous governments; and
- whether the potential effects of the Project on the VC can be measured and / or monitored or would be better ascertained through the analysis of a proxy VC.

Inputs received to date from Indigenous communities, agencies and interested persons through the Consultation and Engagement Program, including inputs received on the Draft ToR, have also been used to inform the selection of the VCs and indicators for Surface Water.

Table 9-2: Surface Water Indicators

Valued Component	Indicators	Rationale for Selection
Surface Water	■ Surface Water Quantity: – changes in drainage patterns – changes in flow – changes in water levels – changes in channel hydraulics – changes in channel stability or erosion-sedimentation processes	■ Importance for the protection of aquatic habitat ■ Importance for potable water supplies ■ Importance for areas of Indigenous cultural importance for consumption ■ Directly linked to surface water and sediment quality ■ Directly linked to groundwater quality and quantity and affects groundwater-surface water interactions
	■ Surface Water Quality: – change in physical parameters (temperature, turbidity, total suspended solids) – change in chemical parameters (pH, electrical conductivity, alkalinity, hardness, dissolved oxygen major and minor ions, trace metals, nutrients, dissolved organic carbon organic compounds, radionuclides, oil / grease)	■ Importance for the protection of aquatic habitat ■ Importance for potable water supplies ■ Importance for areas of Indigenous cultural importance for consumption ■ Directly linked to sediment quality ■ Directly linked to groundwater quality
	■ Sediment Quality: change of physical and chemical characteristics of sediment	■ Importance for the protection of aquatic habitat ■ Directly linked to surface water quality

9.3 Potential Effects

A direct effect occurs through the direct interaction of an activity with an environmental discipline. The Project-environment interactions currently anticipated, based upon preliminary analysis, to result in direct effects to Surface Water have been identified in **Table 9-1**. The potential direct effects resulting from the Project-environment interactions will be confirmed during the IA / EA process and will be based on input

received through the Indigenous Knowledge Program and Consultation and Engagement Program, regulatory agency guidance, and professional judgement.

An indirect effect occurs when a change to one environmental discipline resulting from a Project activity causes a change to another environmental discipline (e.g., changes in surface water quality and quantity could indirectly affect wildlife). **Table 9-3** provides a preliminary identification of how changes to Surface Water may result in indirect effects to other environmental disciplines.

Direct effects of the Project to surface water that alter hydrology and water quality can have indirect effects on abiotic and biotic features and functions. Changes in the quality and quantity of surface water can affect the quality and quantity of water that is available for groundwater recharge. Hydrological changes can also affect Physiography, Geology, Terrain and Soils by altering physical processes such as erosion, leaching of minerals and nutrients, and the decomposition of organic matter. Changes to flow, fluvial geomorphic processes, freeze-thaw patterns and water quality can affect the availability and quality of water and ice to support Wildlife, Fish and Fish Habitat, and Vegetation VCs.

Project effects on surface water can also indirectly affect human valued components. Effects on Aboriginal and Treaty Rights and Interests can occur where changes affect surface water of cultural spiritual significance and the availability and quality of traditional foods and medicine. Surface water changes can also affect the quantity and quality of water for Land and Resource Use including water to support recreation and tourism. Human Health and Community Safety can be affected by changes to quality and quantity of drinking water sources and food (i.e., fish and game). Changes to ice conditions potentially caused by project-related activities can also pose safety issues for winter travel and recreation on water bodies.

Surface water may be indirectly affected by changes to other environmental disciplines. The Atmospheric Environment can affect water quality by aerial deposition of pollutants from Project activities directly to surface water bodies or to the terrestrial environment where pollutants can be transported to water bodies with runoff. Changes to Physiography, Geology, Terrain and Soils as well as Vegetation can alter flow patterns and the interaction of water with soils and vegetation thereby affecting hydrology and water quality. Changes to Groundwater that affect the quality or quantity of groundwater can affect surface water in areas with prominent groundwater-surface water interactions (e.g., springs, groundwater-dominated baseflow periods at permanent watercourses). Land and Resource Use that may be affected by the Project, such as expansion of industry (i.e., forestry, extraction, recreation and tourism) can affect surface water due to water consumptive use and potential for pollution associated with those industries.

Table 9-3: Potential Discipline Interactions

Discipline and Associated Valued Components	Aboriginal and Treaty Rights and Interests	Atmospheric Environment	Acoustic and Vibration Environment	Physiography, Geology, Terrain and Soils	Surface Water	Groundwater and Geochemistry	Vegetation	Wildlife	Fish and Fish Habitat	Social	Economy	Land and Resource Use	Human Health and Community Safety	Visual Aesthetics	Archaeological and Cultural Heritage
Surface Water	X	-	-	X		X	X	X	X	-	-	X	X	-	-

Notes: X = Potential pathway for indirect effect as a result of the Project.
- = No pathway for indirect effect is anticipated as a result of the Project.

9.4 Methods for Predicting Future Conditions

With respect to quantitative models and predictions, the IS / EA Report must detail the model assumptions, parameters, the quality of the data and the degree of certainty of the predictions obtained.

9.4.1 Surface Water Quality

Quantitative and qualitative methods will be used to infer spatial and temporal (i.e., over Project life cycle) changes to surface water quality at potential receptor locations, including traditional land users, due to all Project components and physical activities including changes to physicochemical parameters (temperature, pH, salinity, dissolved oxygen, turbidity, dissolved organic carbon, total suspended solids) and chemical constituents (major and minor ions, trace metals, nutrients, organic compounds). Project activities to be considered will include all Project-related effluent streams. Water quality parameters for potable sources of water will be compared to ODWQS and CWQGs. Note that requirements for an Environmental Compliance Approval for sewage works discharge to surface water are beyond the scope of an effects assessment and would be considered in the design / permitting stage, if required.

Qualitative methods will be used to assess potential effects of the Project to surface water quality based on an understanding of baseline surface water quality, likely parameters / contaminants of potential concern associated with different Project activities, and consideration of mitigation measures inherent to the Project design.

9.4.2 Hydrology

Project-related effects on hydrology will be assessed, where possible, based on the proportion of the catchment area for a given waterbody that is expected to be disturbed or influenced by Project activities. This approach considers drainage area as a proxy or analog for streamflow and, to a lesser extent, the potential for sediment erosion and transport. Mitigation measures may be designed to offset negative impacts.

9.5 Mitigation and Enhancement Measures

Once potential effects have been identified, the effects assessment will explore technically and economically feasible mitigation measures to avoid or minimize the identified negative effects and enhancement measures to increase positive effects beyond those that are already inherent to the design.

These measures will consist of industry-standard practices, federal and provincial standard specifications, regulator-mandated measures, best management practices, Indigenous and community recommendations and recommendations from industry and environmental professionals based on expertise, scientific publications, experience and judgement.

It is important that mitigation and enhancement measures are achievable, measurable and verifiable and monitored for compliance and effectiveness during all temporal phases as part of the Project follow-up monitoring plan. Required environmental monitoring will verify the potential environmental effects predicted in the IS / EA Report, evaluate the effectiveness of mitigation and enhancement measures, and identify the process the Proponent will follow if mitigation and enhancement measures are not effective.

9.5.1 TISG Section 20 Requirements

Mitigation requirements will be provided in the IS / EA Report and will include the general requirements for all VCs in addition to requirements that are specific to Surface Water as set out in Section 20 of the TISG (the Agency 2020c). The requirements specific to Surface Water are as follows:

- A description of the Sediment and Erosion Control Plan, including the proposed mitigation measures and their effectiveness on the contaminants of concern affecting Surface Water;
- Identification of measures to avoid the deposit of substances harmful to fish or migratory birds in water; and
- Identification of measures to prevent surface water conditions at water crossings (i.e., culverts) from negatively impacting freshwater fish movement (e.g., due to flow, debris, or “perching”).

9.6 Residual Effects

Residual effects are the effects remaining after the application of mitigation measures. The IS / EA Report will describe in detail the potential adverse and positive residual effects in relation to each temporal phase of the Project (e.g., construction, operation). Residual effects will be described using criteria to quantify or qualify adverse and positive effects, taking into account any important contextual factors. The residual effects will therefore be described in terms of the direction, magnitude, geographic extent, duration, frequency, likelihood, and whether effects are reversible or irreversible[8]. Ecological and socio-economic

8. *TISG Section 13.1 identifies additional effects characteristics for certain disciplines (e.g., wetlands, birds, terrestrial wildlife, species at risk). These additional effects characteristics are described in the respective discipline-specific study plans.*

context may also be relevant when describing a residual effect. Context relates to the existing setting, its level of disturbance and resilience to adverse effects. Context can also relate to timing as it applies to assessing the worst-case scenario (e.g., effect during migratory or calving season for wildlife). Where appropriate, information regarding residual effects will be disaggregated by sex, gender, age and other community relevant identifying factors to identify disproportionate residual effects for diverse subgroups.

For magnitude, environmental discipline-specific definitions are required and are proposed below in **Table 9-4 and Table 9-5**. The magnitude of anticipated effects for hydrology and surface water quality will be assessed from a largely qualitative standpoint with a plan to evaluate change in surface water indicators from existing conditions and in consideration of natural variability (as defined by the results of the baseline studies) and the design methodology for the Project (including all of the incorporated best management practices and mitigation).

For hydrology, the magnitude of anticipated effects will be based on the proportion of the catchment area for a given waterbody that is expected to be disturbed or influenced by Project activities. This approach considers drainage area as a proxy or analog for streamflow and, to a lesser extent, the potential for sediment erosion and transport. More specifically, the rationale for an effects magnitude of 'Low' (identified in **Table 9-4 and Table 9-5**) reflects the level of reliability of typical flow monitoring instrumentation (i.e., +/- 15%), coupled with observations and inferences from the literature that suggest minimal changes (if any) in streamflow and channel stability as a result of land disturbance if less than approximately 20% of the contributing drainage area is disturbed or influenced.

For surface water and sediment quality, the magnitude of anticipated effects will also consider the following federal and provincial water and sediment quality guidelines and objectives:

- CWQGs for the Protection of Aquatic Life, PWQOs, Guidelines for Canadian Drinking Water Quality and ODWQSs as may be applicable for surface water quality parameters; and
- Provincial Sediment Quality Guidelines and Canadian Sediment Quality Guidelines for the Protection of Aquatic Life as may be applicable for sediment quality parameters.

For parameters with multiple guidelines or objectives, the most stringent guideline or objective will be relied on for the assessment.

Table 9-4: Magnitude Definition for Surface Water Quantity (Hydrology)

Magnitude Level	Definition[1]	Rationale
Negligible	There is little to no variation predicted in indicator parameters, meaning that, where applicable for a given water body, the proportion of the catchment area disturbed or influenced by a specific Project activity is < 5%. As such, indicator parameters are expected to remain within the range of natural variation.	No discernable changes to hydrology, and, hence, no anticipated changes to aquatic life or potable sources of water.
Low	There is a small variation predicted in indicator parameters, meaning that, where applicable for a given water body, the proportion of the catchment area disturbed or influenced by a specific Project activity is between 5% and 20%. As such, the indicator parameters are expected to vary to within the upper or lower limits of, or just outside, the range of natural variation.	Changes to hydrology are discernable, but it is anticipated that surface water quantity conditions remain protective of aquatic life and potable sources of water.
Medium	There is a moderate variation predicted indicator parameters, meaning that, where applicable for a given water body, the proportion of the catchment area disturbed or influenced by a specific Project activity is between 20% and 50%. As such, the indicator parameters are expected to vary outside the range of natural variation.	Changes to hydrology are discernable and / or statistically significant, but it is anticipated that surface water quantity conditions remain protective of aquatic life and potable sources of water.
High	There is a large variation predicted in indicator parameters, meaning that, where applicable for a given water body, the proportion of the catchment area disturbed or influenced by a specific Project activity is greater than 50%. As such, indicator parameters are expected to vary outside the range of natural variation.	Changes to hydrology are discernable and / or statistically significant and may impair aquatic life or potable sources of water.

Notes: 1. The relative (percent) change may be modified as appropriate for specific parameters of interest to consider measurement / monitoring instrumentation error, laboratory detection limits, accepted practice or findings in the scientific literature, and professional judgement.

Table 9-5: Magnitude Definition for Surface Water and Sediment Quality

Magnitude Level	Definition[1]	Rationale
Negligible	There is little to no variation predicted in indicator parameters and, as such, the indicator parameters are expected to remain within the range of natural variation.	No changes to surface water and / or sediment quality are discernable, and, therefore, no changes to aquatic life or potable sources of water are anticipated.
Low	There is a small variation predicted in the indicator parameters such that the indicator parameters are expected to vary within or just outside the range of natural variation (i.e., by less than 20% outside the range of natural variation), but remain below applicable guideline/objective or threshold values (assuming that indicator parameters satisfy the relevant guideline/ objective or threshold values under existing conditions).	Changes to surface water and / or sediment quality are discernable but are anticipated to remain protective of aquatic life and potable sources of water.

Magnitude Level	Definition[1]	Rationale
Medium	There is a modest variation predicted in the indicator parameters such that indicator parameters are expected to vary outside the range of natural variation (i.e., by 20% to 50%), but remain below the applicable guideline / objective or threshold values (assuming that indicator parameters satisfy the relevant guideline / objective or threshold values under existing conditions).	Changes to surface water and / or sediment quality are readily discernable, and, where applicable, of potentially statistical significance, but are anticipated to remain protective of aquatic life and potable sources of water.
High	There is a large variation predicted in the indicator parameters such that indicator parameters are expected to vary outside the range of natural variation (i.e., by more than 50%), and / or, exceed applicable guideline / objective or threshold values.	Changes to surface water and / or sediment quality are readily discernable and / or could potentially impair aquatic life or potable sources of water.

Notes: 1. The relative (percent) change may be modified as appropriate for specific parameters of interest to consider measurement / monitoring instrumentation error, laboratory detection limits, accepted practice or findings in the scientific literature, and professional judgement.

9.7 Consideration of Sustainability Principles

The following provides a generic description of how sustainability principles will be considered in the effects assessment. The extent to which sustainability principles apply to a specific VC will vary depending on the nature of the VC and the potential for Project effects on the VC.

The effects assessment approach for the Project has included the consideration of the sustainability principles outlined in the Project TISG and the Agency's guidance on sustainability. The sustainability principles that have been considered include:

1. Consider the interconnectedness and interdependence of human-ecological systems;
2. Consider the well-being of present and future generations;
3. Consider positive effects and reduce adverse effects of the Project; and
4. Apply the precautionary principle by considering uncertainty and risk of irreversible harm.

The interconnectedness and interdependence of human-ecological systems will be considered through the assessment of potential indirect effects of each alternative. An indirect effect occurs when a change to one environmental discipline resulting from a Project activity causes a change to another environmental discipline (e.g., changes in vegetation could indirectly affect wildlife). A preliminary assessment of indirect effects has been included in **Section 9.3**.

The well-being of present and future generations will be considered in the effects assessment through the application of the long-term operations phase temporal boundary of 75 years (**Section 6.1**) and through the effects characteristics description of duration and reversibility for each residual effect predicted.

The consideration of positive effects and reducing adverse effects of the Project is fundamental to the effects assessment methodology through the identification of mitigation measures to reduce potential adverse effects and the identification of the preferred alternative through the evaluation of advantages (e.g., positive effects) and disadvantages (e.g., adverse effects).

The effects assessment will apply the precautionary principle by clearly describing and documenting all uncertainties and assumptions underpinning the analysis and identifying information sources. The effects assessment will consider risk of irreversible harm through the effects characteristics description of reversibility for each residual effect predicted and will describe any uncertainty associated with the assessment of residual effects.

The scope of the sustainability assessment will be defined by issues of importance identified by Indigenous communities and interested persons through consultation and engagement activities, while also ensuring to be inclusive of the diversity of views expressed. The selection of VCs that will be the focus of the sustainability assessment will be aligned with the issues of importance identified by Indigenous communities and interested persons, as well as residual effects identified through the effects assessment process. The sustainability assessment will describe how the planning and design of the Project, in all phases including follow-up monitoring, considered the sustainability principles.

9.8 Consideration of Identity and Gender-Based Analysis Plus in Effects Assessment

The Proponent recognizes that communities and sub-populations within those communities may be impacted differently by the Project with respect to VCs and indicators. As such, the Project aims to collect baseline information for the purpose of assessing differential effects and establishing relevant mitigation measures, as further elaborated on in **Section 4.3**. Gender-Based Analysis Plus will not be limited to community feedback, when offered or discussed in secondary texts, additional sub-population information as is applicable to the relevant assessment will be incorporated.

9.9 Follow-up Programs

A follow-up monitoring program will be used to verify the accuracy of the effects assessment and evaluates the effectiveness of mitigation measures. Identification of follow-up programs for the Project are not described in this Study Plan as the information needed to determine environmental monitoring requirements is dependent on the outcome of the effects assessment and consultation with Indigenous communities, agencies and interested persons. Therefore, the Proponent will include information on follow-up programs that addresses the requirements outlined in Section 26 of the TISG (the Agency 2020c), in the IS / EA Report and will identify the compliance and effects monitoring activities to be undertaken during all phases of the Project, as required.

9.9.1 TISG Section 26 Requirements

A follow-up program will be developed to verify the accuracy of predicted Project effects and to evaluate the effectiveness of the mitigation measures for Surface Water if required in consideration of the following:

- predicted or uncertain residual adverse Project effects to Surface Water;
- the nature of concerns raised by the public and Indigenous groups about the Project;
- the accuracy of predictions;
- an evaluation of the effectiveness of mitigation measures;
- the efficacy of new or unproven techniques and technology;
- the nature of cumulative effects;
- the degree of uncertainty about the effectiveness of proposed mitigation measures;
- any technically and economically feasible measures to manage effects if the applied mitigation measures do not work as intended; and
- whether there was limited scientific knowledge about the effects in the impact assessment.

10. Assumptions

Any assumption used in the effects assessment, for example the assumed average daily traffic on the CAR, will be clearly identified and a rationale provided in the IS / EA Report.

11. Concordance with Federal and Provincial Guidance

This section provides the best information currently available on how federal and provincial requirements identified for the Project to date will be addressed. The final concordance with federal and provincial requirements will be included in the IS / EA Report, and will be based on regulatory agency guidance, professional judgement and input received through the Project consultation and engagement process.

Table 11-1: Study Plan Federal Concordance – Conformance with Requirements

ID #	Federal TISG Reference	Requirement / Comment / Concern	Response	Study Plan Reference
1	TISG Section 8.6	■ Provide the timing of freeze/thaw cycles, ice cover, and ice conditions for surface water bodies in the Project area	■ Characteristic ice conditions and freeze / thaw cycles for the LSA / RSA will be determined based on available climate data, and where possible, observations from the planned field surveys.	■ Section 7.2.2
2	TISG Section 8.6	■ Develop a quantitative surface water balance for components of the Project that may result in significant changes to surface water flow patterns (e.g., large quarry/aggregate extraction/stockpiles).	■ Water balance analyses will be advanced to support groundwater studies at a discrete set of the proposed quarry/aggregate sites. The scope of work to conduct these water balance assessments has been documented in the Ground Water Study Plan.	■ Section 7.2.2
3	TISG Section 8.6	■ Identify all springs and any other potable surface water resources within the local and regional project areas and describe their current use, potential for future use, and whether their consumption has Indigenous cultural importance.	■ The identification and characterization of springs is included in the study plan for the Groundwater VC. ■ The identification and characterization of surface water drinking sources is captured in the Surface Water VC, with the understanding that Project-related effects on these drinking water sources will be addressed in the Human Health and Community Safety VC.	■ Section 7.1 ■ Section 8.1.2
4	TISG Section 8.6	■ Describe the surface water quality baseline characterization program, including sampling site. selection, monitoring duration and frequency, sampling protocol, and analytical protocol, including quality assurance and quality control measures.	■ The updated version of the Surface Water Study Plan includes the full details of the proposed surface water field program. The specific monitoring locations, frequency and duration of sampling activities and measurements, and the relevant parameter list and QA / QC protocols for water and sediment quality testing has been aligned with Section 8.6 of the TISG and past communications with the regulatory agencies, noting, in particular, that streamflow and water quality monitoring will be conducted at a subset of water body crossing locations (approximately 40% of the total number of crossing locations) over multiple seasons and varying catchment scales to characterize the natural variation in flow and water quality conditions, as well as to inform the preliminary design efforts.	■ Section 7.2.1.3
5	TISG Section 8.6	■ Provide baseline surface water quality data, for a minimum of two years, for physicochemical parameters (temperature, pH, electrical conductivity, dissolved oxygen, turbidity, suspended solids) and relevant chemical constituents (major and minor ions, trace metals, radionuclides, nutrients, and organic compounds, including those of potential concern); the data should illustrate the seasonal and inter-annual variability in baseline surface water quality, including possible changes due to groundwater–surface water interactions.	■ A comprehensive surface water baseline monitoring/investigation program is proposed for the Surface Water VC. The details of this program are described in the updated version of the Surface Water Study Plan, noting, in particular, that streamflow and water quality monitoring for the future field campaigns will be conducted at a subset of water body crossing locations in the spring and summer to further characterize the natural variation in flow and water quality conditions. The results from the completed and planned field campaigns over multiple seasons and years are expected to provide a means to define the characteristic range of natural variation in flows and the water quality parameters of interest, recognizing that, to the extent possible, data from surveyed crossing locations will be extrapolated to non-surveyed sites with similar catchment areas, physiography, and flow regimes. In addition, it is anticipated that the ground-based field surveys conducted in 2011-2012 by Golder in support of the Cliffs Chromite Project (Project EA since terminated) will help to further augment this understanding of natural fluctuations of baseline surface water and aquatic conditions, both on an inter- and intra-annual basis, given that these previous studies occurred in a similar geographic setting as the Project, and, in many cases, the locations of waterbody crossings overlap.	■ Section 7.2.1
6	TISG Section 8.6	■ Provide baseline sediment quality and characteristic data for key surface water sites likely to be effected by the road (i.e., from runoff, spills, erosion and sedimentation, etc.).	■ A comprehensive surface water and sediment quality baseline monitoring / investigation program is proposed for the Surface Water VC.	■ Section 7.2.1
7	TISG Section 14.2	■ Provide a project-specific water use assessment identifying and describing the quantity and quality of water resources potentially affected by the Project, including: – any withdrawal of groundwater or surface water; changes to the groundwater recharge/discharge areas; – temporal and spatial changes in groundwater quantity, quality and flow (e.g., long-term changes in water levels), including how these changes may relate to domestic, communal or municipal water supply wells; – the flow or volume of water available in the water bodies; and – how any waste waters or dewatering water would be managed and where it would be discharged.	■ The effects assessment for the Surface Water VC will consider all Project-related uses of, and interactions with, surface water resources (e.g., water takings or other), with potential implications on the quantity or quality of surface water in the receiving environment. Any required regulatory approvals to address the withdrawal or discharge of surface water (e.g., ECA, PTTW, EASR) will be addressed as part of the permitting stage of the Project. ■ The study plan for the Groundwater VC should be referred to for all groundwater-related comments.	■ Section 9.9; Groundwater VC Study Plan

ID #	Federal TISG Reference	Requirement / Comment / Concern	Response	Study Plan Reference
8	TISG Section 14.2	■ Present estimates of surface water runoff rates for major project components, including aggregate and overburden stockpiles.	■ The baseline studies and effects assessments for the Surface Water VC will be used to evaluate the characteristic flow / runoff rates at a range of watershed scales, as well as to estimate the potential for Project-related changes to these flow conditions.	■ Section 7.2.2 ■ Section 8.2
9	TISG Section 14.2	■ Describe groundwater and surface water monitoring programs during the construction, operation and decommissioning and abandonment	■ The relevant surface water and groundwater monitoring programs will be identified as part of the EA.	■ Section 7.2.1
10	TISG Section 14.2	■ Describe spatial and temporal (i.e., over project life cycle) changes to surface water quality at potential receptor locations, including traditional land users, due to effluents and atmospheric deposition from the Project including changes to physicochemical parameters (temperature, pH, salinity, dissolved oxygen, turbidity, dissolved organic carbon, total suspended solids), chemical constituents (major and minor ions, trace metals, nutrients, organic compounds)	■ The effects assessment for the Surface Water VC will consider all Project-related influences on surface water conditions, with potential implications on the quantity or quality of surface water in the receiving environment (including receptor locations).	■ Section 9

Table 11-2: Study Plan Provincial Concordance – Conformance with Requirements

ID #	Provincial Draft ToR Comment Reference	Requirement / Comment / Concern	Response	Study Plan Reference
1	ToR Section 7.1.4.4 Surface Water	■ Additional representative baseline surface water quality data is required at water crossings along the road corridor. In addition to the in-situ parameters listed, turbidity must also be measured, and representative samples collected must be analyzed for alkalinity, total suspended solids, cations, anions, and total metals. These will provide appropriate baseline data from representative watercourses, for comparison with data collected during the project for assessment of impact. ■ The 'scaled approach' to site selection appears appropriate; however, those rivers that may require more substantial water crossings, e.g. Albany, Ogoki, Dusey, Wabassi, Buffaloskin Rivers, and Gourlie Creek, etc. must be included in the list of surface water features requiring ground-based surface water field surveys, including water chemistry assessments. ■ Best available water quality guidelines should be used respecting the assessment of the surface water results. In most cases sample results are to be compared against Provincial Water Quality Objectives; however, the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guideline for the Protection of Aquatic Life may be more appropriate, specifically for suspended sediment and turbidity.	■ A comprehensive surface water and sediment quality baseline monitoring/investigation program is proposed for the Surface Water VC. The details of this program are described in the updated version of the Surface Water Study Plan. Of particular note, the surface water quality sampling will be conducted at a subset of water body crossing locations over multiple seasons and catchment scales to characterize the natural variation in water quality conditions. The testing of these water quality samples (in-situ and laboratory-based) will account for the requested water quality parameters (including turbidity). ■ Where possible, small watercraft will be used to complete the surface water field studies at the larger river crossings (where wading would be deemed as unsafe). ■ The analysis of the water and sediment quality data will rely on the applicable federal and provincial guidelines and objectives (including PWQO and CCME) as comparison criteria.	■ Section 7.2.1 ■ Section 8.1

Table 11-3: Study Plan Federal and Provincial Concordance – Requirement Deviations

ID #	Federal TISG Reference	Requirement / Comment / Concern	Response (Rationale for not meeting requirement)	Justification (for not complying with requirement including for example scientific research, precedence)	Proposed TISG Amendment
1	TISG Section 8.1	■ "The Impact Statement must:… – for the aquatic environment, provide current underwater soundscape and vibration descriptions of the study area and at the project site from various sources based on acoustic measurements. Provide information on vibration and sound sources, geographic extent and spatial and temporal variations within the water column;…"	■ Based on the proposed engineering and anticipated construction methods of the CAR, there are no anticipated pathways of effects associated with changes in underwater noise and vibration.	■ There are no established underwater noise or vibration criteria associated with road development.	■ Remove this requirement

12. References

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Stormwater Management Planning and Design Manual, Ontario Ministry of Environment, March 2003.

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Water management: policies, guidelines, provincial water quality objectives. Queen's Printer for Ontario, 1994. https://www.ontario.ca/page/water-management-policies-guidelines-provincial-waterquality-objectives

Appendix A

Preliminary List of Data Sources

- Field investigation (undertaken for surface water and other environmental disciplines)
- Indigenous Knowledge
- Date from previous environmental assessments
- Ontario Integrated Hydrology Data
- Ontario Ministry of Natural Resources and Forestry (MNRF), 2020: Natural Heritage Information Centre Make-a-Map: Natural Heritage Areas. https://www.ontario.ca/page/make-natural-heritage-area-map
- Natural Heritage Information Centre
- Ontario Flow Assessment Tool Version 3
- Hydrometric data from Water Survey of Canada and the MECP, or from Ontario Hydro
- Archived water quality data from the MECP provincial (Stream) Water Quality Monitoring Network
- MECP Source Protection Information Atlas
- Archived water taking data from the MECP Permits to Take Water Database
- MECP Water Well Inventory
- Aquatic Ecosystem Assessments for Rivers (Metcalfe *et al.* 2013)
- Support for development of a long-term environmental monitoring strategy for the Ring of Fire area: Background documents, workshop report, pathway diagrams and indicator list (Rempel *et al.*, 2016)

Appendix B

Agency Comments on the Draft Study Plan

Draft Study Plan Comments – Federal

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
General Comment	■ General Comment	■ **Sections 5, 6, 7, 13, 19.2, and 25**	■ In addition to the required actions detailed below, other required actions to be addressed in the update to this study plan are detailed in a separate table titled "2020-07-02 – IAAC to MFFN - General Comments on MFCAR Draft Study Plans". The Agency has provided these other required actions to highlight common sections of the Tailored Impact Statement Guidelines (the Guidelines) where requirements were not met in the draft study plans submitted to the Agency. These additional actions must be addressed in the updated study plans.	■ We have reviewed the relevant comments and incorporated where appropriate. Please refer o the General Comments Table Response submitted separately to the Agency for specific responses.		■ Various Sections
Editorial Comment	■ **Section 4.2.2: Surface Water Quality Figure 4-1: Proposed Surface Water Survey Locations**	■ Editorial Comment	■ It is unclear if Figure 4-1 is showing the proposed locations of future, surface water sampling and in situ parameter measurements or the locations of surface water sampling and in situ parameter measurements of the 2019 sampling program. Also, there is no reference to Figure 4-1 in the study plan.	■ Provide a clear description of Figure 4-1 and reference the figure in the body of the study plan.	■ A location plan for the proposed surface water monitoring program (proposed water body crossing locations for ground-based field studies of water quantity and quality) has been included in the updated version of the Surface Water Study Plan.	■ Figure 7-1 ■ Section 7.2.1
Editorial Comment	■ **Section 4.2.2: Surface Water Quality** – "Proposed locations for surface water sampling are illustrated on Figure 4-2…. – In situ parameters and water samples will be collected at the subset of water crossings (Figure 4-2)"	■ Editorial Comment	■ Section 4.2.2 refers to Figure 4-2, however there is no Figure 4-2 in the study plan.	■ Provide Figure 4-2 to clearly indicate the proposed locations for future surface water sampling and in situ parameter measurements.	■ The reference in Section 4.2.2 of the Draft Study Plan should have been Figure 4-1 (rather than Figure 4-2). Note as well that a location plan for the proposed surface water monitoring program has been included in the updated version of the Surface Water Study Plan.	■ Figure 7-1 ■ Section 7.2.1
SW-01	■ **Section 3: Spatial Boundaries: Study Areas** – "The boundaries of the LSA will be confirmed and refined during the Baseline Study to consider flows in rivers and dilution and assimilation in water bodies, as may be required to capture the extent of direct and indirect project-related effects on surface water (Section 4.1). The RSA for the Water Quality VC encompasses Quaternary subwatersheds crossed by route Alternative 1 and Alternative 4 downstream of the PSA and LSA. This area includes the area where	■ **Section 7.1** – "…Considerations in assigning appropriate study areas or boundaries would include, but not be limited to: • areas potentially effected by changes to water quality and quantity or changes in flow in the watershed and hydrologically connected waters; • areas potentially effected by airborne emissions or odours; • areas determined by dispersion and deposition modelling; • areas within the range of vision, light and sound and the locations and characteristics of the most sensitive receptors;	■ The RSA appears to extend 25 kilometres downstream of the PSA on the Albany River. No detail is provided for why project effects would cease to occur as water continues to flow further downstream. Additionally, there is no indication of how communities will be engaged to confirm the spatial boundaries of the surface water study. The study plan suggests that surface water quality monitoring sites will be selected partly in consultation with Marten Falls First Nation only. It is unclear if all Indigenous groups listed in the Indigenous Engagement and Partnership Plan (IEPP) will be engaged with.	■ Provide details to demonstrate how the RSA spatial boundary was defined, given that water continues to flow further downstream. Provide detail to demonstrate how Indigenous knowledge has been, or will be, incorporated into the design of the field studies, including site selection. All Indigenous groups listed in the IEPP must be provided opportunities to: – provide Indigenous knowledge during baseline data collection; – comment on the list of valued components and indicators;	■ The Surface Water Study Plan has updated to provide additional details on the RSA for Surface Water, with the understanding that the LSA and RSA are preliminary and cover the extent to which surface water could potentially be affected by Project activities. Provisions have been included to refine the LSA and RSA based on the results of the baseline studies, as well as future input from communities and Indigenous groups through consultation and engagement. As identified in **Section 4.2**, the Proponent will provide opportunities for consultation and engagement with Indigenous communities (identified in **Table 4-1**), which is inclusive of all Indigenous communities identified in the	■ Section 6.2 ■ Section 4.2 ■ Section 5

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
	water bodies could potentially be affected by project effects within the PSA and LSA as water flows downstream, and by broad-scale indirect project effects (e.g., potential regional-scale changes in groundwater-surface water interactions and changes to wetlands and peatland hydrology that could affect surface water)." ■ **Section 4.2.2: Surface Water Quality** – "Water quality and sediment quality monitoring (…). The sites will be selected based on findings of the Desktop Assessment, field surveys conducted in 2019, and in consultation with MFFN. The sites selected will aim to capture the range of waterbody types and to consider important features such as fish and fish habitat, areas of groundwater-surface water interactions, and areas of Indigenous cultural importance for consumption." ■ **Section: 6.1 Indicators and Expression of Change** – "The indicators have been determined for the Surface Water through consideration of the following: • consultation with Indigenous stakeholders, communities and Indigenous Knowledge;"	• species habitat areas, usage timing and migratory patterns; • emergency planning and emergency response zones; • the geographic extent of local and regional services; • any impacted local communities, including municipalities; • all potentially impacted Indigenous groups; • areas of known Indigenous land, cultural, spiritual and resource use; and • existing effected infrastructure…" ■ **Section 7.4.1** – "…Spatial boundaries are defined taking into account the appropriate scale and spatial extent of potential effects and impacts of the Project; community knowledge and Indigenous knowledge; current or traditional land and resource use by Indigenous groups; exercise of Aboriginal and Treaty rights of Indigenous peoples, including cultural and spiritual practices; and physical, ecological, technical, social, health, economic and cultural considerations…" ■ **Section 8.6** – "The Impact Statement must:… • • identify all springs and any other potable surface water resources within the local and regional project areas and describe their current use, potential for future use, and whether their consumption has Indigenous cultural importance; • describe the surface water quality baseline characterization program, including sampling site selection, monitoring duration and frequency, sampling protocol, and analytical protocol, including quality assurance and quality control measures;…"		– inform the effects assessment and review its conclusions; and – inform the development of mitigation measures and follow-up programs.	*Indigenous Partnership and Engagement Plan for the Marten Falls Community Access Road Project Impact Assessment* (the Agency 2020a). Further information on how Indigenous Knowledge will be considered in the IS / EA Report has been included in **Section 5** of the Surface Water Study Plan. This includes further details on the two concurrent and complementary avenues for Indigenous communities and groups to be engaged with, and provide input on, the Project, i.e. the Indigenous Knowledge Program and the Consultation and Engagement Program.	

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
SW-02	■ **Section 4.1: Desktop Assessment** – "The desktop assessment will include identification potable surface water sources within the local and regional project areas and a description of their current use, potential for future use, and whether their consumption has Indigenous cultural importance."	■ **Section 7.2** – "…The Impact Statement must provide detailed descriptions of specific data sources, data collection, sampling, survey and research protocols and methods followed for each baseline environmental, health, social and economic condition that is described, in order to corroborate the validity and accuracy of the baseline information collected…" ■ **Section 8.6** – "The Impact Statement must:… • identify all springs and any other potable surface water resources within the local and regional project areas and describe their current use, potential for future use and whether their consumption has Indigenous cultural importance;…	■ It is unclear how a desktop assessment will be able to determine whether consumption of potable surface water sources has Indigenous cultural Importance. ■ It is unclear how Indigenous groups will be provided opportunities to provide Indigenous knowledge and validate the collected baseline data.	■ Provide detail to demonstrate how the desktop assessment will determine whether consumption of potable surface water sources has Indigenous cultural Importance. ■ Describe in the study plan how Indigenous groups will have opportunities to provide Indigenous knowledge on potable surface water sources and validate the baseline data collected.	■ The identification and characterization of surface water drinking sources is captured in the Surface Water VC, with the understanding that Project-related effects on these drinking water sources will be addressed in the Human Health and Community Safety VC. The identification and characterization of springs (and other groundwater-based potable water sources) is included in the study plan for the Groundwater VC.	■ Section 7.1
SW-03	■ **Section 4.1: Desktop Assessment** – "The information will include extensive field records that were obtained from the Cliffs Chromite Project Environmental Assessment project in 2011-2012 (Golder 2014) and other publicly available sources… …A preliminary list of applicable information sources has been included in Appendix A and reflects federal and provincial guidance received to date."	■ **Section 7.2** – "…The Impact Statement must provide detailed descriptions of specific data sources, data collection, sampling, survey and research protocols and methods followed for each baseline environmental, health, social and economic condition that is described, in order to corroborate the validity and accuracy of the baseline information collected… If using existing data sources, the Impact Statement must provide justification to show that the data sources are relevant in spatial and temporal coverage to the Project. Some data sources may have good coverage in Southern Ontario or existing road networks but be unsuitable as a baseline for these northern areas where there are not roads…"	■ It is unclear what publicly available data sources will be used and if they will be relevant to the Project. More detail is required about the specific data sources in order to corroborate the validity and accuracy of the information.	■ Provide detailed descriptions of specific data sources that will be used to identify gaps and inform baseline characterization of surface water. Sources should be listed and clearly correlated to the criteria and indicators that they will inform. Provide justifications to demonstrate that each data source is relevant in spatial and temporal coverage to the Project.	■ A preliminary list of background materials to support the surface water baseline characterization has been included in the updated version of the Surface Water Study Plan. Information on specific data sources and their relevance to the Project will be included in the IS / EA Report.	■ Appendix A

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
SW-04	■ **Section 4.2.1.1: Introduction and Objectives** – "Based on a preliminary review of the alignment for Alternatives 1 and 4 (provided by AECOM on May 30, 2019) relative to available mapping and imagery, 164 waterbodies were identified as potentially being crossed by the Project. On-the-ground field data collection was completed at a subset of the identified waterbody crossings from the aerial reconnaissance to verify or augment the results and assumptions from the desktop analysis." ■ **Section 4.2.3: Hydrology** – "Additional bathymetric information will only be collected at larger water crossings where more detailed hydraulic modelling is required. Location of bathymetry collection will be determined during detailed design phase and will generally be limited to locations where it has been determined that fish passage requirements must be met."	■ **Section 8.6** – "…The Impact Statement must:… • provide the design flood at each water crossing; • provide details on the hydraulic design of the water crossings; • quantify the effects of the Project on the hydrological regime of both the local and regional study area; in particular, in case of any watercourse diversions, describe the effects on the flow upstream and downstream of the diversion; • provide the timing of freeze/thaw cycles, ice cover, and ice conditions for surface water bodies in the Project area; • provide for each water body potentially effected by the Project, the total surface area, bathymetry, bank and bottom features, biological components, flows, maximum and mean depths, and type of substrate (sediments); …"	■ The outcomes of the desktop exercise for the water bodies crossed by the Project are not clear. ■ It is unclear which water crossings were selected for the on-the-ground field survey and how these water crossing were selected. Information at each water crossing including channel geometry and design flood are needed for the preliminary design of the crossing and the evaluation of the project effect at the water crossings. ■ It is unclear if effects on the hydrological regime of both the local and regional study area will be quantified. ■ It is unclear if the upstream and downstream effects of any watercourse diversion will be described.	■ Describe the information that will be determined during the desktop assessment for each waterbody crossing in a manner that demonstrates the requirements of Section 8.6 of the Guidelines will be met. ■ Provide details on the rationale for the selection of the list of waterbody crossings that were selected during the 2019 on-the-ground field surveys. ■ Provide the list of selected water crossings. ■ Provide details to demonstrate how the effects on the hydrological regime of both the local and regional study area will be quantified, including upstream and downstream effects of any watercourse diversion, as per the requirement in Section 8.6 of the Guidelines.	■ The development of the preliminary water body crossing list for the Project, coupled with the site selection process for the surface water field program, has been detailed in the updated version of the Surface Water Study Plan and aligns with Section 8.6 of the TISG (the Agency 2020c) and past communications with the regulatory agencies. Of particular note, streamflow and water quality monitoring will be conducted at a subset of water body crossing locations (approximately 40% of the total number of crossing locations) over multiple seasons and varying catchment scales to characterize the natural variation in flow and water quality conditions, as well as to inform the preliminary design efforts. ■ The effects assessment for the surface water VC will include an evaluation of Project-related changes on flow/runoff volumes, as well as for water diversion activities (e.g., dam and pump bypass to support the installation of water body crossing structures.	■ Section 7.2.1.1 ■ Figure 7.1 ■ Table 7.1 ■ Section 8.2
SW-05	■ **Section 4.2.2: Surface Water Quality** – "The sites selected will aim to capture the range of waterbody types and to consider important features such as fish and fish habitat, areas of groundwater-surface water interactions, and areas of Indigenous cultural importance for consumption. Sites will include rivers that will require more substantial water crossings or requiring longer construction times (i.e., Albany River, Ogoki River, Dusey River, Wabassi River, Buffaloskin River, and Gourlie Creek) and approximately 10% of the wadable water bodies crossed by the route alternatives. Proposed locations for surface water sampling are illustrated on Figure 4-2."	■ **Section 8.6** – "…The Impact Statement must:… • describe the surface water quality baseline characterization program, including sampling site selection, monitoring duration and frequency, sampling protocol, and analytical protocol, including quality assurance and quality control measures…"	■ It is unclear as to the exact number of surface water sampling locations for each of the alternative routes.	■ Provide the number of surface water sampling locations and a description of each of these locations for each of the alternative routes in the surface water study plan.	■ The site selection process for the surface water field program has been detailed in the updated version of the Surface Water Study Plan and aligns with Section 8.6 of the TISG and past communications with the regulatory agencies. Note that streamflow and water quality monitoring will be conducted at a subset of water body crossing locations (approximately 40% of the total number of crossing locations) over multiple seasons and varying catchment scales to characterize the natural variation in flow and water quality conditions. Further to the above, a location plan for the proposed surface water monitoring program (proposed water body crossing locations for ground-based field studies of water quantity and quality) has been included in the updated version of the Surface Water Study Plan.	■ Section 7.2.1 ■ Figure 7.1

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
SW-06	■ **Section 4.2.2: Surface Water Quality** – "The monitoring will be conducted to provide seasonal baseline surface water quality data for a duration of one year. Sampling will occur in spring (during high-flow conditions), and fall (during low-flow conditions). Winter sampling is not proposed due to winter access and safety concerns."	■ **Section 7.2 Sources of Baseline Information** – "…With regard to field studies, survey work must be planned to include multiple sampling locations and multiple visits to each location to support all required assessment analyses..." ■ **Section 8.6** – "The Impact Statement must:… • provide baseline surface water quality data, for a minimum of two years, for physicochemical parameters (temperature, pH, electrical conductivity, dissolved oxygen, turbidity, suspended solids) and relevant chemical constituents (major and minor ions, trace metals, radionuclides, nutrients, and organic compounds, including those of potential concern); the data should illustrate the seasonal and inter-annual variability in baseline surface water quality, including possible changes due to groundwater–surface water interactions;…"	■ Section 8.6 of the Guidelines requires baseline surface water quality data for a minimum of 2 years to illustrate seasonal and inter-annual variability in baseline surface water quality, including possible changes due to groundwater-surface water interactions. The surface water study plan is proposing to monitor seasonal baseline surface water quality data for a duration of one year only, and no monitoring in the summer. The study plan as proposed will not illustrate the seasonal and inter-annual variability in baseline surface water quality, including possible changes due to groundwater–surface water interactions. ■ The study plan identified winter access and safety concerns as reasons for not conducting winter sampling. However, no justification was provided for not conducting summer sampling.	■ Provide details to demonstrate how baseline surface water quality data will be collected for a minimum of 2 years to illustrate inter-annual variability in baseline surface water quality, including possible changes due to groundwater-surface water interactions. ■ Provide details to demonstrate how summer sampling will be conducted to illustrate seasonal variability in baseline surface water quality, including possible changes due to groundwater-surface water interactions.	■ A comprehensive surface water baseline monitoring / investigation program is proposed for the Surface Water VC. The details of this program are described in the updated version of the Surface Water Study Plan. Note that streamflow and water quality monitoring for future field studies will be conducted at a subset of water body crossing locations in the spring and summer to further characterize the natural variation in flow and water quality conditions. The results from the completed and future field studies over multiple seasons and years are expected to provide a means to define the characteristic range of natural variation in flows and water quality, recognizing that, to the extent possible, data from surveyed crossing locations will be extrapolated to non-surveyed sites with similar catchment areas, physiography, and flow regimes. In addition, it is anticipated that the ground-based field surveys conducted in 2011-2012 by Golder in support of the Cliffs Chromite Project (Project EA since terminated) will help to further augment this understanding of natural fluctuations of baseline surface water and aquatic conditions, both on an inter- and intra-annual basis, given that these previous studies occurred in a similar geographic setting as the Project, and, in many cases, the locations of waterbody crossings overlap.	■ Section 7.2.1
SW-07	■ **Section 4.2.2: Surface Water Quality** – "The surface water quality monitoring will include field measurements of physicochemical parameters (i.e., temperature, pH, electrical conductivity, dissolved oxygen, turbidity) and the collection of surface water grab samples for laboratory analysis of relevant constituents including alkalinity, total suspended solids, major and minor ions, total metals, nutrients (total phosphorus, total ammonia, total Kjeldahl nitrogen), and total and dissolved organic carbon. Field	■ **Section 8.6** – "The Impact Statement must:… • provide baseline surface water quality data, for a minimum of two years, for physicochemical parameters (temperature, pH, electrical conductivity, dissolved oxygen, turbidity, suspended solids) and relevant chemical constituents (major and minor ions, trace metals, radionuclides, nutrients, and organic compounds, including those of potential concern); the data should illustrate the seasonal and inter-annual variability in baseline surface water	■ The study plan does not indicate whether it will analyze pH, conductivity, and turbidity in the surface water grab samples in the laboratory to determine if samples changed during transport, as recommended by the Protocols Manual for Water Quality Sampling in Canada (CCME 2011). The study plan also does not indicate if it will analyze surface water grab samples for dissolved metals in the laboratory.	■ Provide details to demonstrate that all of the physicochemical parameters listed in the Guidelines, including pH, conductivity, and turbidity, will be analyzed in the surface water grab samples in the laboratory. Provide details to demonstrate that surface water grab samples will be analyzed in the laboratory for both total and dissolved metals.	■ A comprehensive surface water and sediment quality baseline monitoring / investigation program is proposed for the Surface Water VC. The details of this program are described in the updated version of the Surface Water Study Plan. Of particular note, the surface water quality sampling will be conducted at a subset of water body crossing locations over multiple seasons and catchment scales to characterize the natural variation in water quality conditions. The testing of these water quality samples (in-situ and laboratory-based) has considered the requested water quality parameters from Section 8.6 of TISG and includes plans to obtain measurements of pH,	■ Section 7.2.1.3

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	monitoring protocols will follow the Protocols Manual for Water Quality Sampling in Canada (CCME 2011) and the sample collection methods will be adjusted on a site-specific basis to consider characteristics of the water body being sampled and to ensure safety of the sampling crew." –	quality, including possible changes due to groundwater–surface water interactions;…" –			conductivity, and turbidity both in the field and in the lab. The proposed parameter suite for the laboratory-based tests of water quality samples will be focused on total metals alone (for direct comparison to Provincial Water Quality Objectives).	
SW-08	■ **Section 4.2.2: Surface Water Quality** – "Triplicate sediment samples will be collected at each monitoring site for laboratory analysis of grain size, total metals and nutrients (total organic carbon, total phosphorus, total Kjeldahl nitrogen) on a single sampling event during the monitoring period."	■ **Section 8.6** – "The Impact Statement must:… • describe the surface water quality baseline characterization program, including sampling site selection, monitoring duration and frequency, sampling protocol, and analytical protocol, including quality assurance and quality control measures;…"	■ It is unclear whether triplicate sediment samples will be collected at all monitoring sites for both Alternatives routes 1 and 4.	■ Clarify whether triplicate sediment samples will be collected at all monitoring sites.	■ Triplicate samples will be obtained at the sediment quality sampling locations.	■ Section 7.2.1.3
SW-09	■ **Section 4.2.2: Surface Water Quality** – "The surface water quality monitoring will include field measurements of physicochemical parameters (i.e., temperature, pH, electrical conductivity, dissolved oxygen, turbidity) and the collection of surface water grab samples for laboratory analysis of relevant constituents including alkalinity, total suspended solids, major and minor ions, total metals, nutrients (total phosphorus, total ammonia, total Kjeldahl nitrogen), and total and dissolved organic carbon." ■ **Section 5.1.2: Data Analysis** – "Water quality parameters will also be compared to Ontario Drinking Water Quality Standards (O. reg. 169/03 under the Safe Drinking Water Act, 2002, S.O. 2002, c. 32) for water bodies used or potentially used as a source of potable water including sources of Indigenous cultural importance for consumption."	■ **Section 8.6** – "The Impact Statement must:… • provide baseline surface water quality data, for a minimum of two years, for physicochemical parameters (temperature, pH, electrical conductivity, dissolved oxygen, turbidity, suspended solids) and relevant chemical constituents (major and minor ions, trace metals, radionuclides, nutrients, and organic compounds, including those of potential concern);…" ■ **Section 16.1** – "With respect to biophysical determinants of health, the Impact Statement must:… • identify predicted effects of the Project on the quality and quantity of ground or surface water used for domestic uses based on the most stringent guideline values of the following criteria; Canadian Drinking Water Quality Guidelines (CDWQG), Ontario Drinking Water Quality Standards (ODWQS), or Ontario Soil, Groundwater and Sediment Standards (SGSS);…"	■ The study plan does not specify monitoring of organic contaminants (e.g., combustion by-product, blasting by-product, petroleum product, etc.) that may affect surface water quality by atmospheric deposition and/or chemical spills at construction camps and along the construction corridor. ■ In addition to the monitoring parameters proposed in the surface water study plan, the groundwater study plan includes dissolved metals, organic contaminants (e.g., volatile organic compounds (VOCs) and poly-aromatic hydrocarbons (PAHs)) and radionuclide parameters. (See Section 4.2.6.2 of the groundwater study plan.) ■ If surface water bodies are used as a source of potable water, the surface water quality parameters should be expanded to include these additional contaminants of potential concern (COPCs). ■ Additionally, please note that the ODWQS include less stringent criteria than the most recent CDWQG for lead, manganese and strontium.	■ Update the study plan to provide a full list of COPCs to be addressed in the surface water study, including radionuclides and organic contaminants, as per Section 8.6 of the Guidelines. ■ Revise the study plan to confirm that the most stringent guideline values will be used to compare data, as per Section 16.1 of the Guidelines.	■ The updated version of the Surface Water Study Plan includes the full list of relevant Chemicals of Potential Concern, with the understanding that the most stringent guideline value will be considered as part of the baseline studies and effects assessment.	■ Section 7.2.1.3 ■ Section 8.1.2 ■ Section 9.4.1

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
SW-10	■ **Section 5.1.2: Data Analysis** – "Water quality data will be summarized by site, season, and year using descriptive statistics… Sediment quality data will be summarized by site using descriptive statistics."	■ **Section 8.6** – "The Impact Statement must:… • provide baseline surface water quality data, for a minimum of two years, for physicochemical parameters (temperature, pH, electrical conductivity, dissolved oxygen, turbidity, suspended solids) and relevant chemical constituents (major and minor ions, trace metals, radionuclides, nutrients, and organic compounds, including those of potential concern); the data should illustrate the seasonal and inter-annual variability in baseline surface water quality, including possible changes due to groundwater–surface water interactions;..."	■ It is unclear whether the proponent will present all water quality and sediment quality data in the Impact Statement to meet requirements of Section 8.6 of the Guidelines.	■ Update the study plan to provide detail regarding the water quality and sediment quality data that will gathered and provided in the Impact Statement, per Section 8.6 of the Guidelines.	■ The updated version of the Surface Water Study Plan includes the full details of the proposed surface water field program. The specific monitoring locations, frequency and duration of sampling activities and measurements, and the relevant parameter list for water and sediment quality testing has been aligned with Section 8.6 of the TISG (the Agency 2020c) and past communications with the regulatory agencies, noting, in particular, that streamflow and water quality monitoring will be conducted at a subset of water body crossing locations (approximately 40% of the total number of crossing locations) over multiple seasons and varying catchment scales to characterize the natural variation in flow and water quality conditions, as well as to inform the preliminary design efforts.	■ Section 7 ■ Section 8
SW-11	■ **Table 6-2: Magnitude Definition** – **"Negligible** Definition: There is little to no variation predicted in measurable parameters and is within the range of natural variation. Rationale: No discernable change to surface water therefore no impact on aquatic life or potable use. – **Low** Definition: There is a small variation predicted in measurable parameters, that are outside the range of natural variation and below the applicable guideline/objective or threshold value or within 20% of existing condition values. Rationale: Change to surface water is discernable but remains protective of aquatic life and potable water sources. – **Medium** Definition: There is a modest variation predicted in measurable parameters, is significantly different from existing conditions and is below the applicable guideline/objective or threshold	■ **Section 21** – "…Proponents must describe the extent to which residual effects are adverse. Where relevant, or where best practice or evidence-based thresholds exist, effects should be described using criteria to quantify adverse effects. This includes criteria such as whether the effects are high or low in magnitude, the geographical extent, timing, frequency, duration and reversibility of the effects, taking into account any important contextual factors. – Where the potential for human health effects exist due to exposure to a particular contaminant at any level (e.g., non-threshold air pollutants, including particulate matter and nitrogen dioxide, and water pollutants, such as but not limited to arsenic and lead) mitigation measures should aim to reduce the residual effects to as low as reasonably achievable. – In addition, effects should be characterized using language most appropriate for the effect (for example, impacts on the exercise of Aboriginal and Treaty rights and social effects may be described differently from biophysical effects)…	■ According to the study plan, the magnitude of residual effects will be determined partly based on the percentage deviation (e.g., between 20% and 50%) from the baseline condition. No explanation is provided in the study plan on how the proposed judgement criteria are developed or whether they are adequate to protect human health. ■ Furthermore, the study plan assumes that surface water quality remains protective of human health as long as contaminant levels are below the water quality criteria. However, there is no evidence of a health effect threshold at the population level upon exposure to certain water contaminants, such as arsenic and lead. The characterization of potential health impacts should acknowledge that health risks exist below criteria levels along the continuum of concentrations for these non-threshold pollutants/contaminants. ■ Health Canada encourages the use of all available technologies to reduce emissions as low as reasonably achievable (ALARA) and beyond those required to achieve applicable thresholds	■ Update the study plan to include, in the definitions for magnitude, criteria that are relevant to the protection of human health. ■ Describe the approach that will be used to ensure that these criteria are appropriate for the human health impact assessment.	■ The updated version of the Surface Water Study Plan includes added details and rationale for the magnitude definition and residual effects. ■ The identification and characterization of surface water drinking sources is captured in the Surface Water VC, with the understanding that Project-related effects on these drinking water sources will be addressed in the Human Health and Community Safety Study Plan.	■ Section 9

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
	value, or is between 20% to 50% of existing condition values. Rationale: Change to surface water is significant but remains protective of aquatic life and potable water sources – **High** Definition: There is a large variation predicted in measurable parameters, exceeds an applicable guideline/ objective or threshold value, or is greater than 50% of existing condition values. Rationale: Change to surface water is discernable and can potentially impair aquatic life or potable uses of water."	– The Impact Statement must: • characterize the residual effects using criteria most appropriate for the effect; • characterize residual effects for human health using human health-related criteria most appropriate for the carcinogenic and non-carcinogenic health effects of non-threshold contaminants;… • provide the rationale for the choice of criteria used to determine the extent to which the predicted effects are adverse. – The information provided must be clear and sufficient to enable the Agency, review panel, technical and regulatory agencies, Indigenous groups, and the public to review the proponent's analysis of effects;…"	(i.e., CDWQG levels) in order to reduce the burden of surface water pollution on the population.			
SW-12	■ **Section 7: Conformance with Federal and Provincial Guidance** – "The hydrologic analysis will include changes to the runoff characteristics and drainage patterns on a watershed basis. Hydrologic analyses will be conducted as a high-level, quantitative assessment, given that information on watershed boundaries and runoff characteristics will be coarse…. …Runoff rates will be calculated for the pre-construction (existing), during construction, and post construction conditions."	■ **Section 8.6** – "The Impact Statement must:… • develop a quantitative surface water balance for components of the Project that may result in significant changes to surface water flow patterns (e.g., large quarry/aggregate extraction/stockpiles)…" ■ **Section 14.2** – "…With respect to potential project effects on water quality in the receiving environment, the Impact Statement must: • present estimates of surface water runoff rates for major project components, including aggregate and overburden stockpiles;…"	■ It is unclear if surface water balances will be developed for components of the Project that may result in significant changes to flow patterns (including large quarry/ aggregate extraction /stockpiles). It is unclear if estimates of surface water runoff rates for major components of the Project will be presented. The information provided in Section 7 of the study plan states that the analysis will be conducted at a high level. More information is needed to determine if the requirements in Sections 8.6 and 14.2 of the Guidelines will be met.	■ Update the study plan to provide further detail to demonstrate how the requirements in Sections 8.6 and 14.2 of the Guidelines regarding the development of a surface water balance for components of the Project and the estimates of surface water runoff rates for major components of the Project, will be met.	■ Water balance analyses will be advanced to support groundwater studies at a discrete set of the proposed pits and quarries. The scope of work to conduct these water balance assessments has been documented in the Groundwater Study Plan.The baseline studies and effects assessments for the Surface Water VC will be used to evaluate the characteristic flow / runoff rates at a range of watershed scales and under existing and proposed conditions.	■ Section 8.2
SW-13	■ **Section 6: Effects Assessment Scoping** ■ **Section 7: Conformance with Federal and Provincial Guidance** – "Monitoring programs will be identified as part of the EA."	■ **Section 14.2** – "…With respect to potential project effects on water quality in the receiving environment, the Impact Statement must:… • describe any applicable water quality treatment measures and provide evidence supporting the effectiveness of these measures; • compare the quality of all effluent streams to the Canadian Council of Ministers of the Environment (CCME)	■ Section 6 of the study plan provides very general information about the effects assessment. It is unclear how many of the requirements in Section 14.2 of the Guidelines related to potential project effects on water quality in the receiving environment will be met. ■ The effects assessment must consider the effects of each of the project components and physical activities, in all	■ Provide more detail on the methodology for the effects assessment, and how it will meet the requirements described in Section 14.2 of the Guidelines.	■ The study plan is updated to provide additional detail on methodology for the Effects Assessment per Section 14.2 of the TISG (the Agency 2020c). ■ Additional information specific to groundwater quality is included in the Groundwater Study Plan.	■ Section 9

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
		Water Quality Guidelines for the Protection of Aquatic Life, and to provincial water quality objectives for contaminants of concern (e.g., arsenic, chromium, mercury) that do not have CCME guidelines. CCME's Water Quality Guideline values are national science-based voluntary guidelines developed collaboratively among provincial, territorial, and federal jurisdictions for the protection of freshwater and marine life; • describe any changes to groundwater quality that could affect surface water quality; • provide an assessment for off-site migration pathways for impacted groundwater, and an analysis of contaminant attenuation capacities within the hydrogeological units of the project study area; and • describe groundwater and surface water monitoring programs during the construction, operation and decommissioning and abandonment..."	phases, and be based on a comparison to the proposed baseline work.			
SW-14	■ **Section 6: Effects Assessment Scoping**	■ **Section 14.2** – "…If the proponent undertakes quarrying activities to extract aggregate material that may results in effects on groundwater and surface water levels (i.e., quarrying below the water table), the Impact Statement must: • present an integrated site water balance model incorporating surface and groundwater fluxes for the construction, operation and decommissioning of large quarrying sites; • describe the risk to the receiving environment related to effects to the quantity and quality of all effluent streams released from the site, including surface runoff from aggregate and overburden stockpiles, and dewatering discharge;…	■ Section 6 of the study plan provides very general information about the effects assessment. It is unclear how many of the requirements in Section 14.2 of the Guidelines related to undertaking quarrying activities to extract aggregate material will be met. ■ The effects assessment must consider the effects of each of the project components and physical activities, in all phases, and be based on a comparison to the proposed baseline work.	■ Provide more detail on the methodology for the effects assessment, and how it will meet the requirements described in Section 14.2 of the Guidelines.	■ The study plan is updated to provide additional detail on Project-environment Interactions and methodology for the Effects Assessment per Section 14.2 of the TISG (the Agency 2020c). ■ Additional information specific to groundwater quality is included in the Groundwater Study Plan.	■ Section 9

Comment # / Ref #	Draft Study Plan Section	TISG Section	Comment / Context	Action Item	Final Response	Study Plan Reference
		• identify potential risks to surface and seepage water quality from the aggregate and overburden stockpiles and project infrastructure during construction, and operation, decommissioning and abandonment; • provide aggregate sources, volumes and tonnage, and extraction construction methods;…”				

Draft Study Plan Comments – Provincial

Comment # / Ref #	Draft Study Plan Section	Agency / Regulatory Body Comments Received From	Comment / Context	Action Item	Final Response	Study Plan Reference
1	■ Page 11/Section 4.2.2 Surface Water Quality	■ MECP (Surface Water Specialist Comments)	■ Section 4.2.2 states that water and sediment quality monitoring will be carried out at select water crossings along the proposed road corridor; however, it does not indicate that such monitoring will also occur in water bodies within close proximity of other project infrastructure such as construction camps, laydown areas, aggregate sources, etc.	■ This section should outline which water bodies will be assessed, supported by a map clearly outlining sampling locations respecting water crossings, and other project infrastructure such as construction camps, laydown areas, aggregate sources, etc.	■ A location plan for the proposed surface water monitoring program (proposed water body crossing locations for ground-based field studies of water quantity and quality) has been included in the updated version of the Surface Water Study Plan. The selected sites for field studies will consider, to the extent possible, water body crossings that are located in close proximity to Project infrastructure.	■ Figure 7-1 ■ Section 7.2.1
2	■ Page 12/ Section 4.2.2 Surface Water Quality	■ MECP (Surface Water Specialist Comments)	■ Surface water quality sampling for baseline data is proposed to take place seasonally for the duration of one year. The proponent has proposed to sample in the spring (during high-flow conditions) and fall (during low-flow conditions). However, a commitment should be made to include one additional seasonal sampling event to help determine variability during the ice-free season. It is agreed that winter sampling is not conducted due to safety concerns.	■ Commit to the completion of an additional seasonal surface water quality sampling during the Environmental Assessment process to determine variability during different seasons and under different flow conditions. It is recommended that sampling be conducted under differing flow regimes (ideally corresponding to 25th, 50th and 75th percentile flow) and provide insight into seasonal variability, such that they are indicative of the following seasonal low, average and high flow conditions: spring freshet high flows (typical April and May); summer low flow periods (typically July, August and September); and fall secondary peak flows (typically October).	■ A comprehensive surface water baseline monitoring / investigation program is proposed for the Surface Water VC. The details of this program are described in the updated version of the Surface Water Study Plan, noting, in particular, that streamflow and water quality monitoring for the future field campaigns will be conducted at a subset of water body crossing locations in the spring and summer to further characterize the natural variation in flow and water quality conditions. The results from the completed and planned field studies over multiple seasons and years are expected to provide a means to define the characteristic range of natural variation in flows and water quality, recognizing that, to the extent possible, data from surveyed crossing locations will be extrapolated to non-surveyed sites with similar catchment areas, physiography, and flow regimes. In addition, it is anticipated that the ground-based field surveys conducted in 2011-2012 by Golder in support of the Cliffs Chromite Project (Project EA since terminated) will help to further augment this understanding of natural fluctuations of baseline surface water and aquatic conditions, both on an inter- and intra-annual basis, given that these previous studies occurred in a similar geographic setting as the Project, and, in many cases, the locations of waterbody crossings overlap.	■ Section 7.2.1
3	■ Page 13/ Section 4.2.2 Surface Water Quality	■ MECP (Surface Water Specialist Comments)	■ Surface water quality samples to be sent for laboratory analysis will be analyzed for alkalinity, total suspended solids, major and minor ions, total metals, nutrients (total phosphorus, total ammonia, total Kjeldahl nitrogen), and total and dissolved organic carbon. The specific ions to be analyzed should be specified in the Study Plan.	■ Section 4.2.2 to be updated to include the following specific cations and anions: – cations (i.e. H+, Mg2+, Na+, Ca2+, K+, NH4+) and – anions (i.e. Cl-, SO42-, F-, NO3-, HCO3-, CO32-, PO43-).	■ The updated version of the Surface Water Study Plan has been revised to include the requested water quality parameters for sampling / testing.	■ Section 7.2.1.3
4	■ Page 13/Section 4.2.3 Hydrology	■ MECP (Surface Water Specialist Comments)	■ The Study Plan earlier provides specifics regarding water and sediment sampling; however, section 4.2.3 study methods simply provide a description respecting information to be collected and the objective of the water crossing designs. This section should make reference to Section 5.2 Hydrology so the reader is aware that the details pertaining to how hydrologic calculations/models will be performed is found further in the Plan.	■ Section 4.2.3 to reference Section 5.2 Hydrology for detail respecting how hydrologic calculations/models will be performed.	■ The baseline studies and effects assessments for the Surface Water VC will be used to evaluate the characteristic flow / runoff rates at a range of watershed scales, as well as to estimate the potential for Project-related changes to these flow conditions.	■ Section 7.2.2
5	■ Page 14/ 5.1.2 Data Analysis	■ MECP (Surface Water Specialist Comments)	■ The Study Plan indicates that surface water quality data will be compared to Provincial Water Quality Objectives (PWQOs); and in the absence of PWQOs, against the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG-CCME). Surface water quality results should be compared against both but the more stringent of the two criteria acknowledged.	■ Section 5.1.2 should be edited to state that results of baseline surface water sampling will be compared and assessed against CCME's Water Quality Guidelines for the Protection of Aquatic Life and Ontario's Provincial Water Quality Objectives for the purpose of considering potential impacts to the environment and aquatic life; however, the more stringent of the two criteria will be acknowledged.	■ The updated version of the Surface Water Study Plan includes the full list of relevant Chemicals of Potential Concern, with the understanding that the most stringent guideline criteria will be considered as part of the baseline studies and effects assessment.	■ Section 8.1.2

Comment # / Ref #	Draft Study Plan Section	Agency / Regulatory Body Comments Received From	Comment / Context	Action Item	Final Response	Study Plan Reference
6	■ Pages 14 and 15/5.2 Hydrology	■ MECP (Surface Water Specialist Comments)	■ The Study Plan indicates that design flows/floods will be calculated for each water crossing for the purposes of hydraulic structure design and that provincially accepted hydrologic methods will be used to determine the design flows. This section can be further expanded to acknowledge that where there is no flow-related information available (flow station), flow may have to be estimated based entirely on flows from adjacent areas (pro-rating). Such information should be collected from existing flow stations in the project area and hydrology/hydraulic modelling to be used to assess waterbody crossings. However, it should also be recognized that Water Survey of Canada stations may not be available for all sites and that a prorating method may be required. Where there is no flow-related information available, flow may have to be estimated based entirely on flow from adjacent areas. Regional methods for pro-rating flow data are published in hydrological textbooks for low flows as well as other flow regimes. The methods are commonly known as: isoline, graphical index, statistical index, and regression. The use of these methods is generally qualified based on the transferability of the data. Caution should be exercised when using these extrapolation techniques and their selection thoroughly justified. Transferability of flow data to an ungauged watershed depends on several factors: type and characteristics of the system, proximity, drainage area, water use requirements and in-stream flow method used. The potential to transfer approaches across watersheds is increased where common characteristics can be identified, such as physiography, stream order, ground water regime, regulated versus unregulated flows, availability of historic information, cold water fish communities.	■ The Study Plan should acknowledge that where there is no flow-related information available (flow station), flow may have to be estimated based entirely on flows from adjacent areas. The method selected to determine these flows should be included and the direction included in the Comments & Rationale column should be considered when calculating flows.	■ The updated version of the Surface Water Study Plan provides details on the various methods to estimate flows at ungauged watersheds (including the pro-rate technique).	■ Section 8.2
7	■ Page 16 and 17/ Section 6.2.1 Surface Water Quality	■ MECP (Surface Water Specialist Comments)	■ Section 6.2.1 speaks to methods for predicting future conditions respecting surface water quality. It states: "The modelling will consider seasonal flows and water quality characteristics of the receiver as appropriate for the timing and duration of the Project activity or component that causes the residual effect. The model predictions will assume the condition of fully mixed water in the receiver." It should be noted that should an Environmental Compliance Approval (ECA) be required for an Industrial Sewage Works for this project, the information required to predict impacts to the receiver may differ from those discussed above. The ECA application process is initiated through pre-submission consultation with District and Technical Support MECP staff. Detail pertaining to application requirements would be provided to the proponent at this time.	■ Section 6.2.1 should recognize that should an Environmental Compliance Approval (ECA) be required for an Industrial Sewage Works discharge, additional information may be required to predict impacts to the receiver.	■ The updated version of the Surface Water Study Plan references the potential need to secure discharge approvals for the Project (Environmental Compliance Approval or other).	■ Section 9.4.1

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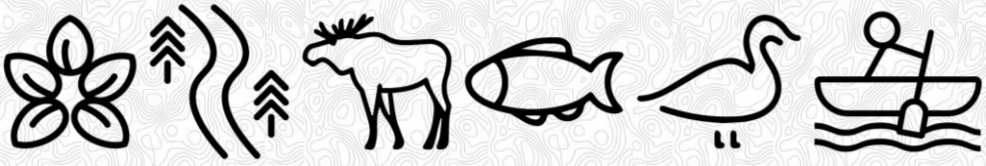

Attachment B – Surface Water Characteristics of Defined Waterbody Crossings

Table B-1: Surface Water Characteristics of Defined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Waterbody Name	Tertiary Watershed Name	Waterbody Type	Flow Regime	Mean Bankfull Width (m)	Surface Area (m²)	Surficial Geology	Dominant Channel Substrate	Mapbook Figure Location
RA1-4-WC-01	Alternative-1-and-Alternative-4	N/A	519622	5666913	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	3	- (d)	Organic deposits	Fi	B-2
RA1-4-WC-02	Alternative-1-and-Alternative-4	N/A	520105	5676979	Dusey River	Lower-Ogoki	Watercourse	Permanent	44	- (d)	Organic deposits	Co, Bo, Gr, Sa, Si, Be	B-3
RA1-4-WC-07	Alternative-1-and-Alternative-4	N/A	519091	5682476	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	6	- (d)	Till	Or	B-3
RA1-4-WC-09B	Alternative-1-and-Alternative-4	N/A	525332	5714194	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	3	- (d)	Organic deposits	Or/Si	B-4
RA1-4-WC-10	Alternative-1-and-Alternative-4	Seg3-Alt1 & Alt4	540829	5740602	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Organic deposits	Or/Si	B-6
RA1-4-WC-19	Alternative-1-and-Alternative-4	N/A	546802	5742739	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	27	- (d)	Organic deposits	Co	B-6
RA1-4-WC-21	Alternative-1-and-Alternative-4	N/A	551025	5740733	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Bedrock	Or	B-6
RA1-4-WC-27	Alternative-1-and-Alternative-4	N/A	559549	5738052	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	4	- (d)	Bedrock	Or/Co/Gr	B-6
RA1-4-WC-31	Alternative-1-and-Alternative-4	N/A	566883	5731970	Buffaloskin River	Upper-Albany---Makokibatan	Watercourse	Permanent	8	- (d)	Organic deposits	Sa	B-7
RA1-4-WC-33	Alternative-1-and-Alternative-4	N/A	569502	5733028	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	3	- (d)	Organic deposits	Or	B-7
RA1-4-WC-34	Alternative-1-and-Alternative-4	N/A	571650	5733977	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	25	- (d)	Organic deposits	Or	B-7
RA1-4-WC-35	Alternative-1-and-Alternative-4	N/A	573750	5732816	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	3	- (d)	Organic deposits	Or	B-7
RA1-4-WC-36	Alternative-1-and-Alternative-4	N/A	577681	5726015	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	16	- (d)	Organic deposits	Or	B-7
RA1-WC-01	Alternative-1	Seg1-Alt1	530918	5629153	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	6	- (d)	Bedrock	Co/Or	B-1
RA1-WC-02	Alternative-1	Seg1-Alt1	532383	5632976	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	8	- (d)	Glaciolacustrine deposits	Co/Gr	B-1
RA1-WC-05	Alternative-1	Seg1-Alt1	534175	5637960	Ogoki River	Lower-Ogoki	Watercourse	Permanent	73	- (d)	Bedrock	Bo/Co/Gr/Sa	B-2
RA1-WC-09	Alternative-1	Seg1-Alt1	532606	5644605	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	2	- (d)	Till	Or	B-2
RA1-WC-11	Alternative-1	Seg1-Alt1	534983	5649288	Ogoki River	Lower-Ogoki	Watercourse	Permanent	110	- (d)	Till	Co/Bo	B-2
RA1-WC-13	Alternative-1	Seg1-Alt1	530495	5654590	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	9	- (d)	Till	Bo/Co/Si	B-2
RA1-WC-14	Alternative-1	Seg1-Alt1	529515	5656013	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	4	- (d)	Till	Or/Si	B-2
RA1-WC-15	Alternative-1	Seg1-Alt1	528799	5657136	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	4	- (d)	Till	Or/Si	B-2
RA1-WC-16	Alternative-1	Seg1-Alt1	526864	5658007	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	7	- (d)	Organic deposits	Or/Si	B-2
RA1-WC-17	Alternative-1	Seg1-Alt1	525296	5659102	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	10	- (d)	Till	Co/Sa	B-2
RA1-WC-19	Alternative-1	Seg1-Alt1	522734	5662540	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	2	- (d)	Till	Or/Si	B-2
RA1-WC-20	Alternative-1	Seg1-Alt1	522442	5662774	Unnamed watercourse	Lower-Ogoki	Watercourse	- (b)	2	- (d)	Till	Or/Si	B-2
RA1-WC-22	Alternative-1	Seg1-Alt1	521713	5663417	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	17	- (d)	Till	Or/Si	B-2
RA1-WC-22A	Alternative-1	Seg1-Alt1	520800	5664189	Unnamed watercourse	Lower-Ogoki	Stream	Permanent	2	- (d)	- (e)	- (e)	B-2
RA1-WC-22B	Alternative-1	Seg1-Alt1	520738	5664191	Unnamed watercourse	Lower-Ogoki	Stream	Permanent	2	- (d)	- (e)	- (e)	B-2
RA1-WC-22C	Alternative-1	Seg1-Alt1	520777	5664211	Unnamed watercourse	Lower-Ogoki	Stream	Permanent	2	- (d)	- (e)	- (e)	B-2
RA1-WC-23	Alternative-1	Seg2-Alt1	521732	5691515	Unnamed watercourse	Upper-Albany---Makokibatan	Lake	Permanent	95	881460	Organic deposits	Fl/Or	B-3
RA1-WC-26	Alternative-1	Seg2-Alt1	519376	5700621	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	2	- (d)	Glaciofluvial ice-contact deposits	- (e)	B-3
RA1-WC-27	Alternative-1	Seg2-Alt1	519244	5702193	Albany River	Upper-Albany---Makokibatan	Watercourse	Permanent	200	- (d)	Glaciofluvial ice-contact deposits	Fl/Or	B-3
RA1-WC-28	Alternative-1	Seg2-Alt1	520172	5703819	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	3	- (d)	Organic deposits	- (e)	B-4
RA1-WC-29	Alternative-1	Seg2-Alt1	520833	5703964	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	- (b)	5	- (d)	Organic deposits	- (e)	B-4
RA1-WC-30	Alternative-1	Seg2-Alt1	520534	5709379	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	3	- (d)	Organic deposits	Or	B-4

Table B-1: Surface Water Characteristics of Defined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Waterbody Name	Tertiary Watershed Name	Waterbody Type	Flow Regime	Mean Bankfull Width (m)	Surface Area (m²)	Surficial Geology	Dominant Channel Substrate	Mapbook Figure Location
RA1-WC-32	Alternative-1	Seg2-Alt1	522111	5711797	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Organic deposits	Si/Or	B-4
RA1-WC-38	Alternative-1	Seg3-Alt1	525639	5715632	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	2	- (d)	- (e)	- (e)	B-4
RA1-WC-39	Alternative-1	Seg3-Alt1	525659	5718840	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	2	- (d)	- (e)	- (e)	B-4
RA1-WC-40	Alternative-1	Seg3-Alt1	525513	5719057	Gourlie Creek	Upper-Albany---Makokibatan	Watercourse	Permanent	17	- (d)	Organic deposits	- (e)	B-4
RA1-WC-41	Alternative-1	Seg3-Alt1	521635	5720108	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	4	- (d)	Organic deposits	Bo/Or	B-4
RA1-WC-42	Alternative-1	Seg3-Alt1	519909	5721171	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	4	- (d)	Organic deposits	- (e)	B-4
RA1-WC-44	Alternative-1	Seg3-Alt1	516855	5724132	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	<1	- (d)	Glaciofluvial ice-contact deposits	Or/Si	B-4
RA1-WC-51	Alternative-1	Seg3-Alt1	510970	5732829	Wabassi River	Upper-Albany---Makokibatan	Watercourse	Permanent	65	- (d)	Organic deposits	Fl/Or	B-4
RA1-WC-52	Alternative-1	Seg3-Alt1	510968	5733080	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	40	- (d)	- (e)	- (e)	B-4
RA1-WC-53	Alternative-1	Seg3-Alt1	511307	5734190	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	9	- (d)	Organic deposits	Or	B-4
RA1-WC-54	Alternative-1	Seg3-Alt1	511339	5734297	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	- (b)	20	- (d)	Organic deposits	Or	B-4
RA1-WC-56	Alternative-1	Seg3-Alt1	513924	5740981	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	- (b)	1	- (d)	Organic deposits	Or/Si	B-5
RA1-WC-57	Alternative-1	Seg3-Alt1	518320	5743418	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	32	- (d)	Organic deposits	Si, Or, Sa	B-5
RA1-WC-58	Alternative-1	Seg3-Alt1	519149	5743642	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	- (b)	50	- (d)	Organic deposits	Or	B-5
RA1-WC-60	Alternative-1	Seg3-Alt1	523117	5742644	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	- (b)	<1	- (d)	Organic deposits	- (e)	B-5
RA1-WC-66	Alternative-1	Seg3-Alt1	527414	5740047	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	5	- (d)	Organic deposits	Or	B-5
RA1-WC-67	Alternative-1	Seg3-Alt1	531917	5741009	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	22	- (d)	Organic deposits	Or	B-5
RA1-WC-68	Alternative-1	Seg3-Alt1	533421	5740556	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	- (b)	<1	- (d)	Organic deposits	- (e)	B-5
RA4B-WC-01	Alternative-4	Seg1-Alt4_West	512247	5636612	Ogoki River	Lower-Ogoki	Watercourse	Permanent	110	- (d)	- (e)	Gr/Fl/Bo	B-2
RA4B-WC-02	Alternative-4	Seg1-Alt4_West	517166	5631036	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	2	- (d)	- (e)	- (e)	B-1
RA4B-WC-03	Alternative-4	Seg1-Alt4_West	516056	5631437	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	>5	- (d)	- (e)	- (e)	B-1
RA4B-WC-04	Alternative-4	Seg1-Alt4_West	511308	5638417	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	>5	- (d)	- (e)	- (e)	B-2
RA4-WC-00	Alternative-4	Seg1-Alt4_East & West	524202	5620008	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	4	- (d)	- (e)	- (e)	B-1
RA4-WC-02	Alternative-4	Seg1-Alt4_East & West	521688	5624119	Colpitts Creek	Lower-Ogoki	Watercourse	Permanent	11	- (d)	Organic deposits	Fl	B-1
RA4-WC-05	Alternative-4	Seg1-Alt4_East & West	519747	5628176	Unnamed watercourse	Lower-Ogoki	Lake	Permanent	11	- (d)	Organic deposits	Fl	B-1
RA4-WC-12	Alternative-4	Seg1-Alt4_East	518647	5635591	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	10	- (d)	Organic deposits	Or	B-1
RA4-WC-13	Alternative-4	Seg1-Alt4_East	517166	5636864	Unnamed watercourse	Lower-Ogoki	Watercourse	- (b)	<1	- (d)	Glaciolacustrine deposits	Or	B-2
RA4-WC-14	Alternative-4	Seg1-Alt4_East	517473	5637479	Unnamed watercourse	Lower-Ogoki	Lake	Permanent	15	- (d)	Glaciolacustrine deposits	Or	B-2
RA4-WC-15	Alternative-4	Seg1-Alt4_East	517655	5638092	Patience Lake	Lower-Ogoki	Lake	Permanent	349	4317390	Bedrock	Gr/Fl/Bo	B-2
RA4-WC-16	Alternative-4	Seg1-Alt4_East & West	519010	5642518	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	<1	- (d)	Bedrock	Or	B-2
RA4-WC-17	Alternative-4	Seg1-Alt4_East & West	522159	5646017	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	30	- (d)	Bedrock	Or	B-2
RA4-WC-18	Alternative-4	Seg1-Alt4_East & West	521894	5647392	Unnamed watercourse	Lower-Ogoki	Lake	Permanent	18	253570	Organic deposits	Co, Gr, Bo, SA, Si, Or	B-2
RA4-WC-19	Alternative-4	Seg1-Alt4_East & West	523071	5649798	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	3	- (d)	Bedrock	Or	B-2
RA4-WC-20	Alternative-4	Seg1-Alt4_East & West	520992	5654446	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	3	- (d)	Till	Fines	B-2
RA4-WC-21	Alternative-4	Seg1-Alt4_East & West	521131	5656047	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	8	- (d)	Till	Or	B-2

Table B-1: Surface Water Characteristics of Defined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Waterbody Name	Tertiary Watershed Name	Waterbody Type	Flow Regime	Mean Bankfull Width (m)	Surface Area (m²)	Surficial Geology	Dominant Channel Substrate	Mapbook Figure Location
RA4-WC-22	Alternative-4	Seg1-Alt4_East & West	520890	5657391	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	9	- (d)	Till	Co/Bo/Fl/Gr	B-2
RA4-WC-23	Alternative-4	Seg1-Alt4_East & West	519751	5658577	Unnamed watercourse	Lower-Ogoki	Watercourse	- (b)	4	- (d)	Bedrock	Or	B-2
RA4-WC-24	Alternative-4	Seg1-Alt4_East & West	519967	5659797	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	1	- (d)	Bedrock	Or	B-2
RA4-WC-25	Alternative-4	Seg1-Alt4_East & West	519870	5662127	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	8	- (d)	Organic deposits	Bo, Sa, Gr, Co, Si	B-2
RA4-WC-26	Alternative-4	Seg1-Alt4_East & West	519974	5663183	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	6	- (d)	Till	Fi, CO, Bo, Gr	B-2
RA4-WC-27	Alternative-4	Seg2-Alt4	522053	5691380	Unnamed watercourse	Upper-Albany---Makokibatan	Lake	Permanent	178	881460	Organic deposits	Or	B-3
RA4-WC-29	Alternative-4	Seg2-Alt4	523148	5695934	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	8	- (d)	Organic deposits	- (e)	B-3
RA4-WC-31	Alternative-4	Seg2-Alt4	523972	5698738	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	4	- (d)	Organic deposits	- (e)	B-3
RA4-WC-32	Alternative-4	Seg2-Alt4	524169	5702612	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	3	- (d)	Organic deposits	- (e)	B-3, B-4
RA4-WC-34	Alternative-4	Seg2-Alt4	525100	5705282	Albany River	Upper-Albany---Makokibatan	Watercourse	Permanent	77	- (d)	Organic deposits	Bo, Sa,Co, Gr	B-4
RA4-WC-35	Alternative-4	Seg2-Alt4	524970	5705565	Unnamed watercourse	Upper-Albany---Makokibatan	Stream	Permanent	2	- (d)	- (e)	- (e)	B-4
RA4-WC-36	Alternative-4	Seg2-Alt4	524911	5706281	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	- (c)	- (d)	- (e)	- (e)	B-4
RA4-WC-37	Alternative-4	Seg2-Alt4	524697	5708581	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Organic deposits	- (e)	B-4
RA4-WC-41	Alternative-4	Seg3-Alt4	526665	5715963	Gourlie Creek	Upper-Albany---Makokibatan	Watercourse	Permanent	34	- (d)	Organic deposits	Sa/Si	B-4
RA4-WC-42	Alternative-4	Seg3-Alt4	527995	5717404	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Glaciolacustrine deposits	Or/Si	B-4
RA4-WC-43	Alternative-4	Seg3-Alt4	528554	5718881	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	25	- (d)	- (e)	- (e)	B-4
RA4-WC-45	Alternative-4	Seg3-Alt4	530801	5722972	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	10	- (d)	Organic deposits	Or/Si	B-4
RA4-WC-50	Alternative-4	Seg3-Alt4	534466	5725709	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	2	- (d)	- (e)	Or	B-4
RA4-WC-55	Alternative-4	Seg3-Alt4	539004	5735928	Wabassi River	Upper-Albany---Makokibatan	Watercourse	Permanent	50	- (d)	Till	Co/Gr	B-6
RA4-WC-57	Alternative-4	Seg3-Alt4	539258	5736888	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	2	- (d)	Organic deposits	Or/Si	B-6
RA4-WC-58	Alternative-4	Seg3-Alt4	539324	5737051	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	15	- (d)	Organic deposits	Or/Si	B-6

a) Based on map projection Universal Transverse Mercator (UTM), Zone 16U (latitude band between 48 and 56 degrees north), with geodetic coordinates based on the NAD83 datum.
b) Waterbody is not permanent.
c) Channel width of watercourse (as an indicator stream size), average of several measurements. Widths at several locations could not be delineated with the aid of aerial imagery, due to forest cover, riparian vegetation, or other obstructions and are designated with "-".
d) Not applicable, a watercourse.
e) Not assessed.
Be = Bedrock; Bo = Boulder; Co = Cobble; Fi = Fine; Gr = Gravel; ID = identification; N/A = not applicable; NAD83 = North American Datum of 1983; Or = Organic; Sa = Sand Si = Silt; UTM = Universal Transverse Mercator.

RA4-WC-12
HARROGATE LAKE
ESSER LAKE
OGOKI RIVER
RA1-WC-02
MCCAW LAKE
RA4B-WC-03
RA4B-WC-02
RA1-WC-01
RA4-WC-05
PAINTER LAKE
DEBAERE LAKE
RA4-WC-02
ORVISS LAKE
COLPITTS LAKE
BURY LAKE
PIGMENT LAKE
RA4-WC-00
CRONY LAKE
RENWICK LAKE
ZURBRIGG LAKE
BURNABY LAKE
SAGA LAKE
KAPIKOTONGWA RIVER
PERCY LAKE
LITTLE CURRENT RIVER
JUNGFRAU LAKE
LITTLE JUNGFRAU LAKE
FARRELL LAKE
MURIEL RIVER
RUNWAY LAKE

Map Location

Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Defined Water Crossings

0 — 2.25 — 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure B-1

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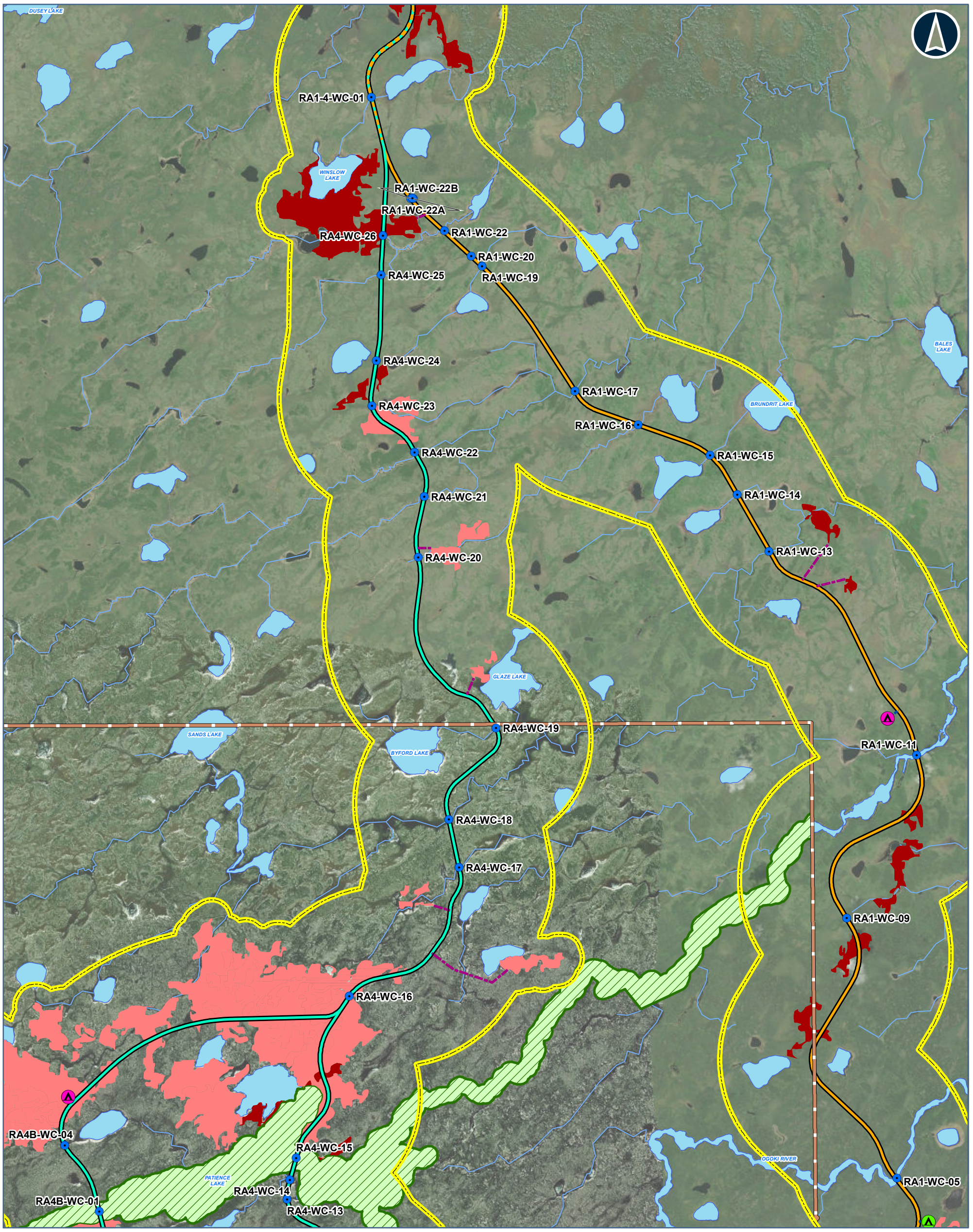

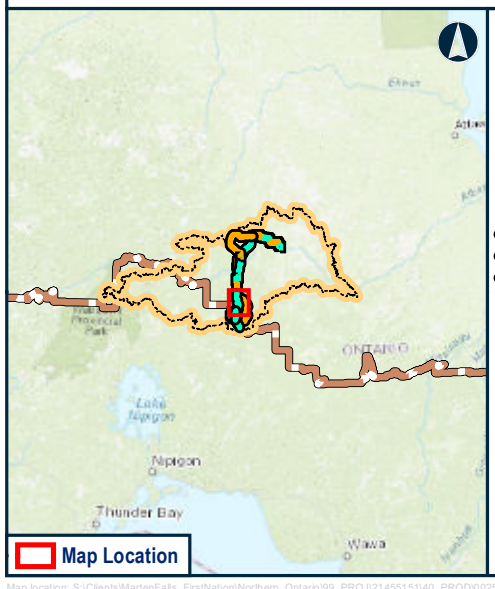

Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Defined Water Crossings

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Kilometres

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Figure B-2

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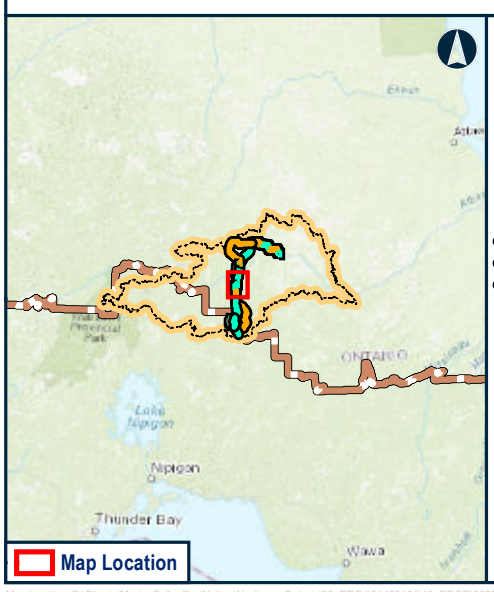
RA1-WC-27
RA4-WC-32
RA1-WC-26
RA4-WC-31
TEABEAU LAKE
RA4-WC-29
TOLFREE LAKE
ALBANY RIVER
RA1-WC-23
RA4-WC-27
SUWALA LAKE
RA1-4-WC-07
DUSEY RIVER
RA1-4-WC-02
TANASE LAKE
DUSEY LAKE



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Defined Water Crossings

0 — 2.25 — 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure B-3

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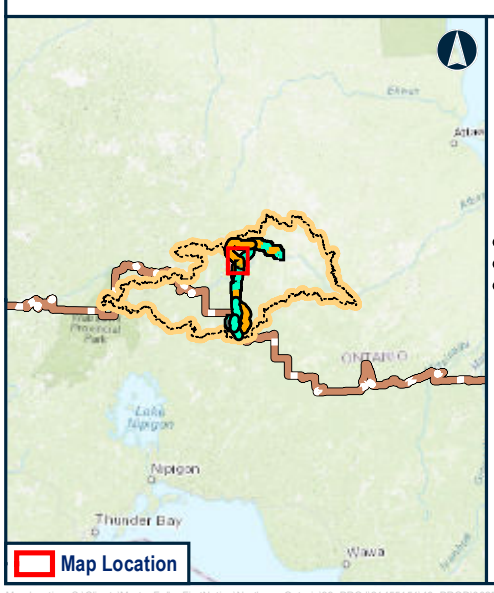
RA1-WC-54
RA1-WC-53
RA1-WC-52
RA1-WC-51
WABASSI RIVER
VENTON LAKE
MAXEY LAKE
RA1-WC-44
RA1-WC-42
RA1-WC-41
RA1-WC-40
RA1-WC-39
RA1-WC-38
RA1-4-WC-09B
RA1-WC-32
RA1-WC-30
RA1-WC-29
RA1-WC-28
SAARIMAKI LAKE
RA4-WC-50
RA4-WC-45
RA4-WC-43
RA4-WC-42
RA4-WC-41
TREBELL LAKE
RA4-WC-37
RA4-WC-36
RA4-WC-35
RA4-WC-34
RA4-WC-32
ALBANY RIVER



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Defined Water Crossings

0 — 2.25 — 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure B-4

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GARVEY LAKE

SLADE LAKE

MABIE LAKE

OXTOBY LAKE

RA1-WC-56

RA1-WC-57

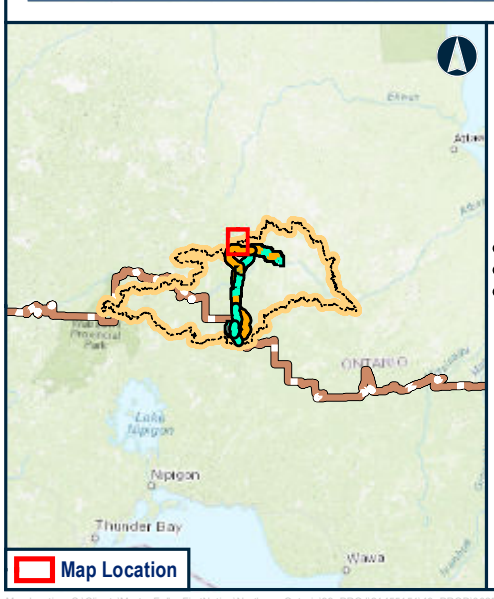
RA1-WC-58

RA1-WC-60

RA1-WC-66

RA1-WC-67

RA1-WC-68



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
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- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Defined Water Crossings

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Kilometres

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GURDEN LAKE

GITTINS LAKE

RA1-4-WC-19

RA1-4-WC-10

RA1-4-WC-21

RA1-4-WC-27

RA4-WC-58

RA4-WC-57

RA4-WC-55

WABASSI RIVER

ALBANY RIVER

Map Location

Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Defined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure B-6

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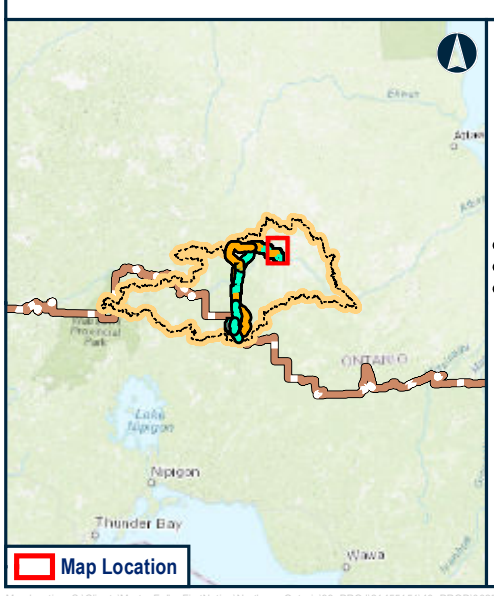
SEBERT LAKE
GURDEN LAKE
TIFFIN LAKE
RA1-4-WC-31
RA1-4-WC-33
RA1-4-WC-34
RA1-4-WC-35
RA1-4-WC-36
ALBANY RIVER



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Defined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure B-7

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Table B-2: Surface Water Characteristics of Defined Waterbody Crossings

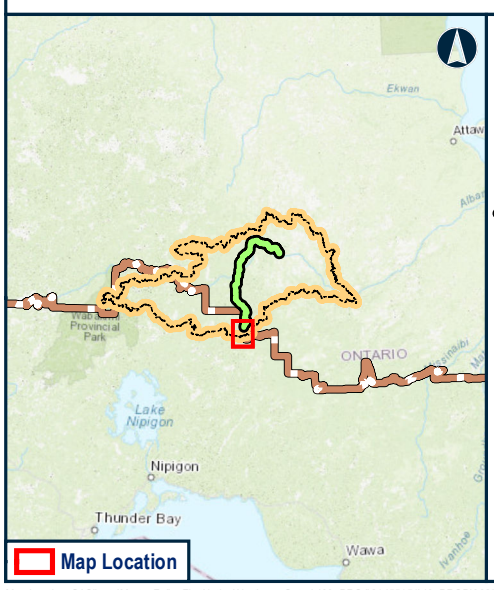
Waterbody Crossing ID	Route	Easting (a)	Northing (a)	Waterbody Name	Tertiary Watershed Name	Waterbody Type	Flow Regime	Mean Bankfull Width (m)	Surface Area (m²)	Surficial Geology	Dominant Channel Substrate	Mapbook Figure Location
RA1-4-WC-01	Preferred	519622	5666913	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	3	- (d)	Organic deposits	Fi	B-9
RA1-4-WC-02	Preferred	520105	5676979	Dusey River	Lower-Ogoki	Watercourse	Permanent	44	- (d)	Organic deposits	Co, Bo, Gr, Sa, Si, Be	B-10
RA1-4-WC-07	Preferred	519091	5682476	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	6	- (d)	Till	Or	B-10
RA1-4-WC-09B	Preferred	525332	5714194	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	3	- (d)	Organic deposits	Or/Si	B-11
RA1-4-WC-10	Preferred	540829	5740602	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Organic deposits	Or/Si	B-12
RA1-4-WC-19	Preferred	546802	5742739	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	27	- (d)	Organic deposits	Co	B-12
RA1-4-WC-21	Preferred	551025	5740733	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Bedrock	Or	B-12
RA1-4-WC-27	Preferred	559549	5738052	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	4	- (d)	Bedrock	Or/Co/Gr	B-12
RA1-4-WC-31	Preferred	566883	5731970	Buffaloskin River	Upper-Albany---Makokibatan	Watercourse	Permanent	8	- (d)	Organic deposits	Sa	B-13
RA1-4-WC-33	Preferred	569502	5733028	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	3	- (d)	Organic deposits	Or	B-13
RA1-4-WC-34	Preferred	571650	5733977	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	25	- (d)	Organic deposits	Or	B-13
RA1-4-WC-35	Preferred	573750	5732816	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	3	- (d)	Organic deposits	Or	B-13
RA1-4-WC-36	Preferred	577681	5726015	Unnamed watercourse	Upper-Albany---Muswabik	Watercourse	Permanent	16	- (d)	Organic deposits	Or	B-13
RA1-WC-01	Preferred	530918	5629153	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	6	- (d)	Bedrock	Co/Or	B-8
RA1-WC-02	Preferred	532383	5632976	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	8	- (d)	Glaciolacustrine deposits	Co/Gr	B-8
RA1-WC-05	Preferred	534175	5637960	Ogoki River	Lower-Ogoki	Watercourse	Permanent	73	- (d)	Bedrock	Bo/Co/Gr/Sa	B-9
RA1-WC-09	Preferred	532606	5644605	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	2	- (d)	Till	Or	B-9
RA1-WC-11	Preferred	534983	5649288	Ogoki River	Lower-Ogoki	Watercourse	Permanent	110	- (d)	Till	Co/Bo	B-9
RA1-WC-13	Preferred	530495	5654590	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	9	- (d)	Till	Bo/Co/Si	B-9
RA1-WC-14	Preferred	529515	5656013	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	4	- (d)	Till	Or/Si	B-9
RA1-WC-15	Preferred	528799	5657136	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	4	- (d)	Till	Or/Si	B-9
RA1-WC-16	Preferred	526864	5658007	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	7	- (d)	Organic deposits	Or/Si	B-9
RA1-WC-17	Preferred	525296	5659102	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	10	- (d)	Till	Co/Sa	B-9
RA1-WC-19	Preferred	522734	5662540	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	2	- (d)	Till	Or/Si	B-9
RA1-WC-20	Preferred	522442	5662774	Unnamed watercourse	Lower-Ogoki	Watercourse	- (b)	2	- (d)	Till	Or/Si	B-9
RA1-WC-22	Preferred	521713	5663417	Unnamed watercourse	Lower-Ogoki	Watercourse	Permanent	17	- (d)	Till	Or/Si	B-9
RA1-WC-22A	Preferred	520800	5664189	Unnamed watercourse	Lower-Ogoki	Stream	Permanent	2	- (d)	- (e)	- (e)	B-9
RA1-WC-22B	Preferred	520738	5664191	Unnamed watercourse	Lower-Ogoki	Stream	Permanent	2	- (d)	- (e)	- (e)	B-9
RA1-WC-22C	Preferred	520777	5664211	Unnamed watercourse	Lower-Ogoki	Stream	Permanent	2	- (d)	- (e)	- (e)	B-9

Table B-2: Surface Water Characteristics of Defined Waterbody Crossings

Waterbody Crossing ID	Route	Easting (a)	Northing (a)	Waterbody Name	Tertiary Watershed Name	Waterbody Type	Flow Regime	Mean Bankfull Width (m)	Surface Area (m²)	Surficial Geology	Dominant Channel Substrate	Mapbook Figure Location
RA4-WC-27	Preferred	522053	5691380	Unnamed watercourse	Upper-Albany---Makokibatan	Lake	Permanent	178	881460	Organic deposits	Or	B-10
RA4-WC-29	Preferred	523148	5695934	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	8	- (d)	Organic deposits	- (e)	B-10
RA4-WC-31	Preferred	523972	5698738	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	4	- (d)	Organic deposits	- (e)	B-10
RA4-WC-32	Preferred	524169	5702612	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	3	- (d)	Organic deposits	- (e)	B-10, B-11
RA4-WC-34	Preferred	525100	5705282	Albany River	Upper-Albany---Makokibatan	Watercourse	Permanent	77	- (d)	Organic deposits	Bo, Sa,Co, Gr	B-11
RA4-WC-35	Preferred	524970	5705565	Unnamed watercourse	Upper-Albany---Makokibatan	Stream	Permanent	2	- (d)	- (e)	- (e)	B-11
RA4-WC-36	Preferred	524911	5706281	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	- (c)	- (d)	- (e)	- (e)	B-11
RA4-WC-37	Preferred	524697	5708581	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Organic deposits	- (e)	B-11
RA4-WC-41	Preferred	526665	5715963	Gourlie Creek	Upper-Albany---Makokibatan	Watercourse	Permanent	34	- (d)	Organic deposits	Sa/Si	B-11
RA4-WC-42	Preferred	527995	5717404	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	6	- (d)	Glaciolacustrine deposits	Or/Si	B-11
RA4-WC-43	Preferred	528554	5718881	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	25	- (d)	- (e)	- (e)	B-11
RA4-WC-45	Preferred	530801	5722972	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	10	- (d)	Organic deposits	Or/Si	B-11
RA4-WC-50	Preferred	534466	5725709	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	2	- (d)	- (e)	Or	B-11
RA4-WC-55	Preferred	539004	5735928	Wabassi River	Upper-Albany---Makokibatan	Watercourse	Permanent	50	- (d)	Till	Co/Gr	B-12
RA4-WC-57	Preferred	539258	5736888	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	2	- (d)	Organic deposits	Or/Si	B-12
RA4-WC-58	Preferred	539324	5737051	Unnamed watercourse	Upper-Albany---Makokibatan	Watercourse	Permanent	15	- (d)	Organic deposits	Or/Si	B-12

a) Based on map projection Universal Transverse Mercator (UTM), Zone 16U (latitude band between 48 and 56 degrees north), with geodetic coordinates based on the NAD83 datum.
b) Waterbody is not permanent.
c) Channel width of watercourse (as an indicator stream size), average of several measurements. Widths at several locations could not be delineated with the aid of aerial imagery, due to forest cover, riparian vegetation, or other obstructions and are designated with "-".
d) Not applicable, a watercourse.
e) Not assessed.
Be = Bedrock; Bo = Boulder; Co = Cobble; Fi = Fine; Gr = Gravel; ID = identification; N/A = not applicable; NAD83 = North American Datum of 1983; Or = Organic; Sa = Sand Si = Silt; UTM = Universal Transverse Mercator.

RA1-WC-02
RA1-WC-01
ESSER LAKE
OGOKI RIVER
MCCAW LAKE
PAINTER LAKE
DEBAERE LAKE
COVEY LAKE
BURY LAKE
PIGMENT LAKE
CRONY LAKE
RENWICK LAKE
SLY LAKE
ZURBRIGG LAKE
BURNABY LAKE
KAPIKOTONGWA RIVER
LITTLE CURRENT RIVER
JUNGFRAU LAKE
PERCY LAKE
FARRELL LAKE
MURIEL RIVER
RUNWAY LAKE



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Defined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure B-8

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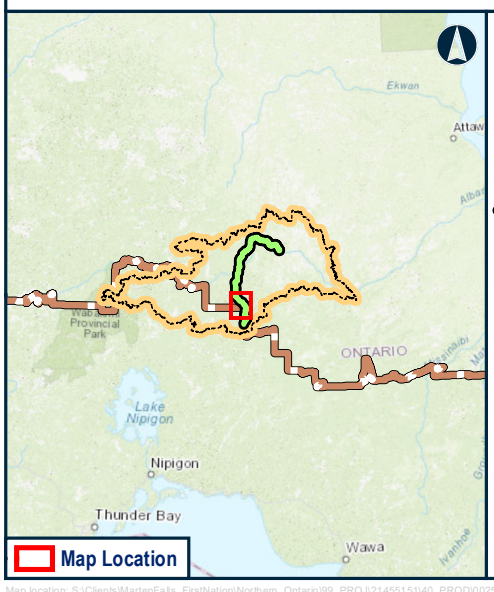
RA1-4-WC-01
RA1-WC-22A
RA1-WC-22B
RA1-WC-22C
RA1-WC-22
RA1-WC-20
RA1-WC-19
RA1-WC-17
RA1-WC-16
RA1-WC-15
RA1-WC-14
RA1-WC-13
RA1-WC-11
RA1-WC-09
RA1-WC-05
WINSLOW LAKE
BALES LAKE
BRUNDRIT LAKE
GLAZE LAKE
SANDS LAKE
BYFORD LAKE
OGOKI RIVER
PATIENCE LAKE



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Defined Water Crossings

0 — 2.25 — 4.5
Kilometres

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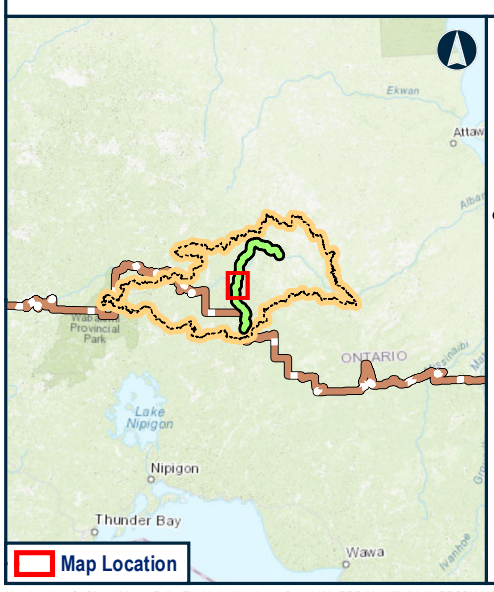
RA4-WC-32
RA4-WC-31
RA4-WC-29
RA4-WC-27
RA1-4-WC-07
RA1-4-WC-02
TEABEAU LAKE
ALBANY RIVER
TOLFREE LAKE
SUWALA LAKE
DUSEY RIVER
TANASE LAKE
DUSEY LAKE



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Defined Water Crossings

0 — 2.25 — 4.5
Kilometres

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Figure B-10

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WABASSI RIVER
MAXEY LAKE
VENTON LAKE
TREBELL LAKE
SAARIMAKI LAKE
ALBANY RIVER
RA4-WC-50
RA4-WC-45
RA4-WC-43
RA4-WC-42
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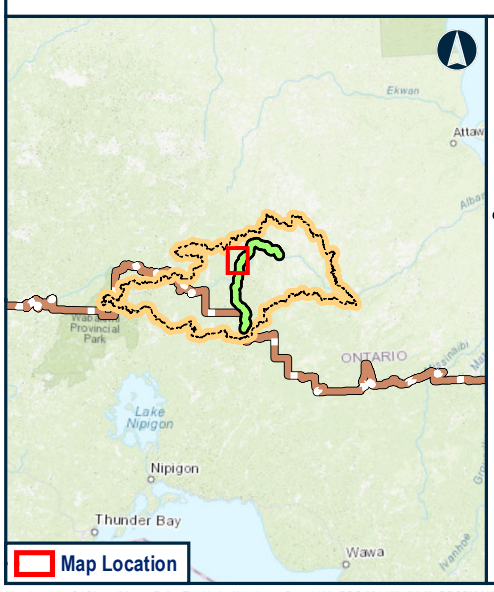
RA4-WC-32



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Defined Water Crossings

0 — 2.25 — 4.5
Kilometres

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Figure B-11

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GUKDEN LAKE

GITTINS LAKE

RA1-4-WC-19

RA1-4-WC-10

RA1-4-WC-21

RA1-4-WC-27

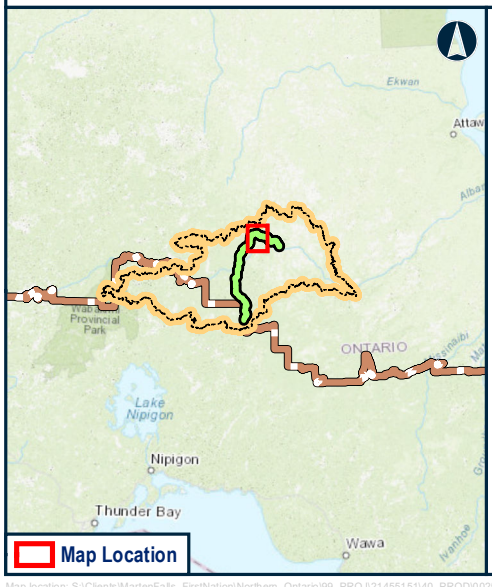
RA4-WC-57

RA4-WC-58

RA4-WC-55

WABASSI RIVER

ALBANY RIVER



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Defined Water Crossings

0 — 2.25 — 4.5
Kilometres

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Figure B-12

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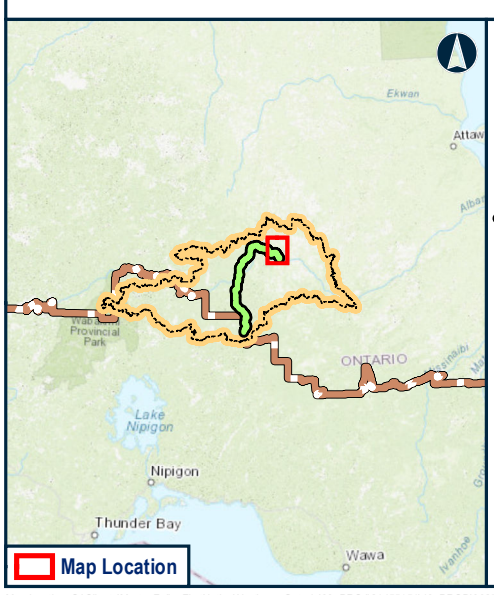
Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0009.mxd
Date Saved: 2/11/2026 1:47:11 PM User Name: INRR172702

SEBERT LAKE
GURDEN LAKE
TIFFIN LAKE
RA1-4-WC-34
RA1-4-WC-33
RA1-4-WC-35
RA1-4-WC-31
RA1-4-WC-36
ALBANY RIVER



Legend

WATER CROSSING
- DEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Defined Water Crossings

0 2.25 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure B-13

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0009.mxd
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Attachment C – Surface Water Characteristics of Undefined Waterbody Crossings

Table C-1: Surface Water Characteristics of Undefined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Tertiary Watershed Name	Mapped or Unmapped	Flow Regime	Flow Class	Approximate Bankfull Width (c)(m)	Surficial Geology	Mapbook Figure Location
RA1-4-WC-03	Alternative-1-and-Alternative-4	N/A	520000	5677586	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-3
RA1-4-WC-04	Alternative-1-and-Alternative-4	N/A	519811	5678161	Lower-Ogoki	Mapped	Permanent	Primary	<1	- (b)	C-3
RA1-4-WC-05	Alternative-1-and-Alternative-4	N/A	519666	5680140	Lower-Ogoki	Mapped	Permanent	Primary	<1	- (b)	C-3
RA1-4-WC-06	Alternative-1-and-Alternative-4	N/A	519637	5680917	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-3
RA1-4-WC-08	Alternative-1-and-Alternative-4	N/A	518949	5682735	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Organic deposits	C-3
RA1-4-WC-09	Alternative-1-and-Alternative-4	N/A	519730	5684531	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Glaciofluvial ice-contact deposits	C-3
RA1-4-WC-11	Alternative-1-and-Alternative-4	N/A	541778	5741437	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-12	Alternative-1-and-Alternative-4	N/A	543279	5742500	Upper-Albany---Makokibatan	Mapped	Permanent	- (b)	<1	Organic deposits	C-6
RA1-4-WC-13	Alternative-1-and-Alternative-4	N/A	544083	5742651	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-14	Alternative-1-and-Alternative-4	N/A	544153	5742644	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-15	Alternative-1-and-Alternative-4	N/A	544234	5742636	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-16	Alternative-1-and-Alternative-4	N/A	544305	5742628	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-17	Alternative-1-and-Alternative-4	N/A	544347	5742624	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-18	Alternative-1-and-Alternative-4	N/A	545375	5742501	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-20	Alternative-1-and-Alternative-4	N/A	548340	5742737	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-22	Alternative-1-and-Alternative-4	N/A	552546	5739419	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-23	Alternative-1-and-Alternative-4	N/A	554544	5739414	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-24	Alternative-1-and-Alternative-4	N/A	555686	5739573	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-25	Alternative-1-and-Alternative-4	N/A	556921	5738753	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-26	Alternative-1-and-Alternative-4	N/A	558205	5738243	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA1-4-WC-28	Alternative-1-and-Alternative-4	N/A	562103	5738045	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-7
RA1-4-WC-29	Alternative-1-and-Alternative-4	N/A	563810	5734170	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-7

Table C-1: Surface Water Characteristics of Undefined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Tertiary Watershed Name	Mapped or Unmapped	Flow Regime	Flow Class	Approximate Bankfull Width (c)(m)	Surficial Geology	Mapbook Figure Location
RA1-4-WC-30	Alternative-1-and-Alternative-4	N/A	563822	5734153	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-7
RA1-4-WC-32	Alternative-1-and-Alternative-4	N/A	567922	5732413	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-7
RA1-WC-03	Alternative-1	Seg1-Alt1	533812	5634366	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-1
RA1-WC-04	Alternative-1	Seg1-Alt1	534433	5635846	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-1
RA1-WC-06	Alternative-1	Seg1-Alt1	532919	5639277	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Bedrock	C-2
RA1-WC-07	Alternative-1	Seg1-Alt1	532590	5642637	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-2
RA1-WC-08	Alternative-1	Seg1-Alt1	532911	5643535	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-2
RA1-WC-10	Alternative-1	Seg1-Alt1	532424	5646501	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-2
RA1-WC-12	Alternative-1	Seg1-Alt1	532144	5653442	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-2
RA1-WC-18	Alternative-1	Seg1-Alt1	523029	5662298	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-2
RA1-WC-21	Alternative-1	Seg1-Alt1	522006	5663171	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-2
RA1-WC-24	Alternative-1	Seg2-Alt1	521657	5691768	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-3
RA1-WC-25	Alternative-1	Seg2-Alt1	519678	5699413	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Till	C-3
RA1-WC-31	Alternative-1	Seg2-Alt1	521587	5711787	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA1-WC-33	Alternative-1	Seg2-Alt1	522725	5711811	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-4
RA1-WC-34	Alternative-1	Seg2-Alt1	523410	5712188	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA1-WC-35	Alternative-1	Seg2-Alt1	523937	5712348	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-4
RA1-WC-37	Alternative-1	Seg3-Alt1	525524	5714913	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	- (b)	C-4
RA1-WC-43	Alternative-1	Seg3-Alt1	518281	5722675	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Glaciofluvial ice-contact deposits	C-4
RA1-WC-55	Alternative-1	Seg3-Alt1	511484	5734824	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	20	- (b)	C-4
RA1-WC-59	Alternative-1	Seg3-Alt1	521927	5742953	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-5
RA1-WC-61	Alternative-1	Seg3-Alt1	523202	5742193	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-5

Table C-1: Surface Water Characteristics of Undefined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Tertiary Watershed Name	Mapped or Unmapped	Flow Regime	Flow Class	Approximate Bankfull Width (c)(m)	Surficial Geology	Mapbook Figure Location
RA1-WC-62	Alternative-1	Seg3-Alt1	523242	5741847	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-5
RA1-WC-63	Alternative-1	Seg3-Alt1	523650	5740383	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-5
RA1-WC-64	Alternative-1	Seg3-Alt1	523623	5740411	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-5
RA1-WC-65	Alternative-1	Seg3-Alt1	524043	5739988	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-5
RA1-WC-69	Alternative-1	Seg3-Alt1	534369	5740229	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-5
RA4-WC-01	Alternative-4	Seg1-Alt4_East & West	523541	5621344	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-1
RA4-WC-03	Alternative-4	Seg1-Alt4_East & West	521041	5625041	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Bedrock	C-1
RA4-WC-04	Alternative-4	Seg1-Alt4_East & West	519778	5627216	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-1
RA4-WC-06	Alternative-4	Seg1-Alt4_East & West	518282	5629251	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-1
RA4-WC-07	Alternative-4	Seg1-Alt4_East & West	518280	5629260	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-1
RA4-WC-08	Alternative-4	Seg1-Alt4_East & West	518276	5629324	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-1
RA4-WC-09	Alternative-4	Seg1-Alt4_East & West	518270	5629412	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-1
RA4-WC-10	Alternative-4	Seg1-Alt4_East & West	518270	5629419	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-1
RA4-WC-11	Alternative-4	Seg1-Alt4_East & West	518268	5629451	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-1
RA4-WC-28	Alternative-4	Seg2-Alt4	522327	5694071	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-3
RA4-WC-30	Alternative-4	Seg2-Alt4	523610	5697164	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	6	Organic deposits	C-3
RA4-WC-33	Alternative-4	Seg2-Alt4	524442	5703680	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA4-WC-38	Alternative-4	Seg2-Alt4	524820	5709893	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA4-WC-40	Alternative-4	Seg3-Alt4	526271	5715544	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-4
RA4-WC-44	Alternative-4	Seg3-Alt4	529272	5721878	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA4-WC-46	Alternative-4	Seg3-Alt4	531310	5723310	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA4-WC-47	Alternative-4	Seg3-Alt4	531559	5723581	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4

Table C-1: Surface Water Characteristics of Undefined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Tertiary Watershed Name	Mapped or Unmapped	Flow Regime	Flow Class	Approximate Bankfull Width (c)(m)	Surficial Geology	Mapbook Figure Location
RA4-WC-48	Alternative-4	Seg3-Alt4	532055	5724757	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA4-WC-49	Alternative-4	Seg3-Alt4	532545	5725566	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-4
RA4-WC-51	Alternative-4	Seg3-Alt4	536335	5727159	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-6
RA4-WC-52	Alternative-4	Seg3-Alt4	536623	5727401	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-6
RA4-WC-53	Alternative-4	Seg3-Alt4	537667	5728714	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-6
RA4-WC-54	Alternative-4	Seg3-Alt4	537072	5727839	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6
RA4-WC-56	Alternative-4	Seg3-Alt4	539023	5736140	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-6

a) Based on map projection Universal Transverse Mercator (UTM), Zone 16U (latitude band between 48 and 56 degrees north), with geodetic coordinates based on the NAD83 datum.
b) Water body characteristics are unknown. Unable to verify using aerial imagery, LiDAR datasets or arial reconaissance
c) Channel width of watercourse (as an indicator stream size), average of several measurements. Widths at several locations could not be delineated with the aid of aerial imagery, due to forest cover, riparian vegetation, or other obstructions and are designated with "-".
ID = identification; N/A = not applicable; NAD83 = North American Datum of 1983; UTM = Universal Transverse Mercator.

RA1-WC-04
RA1-WC-03
RA4-WC-11-REV03
RA4-WC-10-REV03
RA4-WC-06-REV03
RA4-WC-04-REV03
RA4-WC-03-REV03
RA4-WC-01-REV03
HARROGATE LAKE
MCCAW LAKE
ESSER LAKE
OGOKI RIVER
PAINTER LAKE
DEBAERE LAKE
ORVISS LAKE
COLPITTS LAKE
BURY LAKE
ZURBRIGG LAKE
BURNABY LAKE
CRONY LAKE
RENWICK LAKE
PIGMENT LAKE
SAGA LAKE
KAPIKOTONGWA RIVER
PERCY LAKE
LITTLE CURRENT RIVER
JUNGFRAU LAKE
LITTLE JUNGFRAU LAKE
FARRELL LAKE
MURIEL RIVER
RUNWAY LAKE

Map Location

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-1

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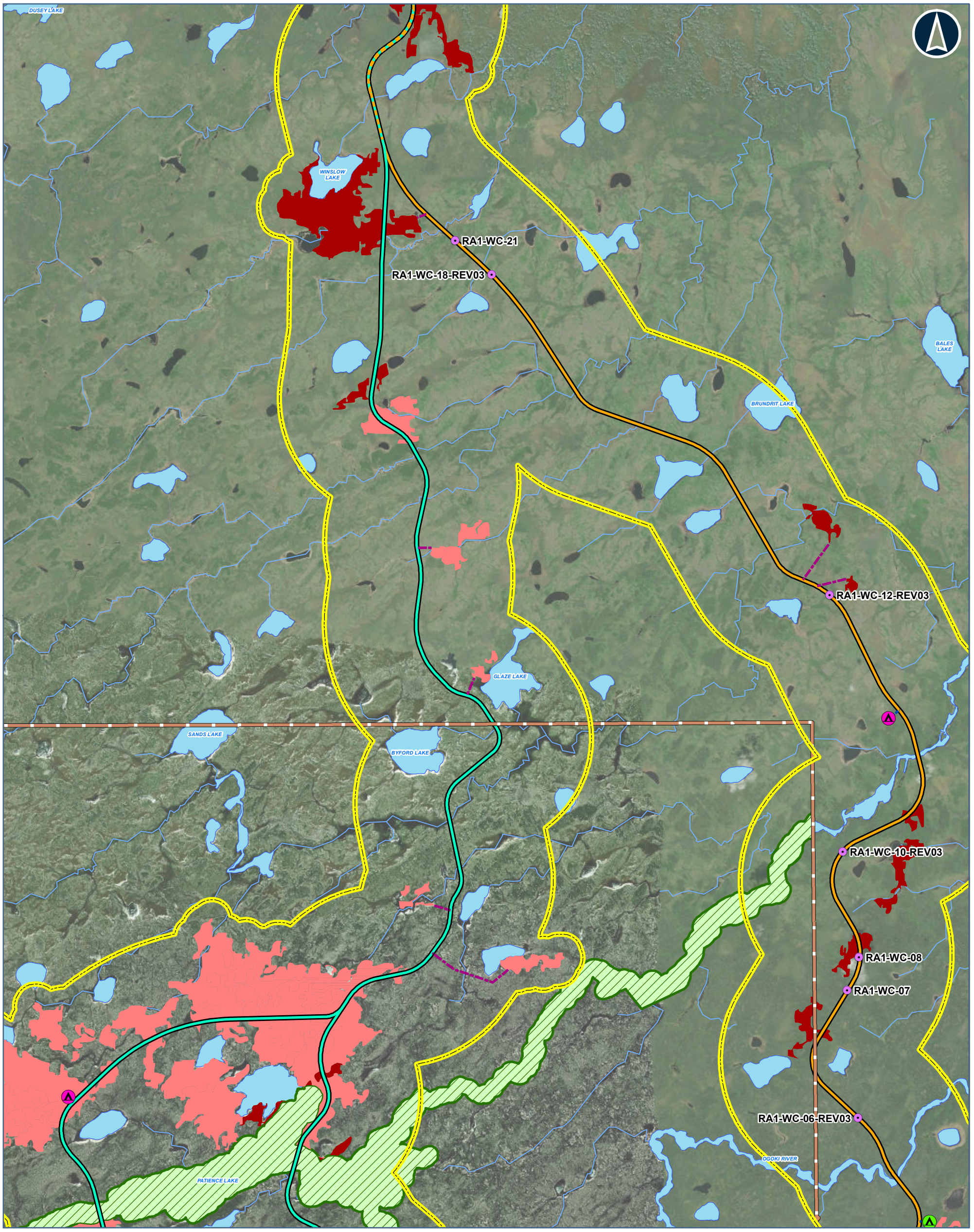

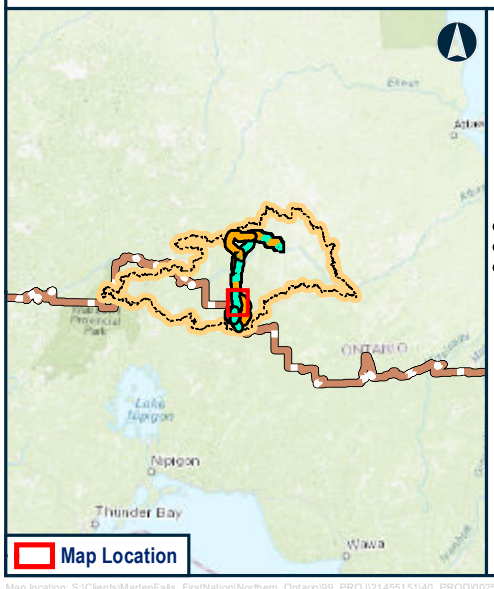

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-2

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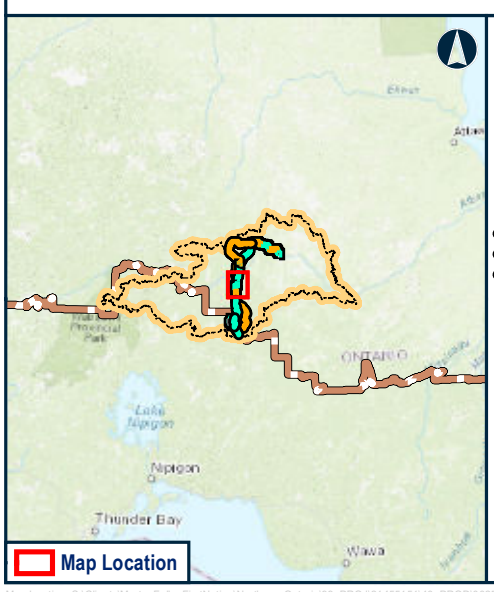
Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0002.mxd
Date Saved: 2/11/2026 1:45:44 PM User Name: gld_rduval

RA1-WC-25
RA4-WC-30
RA4-WC-28
RA1-WC-24-REV03
RA1-4-WC-08
RA1-4-WC-06
RA1-4-WC-05
RA1-4-WC-04
RA1-4-WC-03
TEABEAU LAKE
ALBANY RIVER
TOLFREE LAKE
SUWALA LAKE
DUSEY RIVER
DUSEY LAKE
TANASE LAKE



Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-3

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0002.mxd
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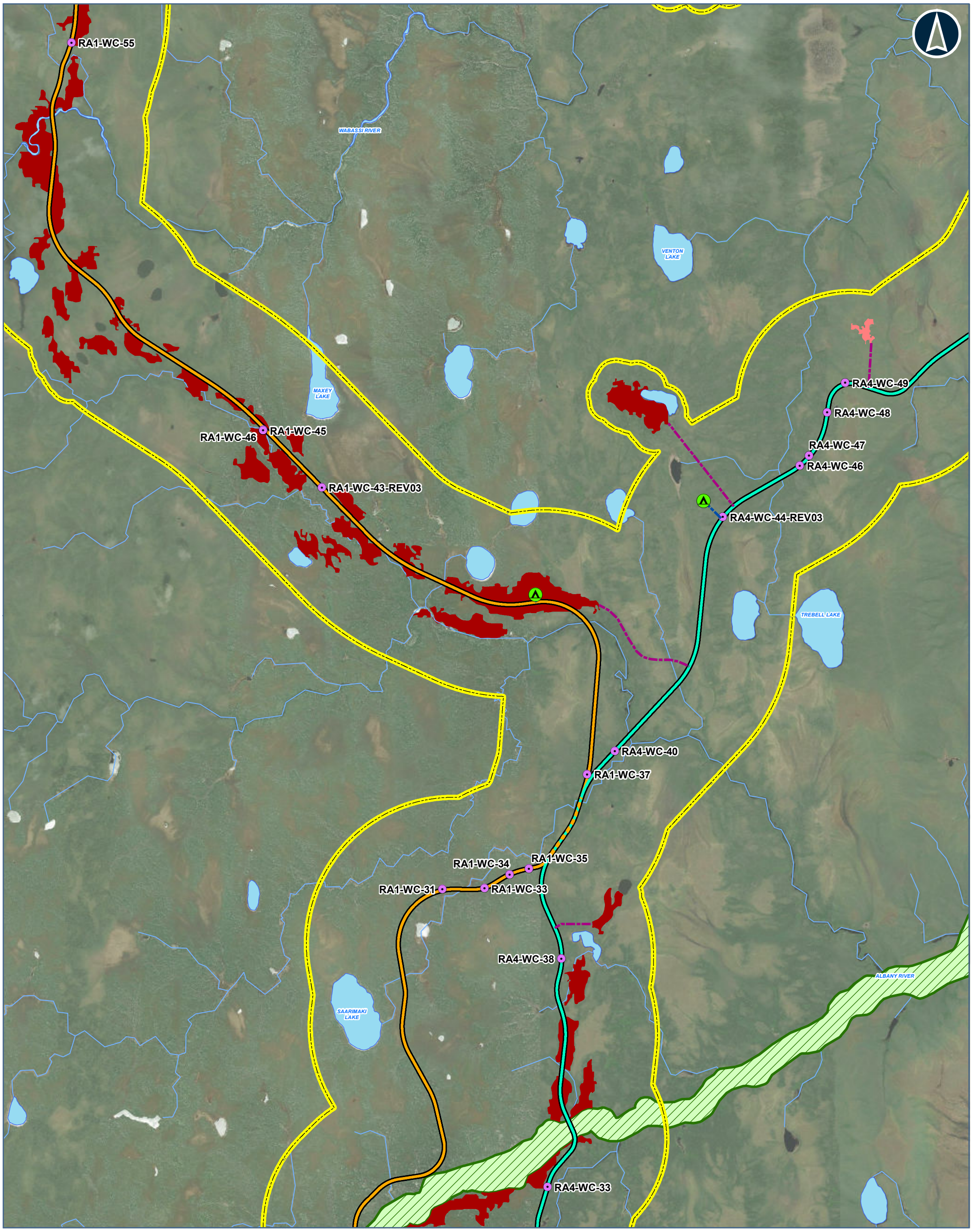

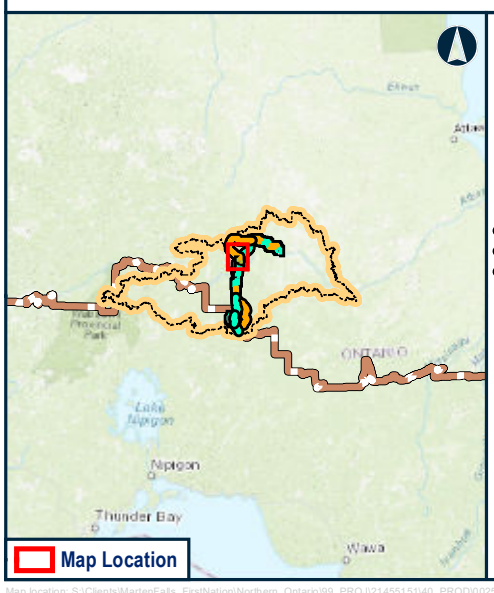

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

Data Source:
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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-4

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0002.mxd
Date Saved: 2/11/2026 1:45:44 PM User Name: gld_rduval

GARVEY LAKE

SLADE LAKE

MABIE LAKE

OXTOBY LAKE

RA1-WC-59-REV03

RA1-WC-61

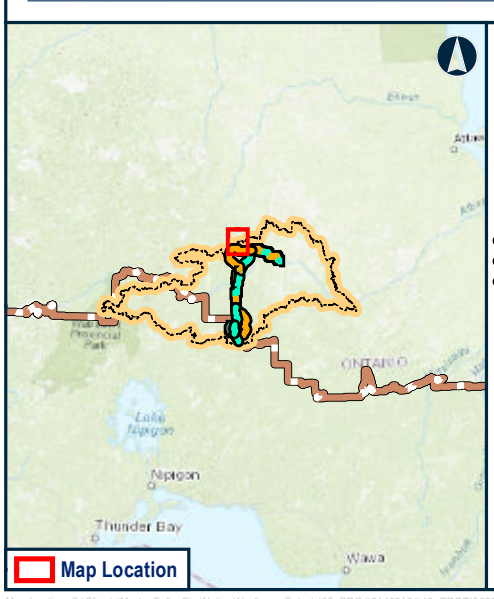
RA1-WC-62

RA1-WC-64

RA1-WC-63

RA1-WC-65

RA1-WC-69



Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

Data Source:
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-5

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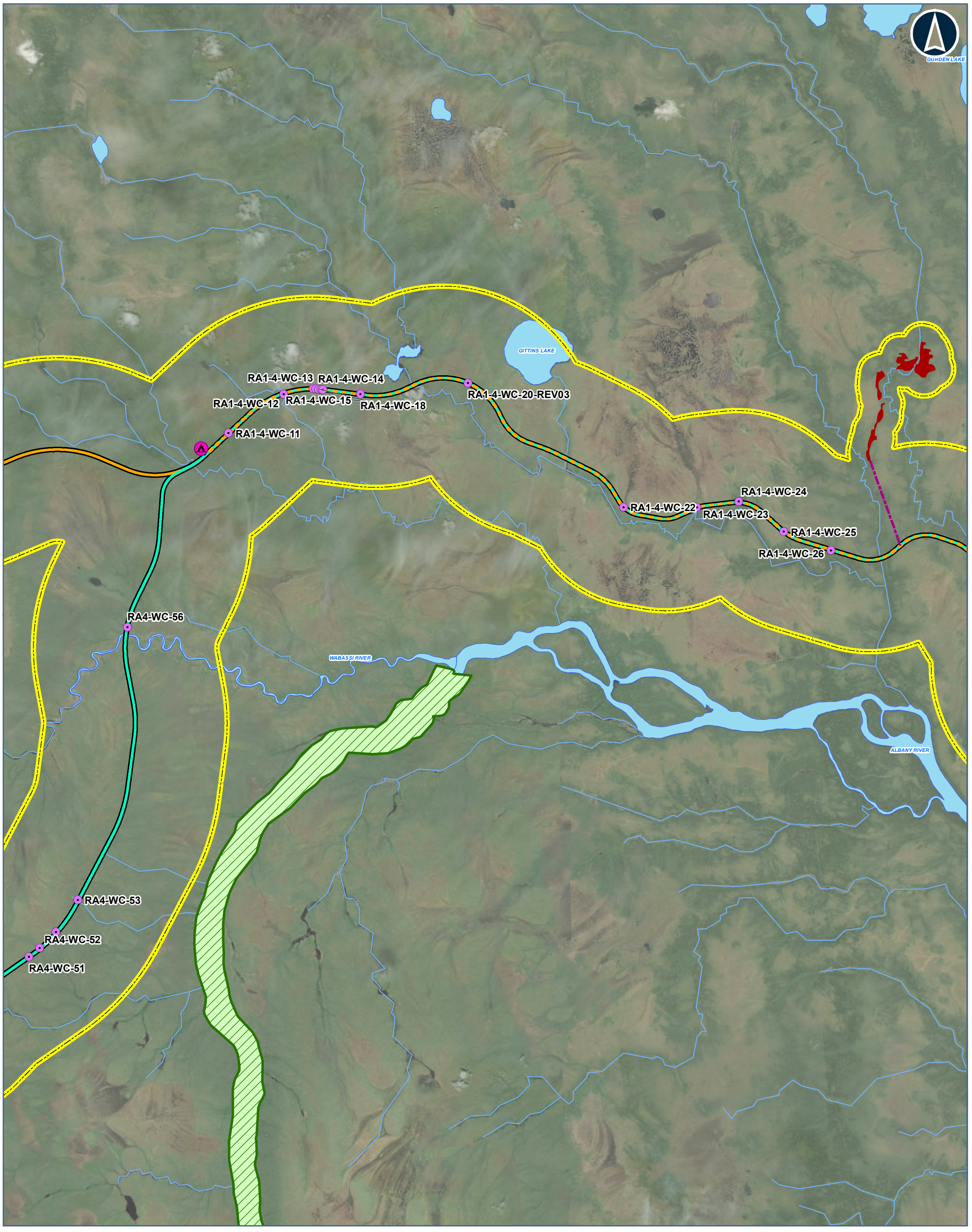

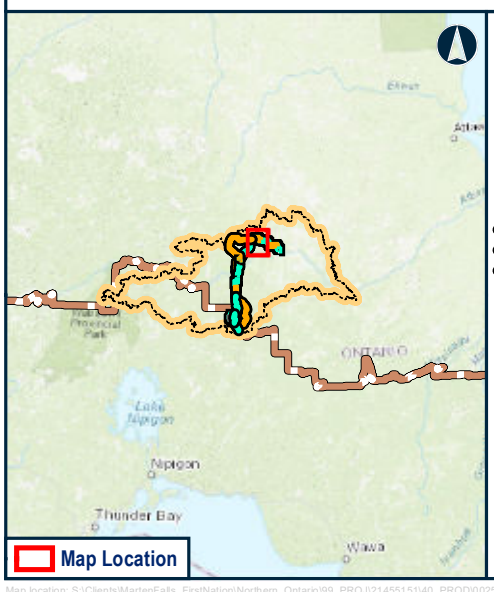

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-6

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SEBERT LAKE
GURDEN LAKE
TIFFIN LAKE
RA1-4-WC-28
RA1-4-WC-30
RA1-4-WC-29
RA1-4-WC-32
RA1-4-WC-37
ALBANY RIVER

Map Location

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)
- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

Data Source:
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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-7

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0002.mxd
Date Saved: 2/11/2026 1:45:44 PM User Name: gld_rduval

Table C-2: Surface Water Characteristics of Undefined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Tertiary Watershed Name	Mapped or Unmapped	Flow Regime	Flow Class	Approximate Bankfull Width (c)(m)	Surficial Geology	Mapbook Figure Location
RA1-4-WC-03	Preferred	N/A	520000	5677586	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-10
RA1-4-WC-04	Preferred	N/A	519811	5678161	Lower-Ogoki	Mapped	Permanent	Primary	<1	- (b)	C-10
RA1-4-WC-05	Preferred	N/A	519666	5680140	Lower-Ogoki	Mapped	Permanent	Primary	<1	- (b)	C-10
RA1-4-WC-06	Preferred	N/A	519637	5680917	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-10
RA1-4-WC-08	Preferred	N/A	518949	5682735	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Organic deposits	C-10
RA1-4-WC-11	Preferred	N/A	541778	5741437	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-12	Preferred	N/A	543279	5742500	Upper-Albany---Makokibatan	Mapped	Permanent	- (b)	<1	Organic deposits	C-12
RA1-4-WC-13	Preferred	N/A	544083	5742651	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-14	Preferred	N/A	544153	5742644	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-15	Preferred	N/A	544234	5742636	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-16	Preferred	N/A	544305	5742628	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-17	Preferred	N/A	544347	5742624	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-18	Preferred	N/A	545375	5742501	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-20	Preferred	N/A	548340	5742737	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-22	Preferred	N/A	552546	5739419	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-23	Preferred	N/A	554544	5739414	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-24	Preferred	N/A	555686	5739573	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-25	Preferred	N/A	556921	5738753	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-26	Preferred	N/A	558205	5738243	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA1-4-WC-28	Preferred	N/A	562103	5738045	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-13
RA1-4-WC-29	Preferred	N/A	563810	5734170	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-13

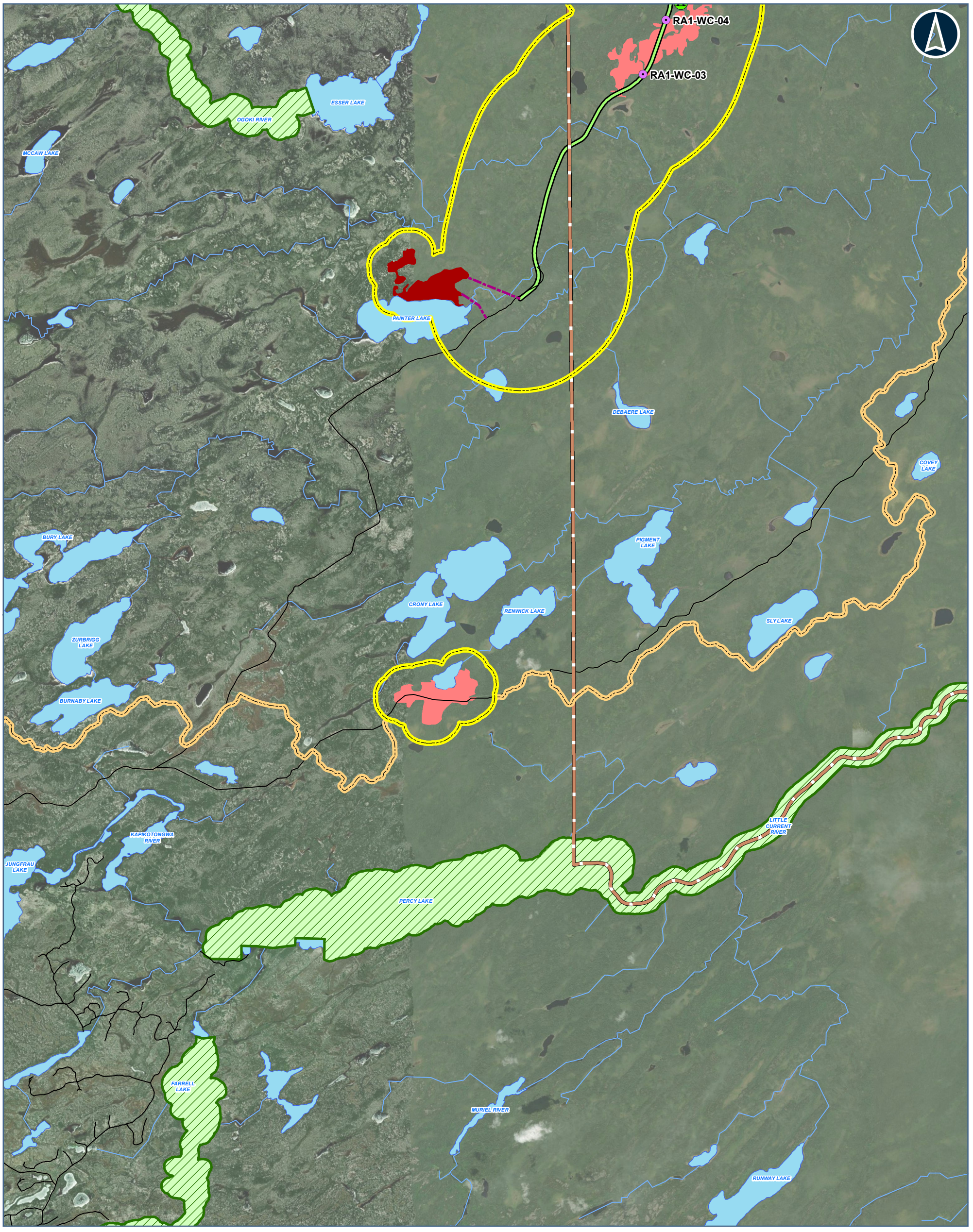
Table C-2: Surface Water Characteristics of Undefined Waterbody Crossings

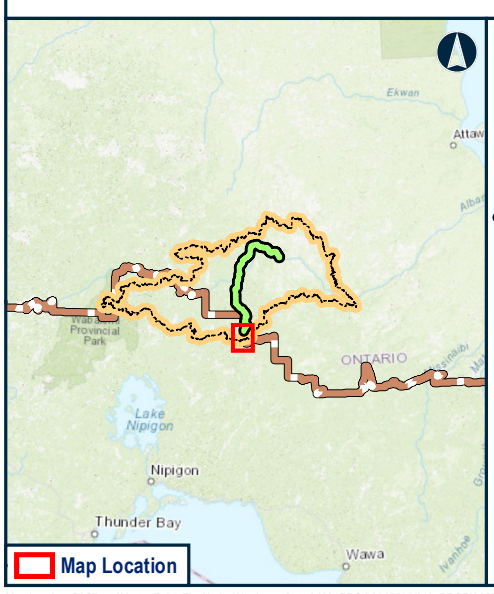
Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Tertiary Watershed Name	Mapped or Unmapped	Flow Regime	Flow Class	Approximate Bankfull Width (c)(m)	Surficial Geology	Mapbook Figure Location
RA1-4-WC-30	Preferred	N/A	563822	5734153	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-13
RA1-4-WC-32	Preferred	N/A	567922	5732413	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-13
RA1-4-WC-37	Preferred	N/A	577418	5725568	Upper-Albany---Muswabik	Mapped	Permanent	Primary	<1	Organic deposits	C-13
RA1-WC-03	Preferred	Seg1-Alt1	533812	5634366	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	- (b)	C-8
RA1-WC-04	Preferred	Seg1-Alt1	534433	5635846	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Glaciolacustrine deposits	C-8
RA1-WC-06	Preferred	Seg1-Alt1	532919	5639277	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Bedrock	C-9
RA1-WC-07	Preferred	Seg1-Alt1	532590	5642637	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-9
RA1-WC-08	Preferred	Seg1-Alt1	532911	5643535	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-9
RA1-WC-10	Preferred	Seg1-Alt1	532424	5646501	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-9
RA1-WC-12	Preferred	Seg1-Alt1	532144	5653442	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-9
RA1-WC-18	Preferred	Seg1-Alt1	523029	5662298	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-9
RA1-WC-21	Preferred	Seg1-Alt1	522006	5663171	Lower-Ogoki	Unmapped	- (b)	- (b)	<1	Till	C-9
RA4-WC-28	Preferred	Seg2-Alt4	522327	5694071	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-10
RA4-WC-30	Preferred	Seg2-Alt4	523610	5697164	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	6	Organic deposits	C-10
RA4-WC-33	Preferred	Seg2-Alt4	524442	5703680	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-11
RA4-WC-38	Preferred	Seg2-Alt4	524820	5709893	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-11
RA4-WC-40	Preferred	Seg3-Alt4	526271	5715544	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-11
RA4-WC-44	Preferred	Seg3-Alt4	529272	5721878	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-11
RA4-WC-46	Preferred	Seg3-Alt4	531310	5723310	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-11
RA4-WC-47	Preferred	Seg3-Alt4	531559	5723581	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-11
RA4-WC-48	Preferred	Seg3-Alt4	532055	5724757	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-11

Table C-2: Surface Water Characteristics of Undefined Waterbody Crossings

Waterbody Crossing ID	Route	Segment	Easting (a)	Northing (a)	Tertiary Watershed Name	Mapped or Unmapped	Flow Regime	Flow Class	Approximate Bankfull Width (c)(m)	Surficial Geology	Mapbook Figure Location
RA4-WC-49	Preferred	Seg3-Alt4	532545	5725566	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-11
RA4-WC-51	Preferred	Seg3-Alt4	536335	5727159	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-12
RA4-WC-52	Preferred	Seg3-Alt4	536623	5727401	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-12
RA4-WC-53	Preferred	Seg3-Alt4	537667	5728714	Upper-Albany---Makokibatan	Mapped	Permanent	Primary	<1	Organic deposits	C-12
RA4-WC-54	Preferred	Seg3-Alt4	537072	5727839	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12
RA4-WC-56	Preferred	Seg3-Alt4	539023	5736140	Upper-Albany---Makokibatan	Unmapped	- (b)	- (b)	<1	Organic deposits	C-12

a) Based on map projection Universal Transverse Mercator (UTM), Zone 16U (latitude band between 48 and 56 degrees north), with geodetic coordinates based on the NAD83 datum.
b) Water body characteristics are unknown. Unable to verify using aerial imagery, LiDAR datasets or arial reconaissance
c) Channel width of watercourse (as an indicator stream size), average of several measurements. Widths at several locations could not be delineated with the aid of aerial imagery, due to forest cover, riparian vegetation, or other obstructions and are designated with "-".
ID = identification; N/A = not applicable; NAD83 = North American Datum of 1983; UTM = Universal Transverse Mercator.





Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-8

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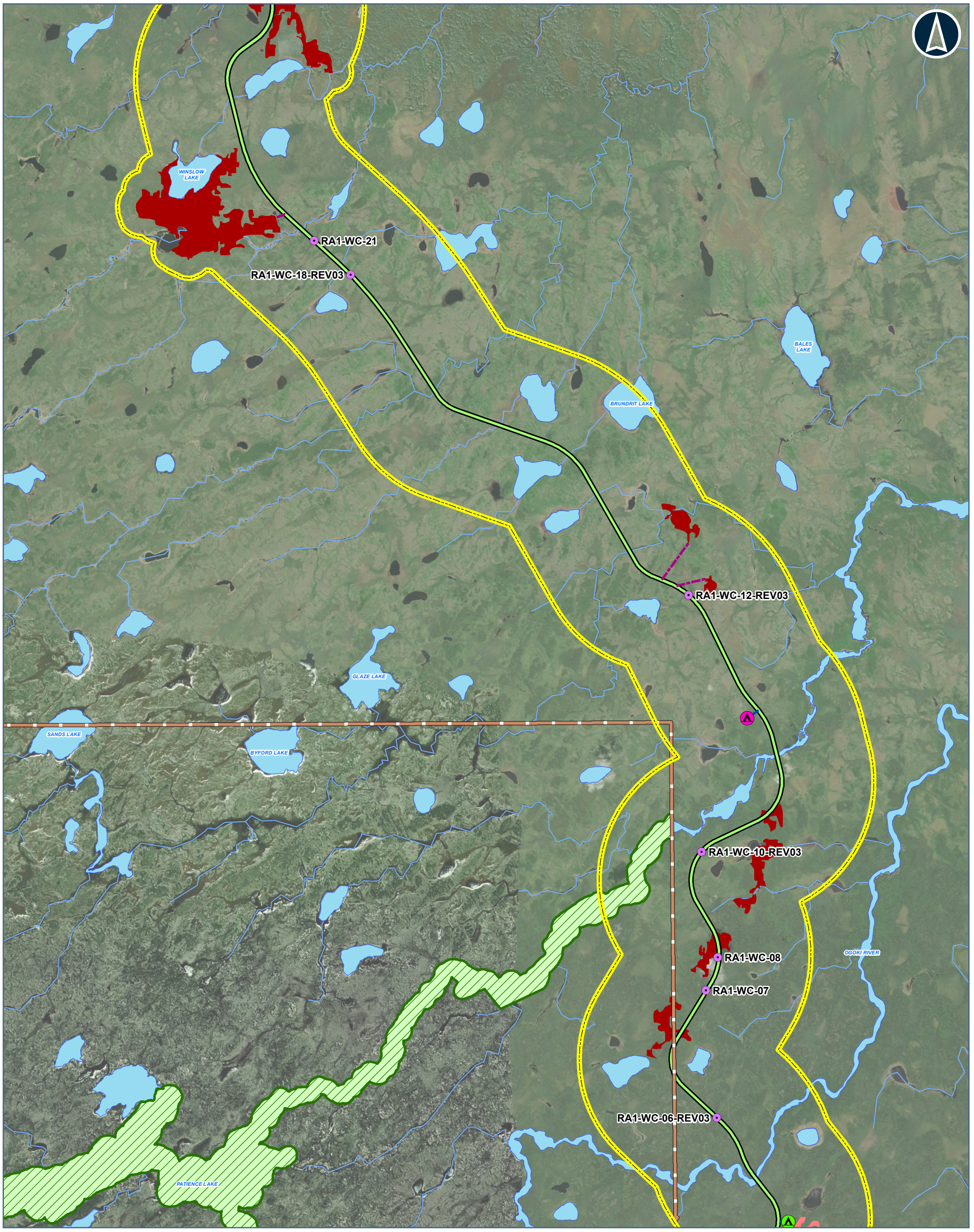

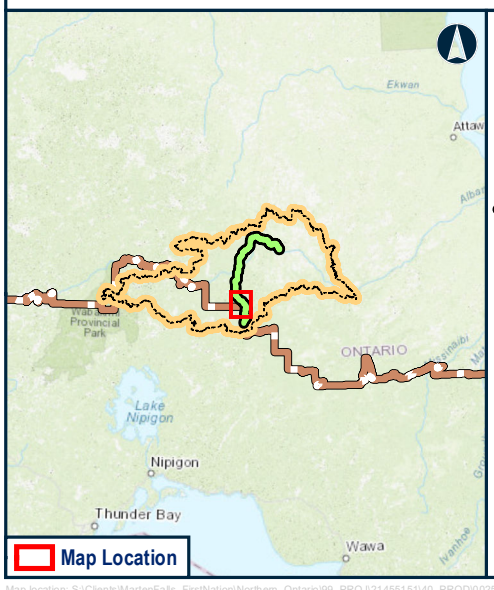

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-9

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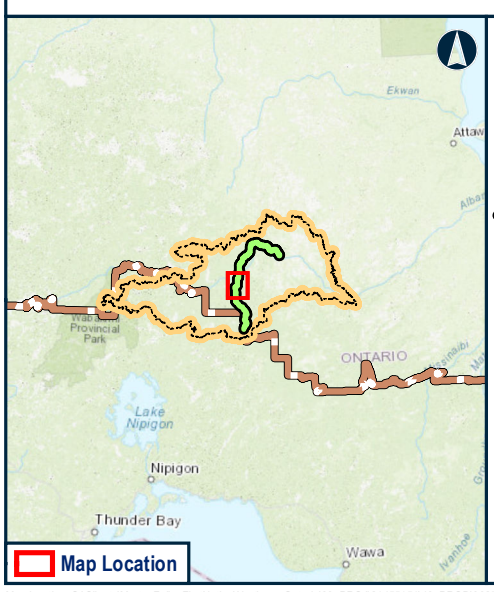
Date Saved: 2/11/2026 11:42:16 AM User Name: INRR172702

RA4-WC-30
RA4-WC-28
RA1-4-WC-08
RA1-4-WC-06
RA1-4-WC-05
RA1-4-WC-04
RA1-4-WC-03
TEABEAU LAKE
ALBANY RIVER
TOLFREE LAKE
SUWALA LAKE
DUSEY RIVER
TANASE LAKE
DUSEY LAKE



Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-10

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WABASSI RIVER
VENTON LAKE
MAXEY LAKE
TREBELL LAKE
SAARIMAKI LAKE
ALBANY RIVER
RA4-WC-49
RA4-WC-48
RA4-WC-47
RA4-WC-46
RA4-WC-44-REV03
RA4-WC-40
RA4-WC-38
RA4-WC-33

Map Location
Ekwan
Attawapiskat
Wabakimi Provincial Park
ONTARIO
Lake Nipigon
Nipigon
Thunder Bay
Wawa

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-11

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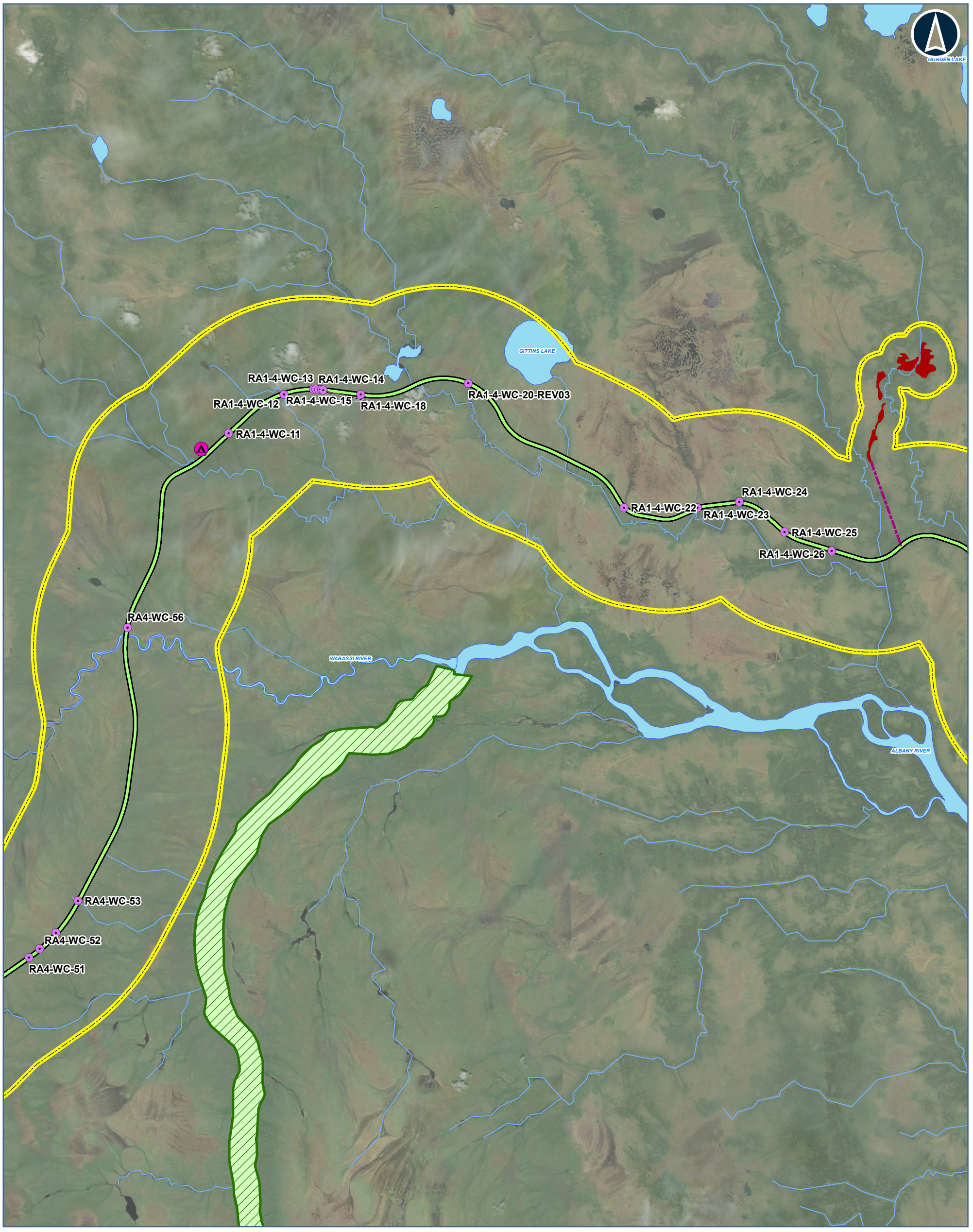

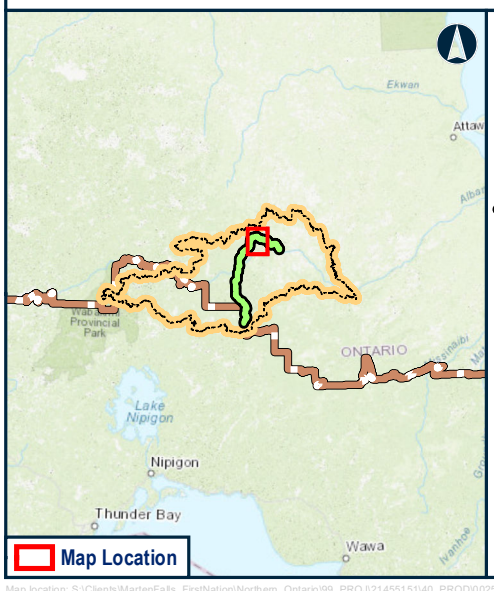

Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS
- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-12

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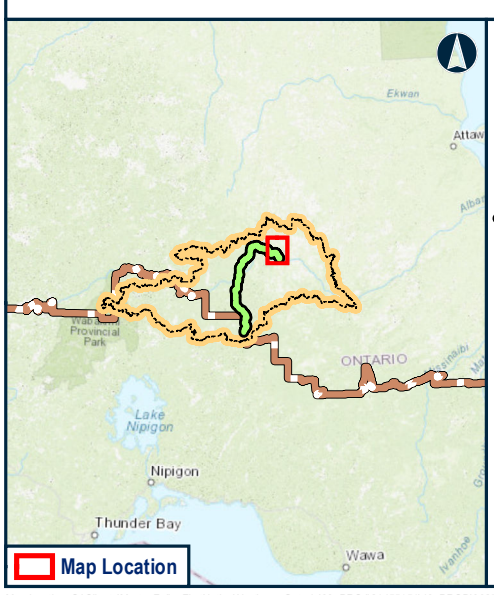
SEBERT LAKE
GURDEN LAKE
TIFFIN LAKE
RA1-4-WC-28
RA1-4-WC-30
RA1-4-WC-29
RA1-4-WC-32
RA1-4-WC-37
ALBANY RIVER



Legend

WATER CROSSING
- UNDEFINED

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)
- 50 PERSONS
- 200 PERSONS

- PREFERRED ROUTE
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE
- BEDROCK
- SAND AND GRAVEL

- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

Data Source:
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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Preferred Route and Undefined Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure C-13

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Attachment D – Hydrological, Hydraulic, and Geomorphic Characteristics of Project Watercourse Crossings

Table D-1: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (September 2019)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA1-4-WC-02	2019-09-06	Dusey River	Lower Ogoki	Mapped	Large	No	1494	Large permanent watercourse with well-defined bed and banks, notable entrenchment and moderately stable channel conditions (i.e., densely vegetated with some evidence of slumping).	Bedrock or Alluvial-Type Influences	31	1.3	43	2	1,098	1	Co, Bo, Gr, Sa, Si, Be	520105	5676979	D-3
RA1-4-WC-07	2019-09-06	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	23	Medium-sized permanent watercourse with moderately-defined bed and banks, meandering and braided planform (multiple thread), little to no entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	6	1.3	60	0.5	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	519091	5682476	D-3
RA1-4-WC-21	2019-09-08	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	20	Medium permanent watercourse with slightly-defined bed and banks, little to no entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	8	Approximately 1.5 (Unable to safely retrieve measurement due to deep water conditions)	150	>1.5	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	551025	5740733	D-6
RA1-WC-05	2019-09-09	Ogoki River	Lower Ogoki	Mapped	Medium	No	98	Large permanent watercourse with well-defined bed and banks, notable entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Bedrock or Alluvial-Type Influences	39.5	Approximately 1.5 (Unable to safely retrieve measurement due to deep water conditions)	50	2	7,639	1	Bo, Co, Gr, Sa	534175	5637960	D-2
RA1-WC-09	2019-09-09	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	6	Small permanent watercourse with moderately-defined bed and banks, moderate entrenchment, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks).	Peat/Bog Influenced	5	0.2	5	0.5	2	1	Or	532606	5644605	D-2
RA1-WC-57	2019-09-10	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	41	Medium-sized permanent watercourse with moderately-defined bed and banks, entrenched, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	12	Approximately 1.2 (Unable to safely retrieve measurement due to deep water conditions)	35	Approximately 1.4 (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	0.8	Si, Or, Sa	518320	5743418	D-5
RA4-WC-12	2019-09-09	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	8	Medium-sized permanent watercourse with moderately-defined bed and banks, moderate entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	8	0.6	100	2	Not measured (Unable to safely retrieve measurement due to deep water conditions)	2	Or	518647	5635591	D-1
RA4-WC-18	2019-09-07	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	117	Medium-sized permanent watercourse with moderately-defined bed and banks, entrenched, and mostly stable channel conditions (i.e., densely vegetated with evidence of undercutting and sedimentation).	Peat/Bog Influenced	9	0.5	10.5	0.6	44.4	0.8	Co, Gr, Bo, Sa, Si, Or	521894	5647392	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC11 (July 15, 2012), located approximately 95m downstream of RA4-WC-18 crossing location:						8.8	0.7	11.9	1.2	- (a)	0.24	Gr, Co, Bo, Or	521814	5647338	
RA4-WC-25	2019-09-06	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	28	Small permanent meandering watercourse with moderately-defined bed and banks, slight entrenchment, and mostly stable channel conditions (i.e., well vegetated with evidence of undercutting).	Peat/Bog Influenced	3.2	0.4	5	1.3	19.8	1.1	Bo, Sa, Gr, Co, Si	519870	5662127	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC18 (July 31, 2012), located approximately 200m upstream of RA4-WC-25 crossing location:						3.2	0.4	4.3	1	- (a)	0.16	Or, Gr, Bo	520060	5662108	
RA4-WC-27	2019-09-07	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	323	Large permanent meandering watercourse with well-defined bed and banks, notable entrenchment, and mostly stable channel conditions (i.e., well vegetated with evidence of deep organic sedimentation).	Peat/Bog Influenced	53	Approximately 2 (Unable to safely retrieve measurement due to deep water conditions)	70	3	Not measured (Unable to safely retrieve measurement due to deep water conditions)	1.7	Or	522053	5691380	D-3

Table D-1: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (September 2019)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA4-WC-34	2019-09-06	Albany River	Upper Albany – Makokibatan	Mapped	Large	No	18350	Large permanent watercourse with well-defined bed and banks, notable entrenchment, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).	Bedrock or Alluvial-Type Influences	50	Approximately 2 (Unable to safely retrieve measurement due to deep water conditions)	70	Approximately 5 (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	0.4	Bo, Sa,Co, Gr	525100	5705282	D-4

Note(s):
a) Trace flow, could not be measured with the available equipment.
b) Geometry and flow measurement not taken; unable to safely take measurement (large river).
Be = Bedrock; Bo = Boulder; Co = Cobble; Gr = Gravel; Or = Organic; Sa = Sand; Si = Silt.

Table D-2: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (October 2020)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA1-4-WC-33	2020-10-19	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Small	No	3	Medium-sized permanent watercourse with poorly-defined bed and banks, and moderately stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	5.2	0.55	5.7	0.7	60	-	Or	569512	5733023	D-7
RA1-4-WC-35	2020-10-16	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Medium	No	15	Small permanent watercourse with poorly-defined bed and banks, moderate entrenchment, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks).	-	2.5	0.7	3.2	0.9	166	-	Or, Sa	573754	5732806	D-7
RA1-4-WC-37	2020-10-14	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Small	No	1	Small straight channel approximately 0.65m wide and 0.4 m deep; mostly organics and organic debris	Peat/Bog Influenced	0.45	0.25	0.5	0.55	5	-	Or, Si,Sa	577424	5725571	D-7
RA1-WC-14	2020-10-19	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	6	Small permanent watercourse with moderately-defined bed and banks, not entrenched, and deeply incised channels (i.e., densely vegetated with hummocky grasses and flooded banks).	-	4	1.2	3.5	1.7	40	-	Or, Si	529517	5656008	D-2
RA1-WC-26	2020-10-20	Unnamed Tributary	Upper Albany – Makokibatan	Un-mapped	Small	No	-	Small braided watercourse with poorly-defined bed and banks, moderate entrenchment, and unstable channel conditions (i.e., vegetated with evidence of slumping banks and woody debris in reach).	Peat/Bog Influenced	1.25	0.15	2	0.3	3.16	-	Or,Si	519366	5700625	D-3
RA1-WC-26	2020-10-20	Unnamed Tributary	Upper Albany – Makokibatan	Un-mapped	Small	No	-	West braid; originates from underground flow approximately 95m upstream	Peat/Bog Influenced	2	0.15	4.5	0.3	2.71	-	Or,Si	519344	5700603	D-3
RA1-WC-27	2020-10-24	Albany River	Upper Albany – Makokibatan, Misehkow, Osnaburgh	Mapped	Large	Yes	18334	Large permanent watercourse with well-defined bed and banks, moderate entrenchment and stable channel conditions (i.e., bank substrates are primarily cobbles, boulders and gravel with little evidence of undercut).	Bedrock or Alluvial-Type Influences	210	1.2	200	N/A (water depths too deep to allow safe collection)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Bo,Co,Gr,Sa	519260	5702107	D-3
				Surveyed parameters for previously assessed Cliffs crossing WC29 (August 3, 2012), located immediately beside RA1-WC-27 crossing location:						>100	>3	>100	>3	- (b)	0.08	Bo, Co, Gr	519242	5709213	
RA1-WC-28	2020-10-24	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Small	No	4	Small watercourse with moderately-defined bed and banks, moderate entrenchment, and un-stable channel conditions (i.e., vegetated with grasses and shrubs and evidence of steep undercut banks).	Peat/Bog Influenced	2	0.3	2.5	0.6	32	-	Or,Sa,Bo	520181	5703724	D-4
RA1-WC-30	2020-10-24	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	11	Small permanent braided watercourse with moderately-defined bed and banks, flooded banks in areas with no entrenchment, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks).	Peat/Bog Influenced	3	0.5	3	-	-	0.5	Or,Si,Sa	520534	5709379	D-4
RA1-WC-57	2020-10-20	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	42	Large permanent watercourse with well-defined bed and banks, moderate entrenchment, and moderately stable channel conditions (i.e., densely vegetated with little to no evidence of erosion).	Bedrock or Alluvial-Type Influences	22	2	26	>2.5	-	-	Or,Si	518328	5743411	D-5
RA1-WC-66	2020-10-20	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	25	Medium-sized permanent watercourse with poorly defined bed and banks, moderate entrenchment, and moderately stable channel conditions (i.e., densely vegetated with grasses, alders and shrubs with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	9	0.8	17	1.2	290	-	Or,Si	527708	5740167	D-5
RA4B-WC-01	2020-10-15	Ogoki River	Upper Ogoki	Mapped	Large	Yes	2386	Large permanent watercourse with well-defined bed and banks, notable entrenchment, and stable channel conditions (i.e., banks substrate is primarily boulders, cobbles and gravel).	Bedrock or Alluvial-Type Influences	80	-	110	N/A (water depths too deep to allow safe collection)	-	-	Co,Bo,Gr,Sa, Si	512216	5636643	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC9 (July 13, 2012), located approximately 100m downstream of RA4B-WC-01 crossing location:						>100	>3	>100	>3	- (b)	0.1	Sa, Si, Or	517579	5638042	

Table D-2: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (October 2020)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA4-WC-15	2020-10-25	Ogoki River	Lower Ogoki	Mapped	Large	No	1181	Large permanent watercourse with well-defined bed and banks, notable entrenchment, and stable channel conditions (i.e., banks substrate is primarily boulders, cobbles and gravel).	Bedrock or Alluvial-Type Influences	150	-	190	N/A (water depths too deep to allow safe collection)	-	-	Bo,Co,Be	517636	5638222	D-2
RA4-WC-18	2020-10-15	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	117	Medium-sized permanent watercourse with moderately-defined bed and banks, riffles comprised of boulders and bedrock, moderate entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Bedrock or Alluvial-Type Influences	14	0.4	16	0.9	46	-	Co,Bo,Gr,Sa,or	521904	5647399	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC11 (July 15, 2012), located approximately 95m downstream of RA4-WC-18 crossing location:						8.8	0.7	11.9	1.2	- (a)	0.24	Gr, Co, Bo, Or	521814	5647338	
RA4-WC-22	2020-10-25	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	86	Medium-sized permanent watercourse with moderately-defined bed and banks, little to no entrenchment, and stable channel conditions (i.e., bed rock chutes with limited evidence of erosion and sedimentation).	Bedrock or Alluvial-Type Influences	9	0.4	9.2	1	746	-	Be,Bo,Co, Gr,Sa	520889	5657364	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC15 (July 17, 2012), located approximately 95m downstream of RA4-WC-22 crossing location:						13	1	13.9	1.4	- (a)	<0.5	Bo, Be, Sa, Si	520839	5657302	
RA4-WC-31	2020-10-18	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Small	No	4	Small permanent watercourse with moderately-defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks).	Peat/Bog Influenced	2.5	0.4	2.25	0.8	90	-	Sa,Co,Bo,Gr	523971	5698739	D-3
RA4-WC-34	2020-10-26	Albany River	Upper Albany – Makokibatan, Misehkow, Osnaburgh	Mapped	Large	No	18361	Large permanent watercourse with well-defined bed and banks, notable entrenchment and stable channel conditions (i.e., densely vegetated with boulders and cobbles some evidence of erosion).	Bedrock or Alluvial-Type Influences	63	-	73	N/A (water depths too deep to allow safe collection)	-	-	-	525077	5705307	D-4
RA4-WC-42	2020-10-19	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	17	Small deeply incised watercourse through muskeg, moderately-defined bed and banks, little to no entrenchment with flooded banks, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks).	Peat/Bog Influenced	55	0.9	4.2	1.3	-	-	Or,Si	528260	5716756	D-4
RA4-WC-42	2020-10-19	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	17	Additional channel resulting from beaver dam upstream of crossing.	Peat/Bog Influenced	4	0.7	6	-	-	-	Or,Si	528271	5716778	D-4
RA4-WC-45	2020-10-18	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	26	Medium-sized deeply incised permanent watercourse through muskeg with poorly-defined bed and banks, little to no entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	7	1.1	100	>1.15	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or,Si	530776	5723159	D-4
RA4-WC-55	2020-10-20	Wabassi River	Upper Albany – Makokibatan	Mapped	Large	No	1656	Large permanent watercourse with well-defined bed and banks, notable entrenchment and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion).	Bedrock or Alluvial-Type Influences	45	1.2	50	1.95	-	-	Sa,Co,Gr,Bo	539017	5735933	D-6
RA4-WC-58	2020-10-18	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	14	Medium-sized permanent watercourse with poorly-defined bed and banks with little to moderate entrenchment (some areas of flooding), and stable channel conditions (i.e., densely vegetated with grasses and limited evidence of erosion and sedimentation).	Peat/Bog Influenced	5	0.8	15	0.9	-	-	Or	539632	5736591	D-6

Note(s):
a) Trace flow, could not be measured with the available equipment.
b) Geometry and flow measurement not taken; unable to safely take measurement (large river).
Be = Bedrock; Bo = Boulder; Co = Cobble; Gr = Gravel; Or = Organic; Sa = Sand; Si = Silt.

Table D-3: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (September 2021)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA1-4-WC-01	2021-09-11	Unnamed Tributary	Lower Ogoki	Mapped	Small	Yes	6	Large permanent watercourse with poorly defined bed and banks, moderately stable channel conditions (i.e., densely vegetated); wide bankfull with incised channel in the middle	Bedrock or Alluvial-Type Influences	1	0.5	1.1	1	31	0.5	Or,Si,Sa	519622	5666913	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC20 (August 1, 2012), located approximately 50 m downstream of RA1-4-WC-01 crossing location:						2	0.5	2.3	0.7	- (a)	<0.5	Or	519604	5666837	
RA1-4-WC-07	2021-09-11	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	23	Small permanent watercourse with moderately-defined bed and banks, and mostly incised channels, grassy riparian	Peat/Bog Influenced	-	-	-	-	977	-	Or,Si	519088	5682476	D-3
RA1-WC-02	2021-09-14	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	129	Large-sized permanent watercourse with well-defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation)	Peat/Bog Influenced	8	0.7	8	N/A	1,126	-	Bo,Co,Si	532383	5632978	D-1
RA1-WC-09	2021-09-17	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	6	Large, winding channel; Crossing is located on a small pooled area downstream of a beaver dam	Peat/Bog Influenced	-	-	-	N/A	56	-	Or,Si	532602	5644607	D-2
RA1-WC-23	2021-09-15	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	Yes	323	Large permanent watercourse with well-defined bed and banks, no entrenchment and moderately stable channel conditions (i.e., densely vegetated with flooded banks).	Peat/Bog Influenced	100	>2	85	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Si,Or	521738	5691477	D-3
				Surveyed parameters for previously assessed Cliffs crossing WC27 (August 4, 2012), located approximately 40 m downstream of RA1-WC-23 crossing location:						- (b)	- (b)	10	1.5	- (b)	0.14	Si, Or	521688	5691500	
RA1-WC-67	2021-09-18	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	111	Large permanent watercourse with well-defined bed and banks, notable entrenchment and stable channel conditions (i.e., densely vegetated with some little evidence of erosion and sedimentation).	Peat/Bog Influenced	18	1.1	22	Not measured (Unable to safely retrieve measurement due to deep water conditions)	1,450	-	Or,Si,Sa	531908	5741006	D-5
RA4-WC-02	2021-09-17	Colpitts creek	Lower Ogoki	Mapped	Medium	Yes	100	Medium-sized permanent watercourse with defined bed and banks, meandering channel, moderate entrenchment, and stable channel conditions (i.e., densely vegetated with boulder and cobbles).	Peat/Bog Influenced	12	1	13	Not measured (Unable to safely retrieve measurement due to deep water conditions)	1,500	-	Si	521683	5624116	D-1
				Surveyed parameters for previously assessed Cliffs crossing WC2 (July 10, 2012), located approximately 70m downstream of RA4-WC-02 crossing location:						11	1	11.2	1.5	174	0.2	Or	521688	5624045	
RA4-WC-21	2021-09-18	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	12	Large well defined channel with irregular meandering and unconfined; moderately stable channel conditions, fully vegetated grass and forb banks with limited evidence of erosion	Peat/Bog Influenced	125	>1.5	8	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Si,Or	521136	5656049	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC14 (July 16, 2012), located approximately 110m downstream of RA4-WC-21 crossing location:						>6	1.1	3.3	0.6	- (a)	0.4	Or	521041	5656063	
RA4-WC-26	2021-09-13	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	28	Small permanent watercourse with defined bed and banks, little to no entrenchment, and mostly stable channel conditions (i.e., vegetated with some undercut banks).	Peat/Bog Influenced	2.25	0.4	2.25	N/A	138	-	Bo,Si, Co,Sa,Gr	519976	5663163	D-2
RA4-WC-26	2021-09-13	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	28	North branch or reach; diverted flow from beaver dam	Peat/Bog Influenced	5.5	0.8	5.5	-	-	-	Bo,Si, Co,Sa,Gr	519977	5663181	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC19 (July 31, 2012), located approximately 50m downstream of RA4-WC-26 crossing location:						5.8	0.9	6.2	0.8	- (a)	<0.5	Co, Bo, Or	519935	5663157	
RA4-WC-27	2021-09-15	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	323	Large permanent watercourse; well defined bed and banks, stable channel conditions; flooded banks, lined with shrubs, surrounded by coniferous forests	Peat/Bog Influenced	-	-	-	N/A	-	-	Si	521997	5691374	D-3
RA4-WC-34	2021-09-15	Albany River	Upper Albany – Makokibatan, Misehkow, Osnaburgh	Mapped	Large	No	18361	Large permanent watercourse with well-defined bed and banks, notable entrenchment and stable channel conditions (i.e., densely vegetated with swift deep current).	Bedrock or Alluvial-Type Influences	-	-	-	N/A	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Bo,Co,Gr	525111	5705262	D-4
RA4-WC-37	2021-09-15	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	11	Medium-sized permanent watercourse with poorly defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	90	>1.5	6	>1.5	263	-	Or,Si	524697	5708581	D-4

Table D-3: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (September 2021)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA4-WC-55	2021-09-16	Wabassi River	Upper Albany – Makokibatan	Mapped	Large	No	1656	Large-sized permanent watercourse with well-defined bed and banks; stable channel conditions, well vegetated banks with limited evidence of erosion and sedimentation	Bedrock or Alluvial-Type Influences	-	-	-	-	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Bo, Co,Si	539024	5735944	D-6
RA4-WC-57	2021-09-16	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Small	No	4	Small permanent watercourse with moderately-defined bed and banks, little to no entrenchment (flooded banks), and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks). 95 m down stream of crossing watercourse transitions to an undefined and braided channel.	Peat/Bog Influenced	2	0.5	2	1	68	-	Or,Si,Sa	539258	5736889	D-6

Note(s):
a) Trace flow, could not be measured with the available equipment.
b) Geometry and flow measurement not taken; unable to safely take measurement (large river).
Be = Bedrock; Bo = Boulder; Co = Cobble; Gr = Gravel; Or = Organic; Sa = Sand; Si = Silt.

Table D-4: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (June, July, and August 2022)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA1-4-WC-10	2022-08-18	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	55	Medium-sized permanent watercourse intersecting a fen/bog with moderately-defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation).	Peat/Bog Influenced	12	>1.5	12	>1.5	-	-	Or,Si	540827	5740605	D-6
RA1-4-WC-19	2022-06-29	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	120	Large permanent watercourse with poorly defined bed and banks, unconfined, flooded and mostly stable channel conditions between two water bodies (i.e., densely vegetated through muskeg).	Peat/Bog Influenced	55	>2	23	>2	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	546816	5742739	D-6
RA1-4-WC-19	2022-08-18	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	120	Medium-sized permanent watercourse intersecting a fen/bog with poorly defined bed and banks, little to no entrenchment (flooded banks), and moderately stable channel conditions (i.e., vegetated some limited evidence of erosion and sedimentation).	Peat/Bog Influenced	30	>1.5	40	>1.5	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	546812	5742742	D-6
RA1-4-WC-21	2022-07-01	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	20	Medium-sized permanent watercourse through muskeg, fairly defined bed and banks, little to no entrenchment (flooded to tree line), and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	65	1.1	6	-	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	551026	5740736	D-6
RA1-4-WC-21	2022-08-16	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	20	Small permanent watercourse with moderately-defined bed and banks, little to no entrenchment (some flooding), and unstable channel conditions (i.e., vegetated with some evidence of erosion).	Peat/Bog Influenced	5.5	1.2	6	>1.5	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	551024	5740735	D-6
RA1-4-WC-33	2022-06-24	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Small	No	3	Small permanent watercourse moderately defined banks, unconfined, and mostly stable channel conditions (i.e., densely vegetated with limited erosion).	Peat/Bog Influenced	1.9	0.4	2	0.4	43	-	Or	569514	5733022	D-7
RA1-4-WC-33	2022-08-19	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Small	No	3	Medium-sized permanent watercourse with moderately-defined bed and banks, moderate entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	7	0.9	9	1	42	-	Or	569514	5733025	D-7
RA1-4-WC-35	2022-06-28	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Medium	No	15	Medium-sized permanent watercourse, irregular meander and braided, unconfined flooded bank, mostly stable channel conditions (i.e., densely vegetated).	Peat/Bog Influenced	45	0.8	3.5	1.2	100	-	Or	573754	5732806	D-7
RA1-4-WC-35	2022-08-19	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Medium	No	15	Small permanent watercourse intersecting dense alders with moderately-defined bed and banks, little to no entrenchment (flooding in areas due to beaver dams), and unconfined and mostly stable channel conditions (i.e., densely vegetated with limited evidence of undercut banks).	Peat/Bog Influenced	3.5	1.1	3.5	1.2	6	-	Or	573747	5732807	D-7
RA1-4-WC-36	2022-08-22	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Medium	No	130	Medium-sized permanent watercourse with moderately-defined bed and steep banks, meandering and neutral, little to no entrenchment, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	10	>1.5	10.8	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Si,Or	577674	5726014	D-7

Table D-4: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (June, July, and August 2022)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA1-4-WC-37	2022-08-16	Unnamed Tributary	Upper Albany – Muswabik River	Mapped	Small	No	1	Small intermittent watercourse through coniferous forest and dense alders; poorly defined bed and banks; unstable channel conditions, some evidence of erosion	Peat/Bog Influenced	0.3	0.2	0.3	0.5	1	-	Or,Si	577418	5725570	D-7
RA1-WC-01	2022-08-20	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	31	Medium-sized permanent watercourse with well defined bed and banks, riffles in reach from cobbles and boulders, little to no entrenchment, stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation). Up stream beaver dam restricting flow.	Bedrock or Alluvial-Type Influences	8	0.25	8.8	N/A	51	-	Or,Bo,Co	530918	5629154	D-1
RA1-WC-09	2022-06-23	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	6	Small permanent watercourse with well-defined bed and banks, moderate entrenchment, and stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation such as undercut banks).	Peat/Bog Influenced				-	2	-	Or,Si	532605	5644607	D-2
RA1-WC-09	2022-08-17	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	6	Small permanent watercourse with moderately-defined bed and banks, moderate entrenchment, and unstable channel conditions (i.e., vegetated with undercut banks).	Peat/Bog Influenced	1.5	0.5	1.8	N/A	27	-	Or	532601	5644610	D-2
RA1-WC-11	2022-06-29	Ogoki River - North channel	Lower/Upper Ogoki	Mapped	Large	No	2535	Large permanent watercourse with well-defined bed and banks, little to no entrenchment and stable channel conditions (i.e., densely vegetated with bedrock and cobble substrates, some evidence of sedimentation from flooding).	Bedrock or Alluvial-Type Influences	110	>2.5	105	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Be,Bo,Co,Or	534519	5649039	D-2
RA1-WC-11	2022-08-21	Ogoki River	Lower/Upper Ogoki	Mapped	Large	No	2565	Large permanent watercourse with well-defined bed and banks, notable entrenchment and stable channel conditions (i.e., densely vegetated with bed rock and boulder substrate).	Bedrock or Alluvial-Type Influences	32	>1.4	34	>3	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Bo,Co	534519	5649039	D-2
RA1-WC-14	2022-06-23	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	6	Small permanent watercourse with well-defined bed and banks, little to no entrenchment, and mostly stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation such as undercut banks).	Peat/Bog Influenced				-	42	-	Or,Si,Sa	529624	5656141	D-2
RA1-WC-14	2022-08-22	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	6	Small permanent watercourse with moderately-defined bed and banks, some entrenchment, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of erosion).	Peat/Bog Influenced	1.3	0.75	1.5	0.8	42	-	Or	529624	5656141	D-2
RA1-WC-16	2022-06-22	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	23	Medium-sized permanent watercourse meandering, with poorly defined bed and banks, little to no entrenchment, and mostly stable incised channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	10	>2.3	6	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or,Si	526927	5658038	D-2
RA1-WC-16	2022-08-19	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	22	Medium-sized permanent watercourse intersecting a flooded grassy wetland with moderately-defined bed and banks, little to no entrenchment, and mostly stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	70	1.7	7	2.5	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	526927	5658038	D-2

Table D-4: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (June, July, and August 2022)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA1-WC-17	2022-08-19	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	119	Medium-sized permanent watercourse with moderately-defined bed and banks, some entrenchment, and moderately stable channel conditions (i.e., densely vegetated with some evidence of undercut banks).	Peat/Bog Influenced	9	0.9	10	1	669	-	Gr,Sa,Si,Co,Or	525210	5658953	D-2
RA1-WC-22	2022-08-20	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	63	Medium-sized permanent watercourse with poorly defined bed and banks, little to no entrenchment (flooding into adjacent grass hummocks), and mostly stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation). Large beaver dam present upstream with impoundment pond	Peat/Bog Influenced	-	-	-	-	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	521647	5663317	D-2
RA1-WC-30	2022-08-22	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	11	Medium sized permanent watercourse; defined bed and banks; flooded banks with hummocks, flooded grasses and shrubs in riparian	Peat/Bog Influenced	40	0.75	3.25	0.8	89	-	Or,Sa	520532	5709373	D-4
RA1-WC-32	2022-06-25	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	22	No defined channel	-	-	-	-	-	-	-	-	522111	5711798	D-4
RA1-WC-32	2022-08-21	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	22	Medium-sized permanent watercourse with moderately-defined bed and banks, little to no entrenchment (flooded banks with hummocks), and mostly stable channel conditions (i.e., densely vegetated with flooded grasses and shrubs).	Peat/Bog Influenced	90	1.2	6	Not measured (Unable to safely retrieve measurement due to deep water conditions)	76	-	Or	522108	5711800	D-4
RA1-WC-41	2022-08-23	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	23	Small permanent watercourse with moderately-defined bed and banks, little to no entrenchment (some flooding), and unstable channel conditions (i.e., vegetated with ox bow channel forming and some evidence of erosion and sedimentation).	Peat/Bog Influenced	4	1.1	4.25	1.8	160	-	Or,Sa,Gr	521631	5720102	D-4
RA1-WC-51	2022-08-26	Wabassi River	Upper Albany – Makokibatan	Mapped	Large	Yes	1011	Large permanent watercourse with well-defined bed and banks, notable entrenchment and moderately stable channel conditions (i.e., densely vegetated with little evidence of erosion and sedimentation).	Bedrock or Alluvial-Type Influences	60	>1.5	65	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Si, Or	510966	5732848	D-4
				Surveyed parameters for previously assessed Cliffs crossing WC38 (August 4, 2012), located approximately 300 m upstream of RA1-WC-51 crossing location:						20	3	10	- (b)	- (b)	- (b)	Si, Or, Bo, Co	511271	5732949	
RA4B-WC-02	2022-08-23	Unnamed Tributary	Lower Ogoki	Mapped	Small	No	9	Small permanent watercourse with defined bed and banks, and unstable channel conditions (i.e., vegetated with evidence of undercut banks).	Peat/Bog Influenced	-	-	-	1.2	51	-	Or	517166	5631036	D-1
RA4-WC-00	2022-08-25	Unknown	-	-	Small	No	8	Small permanent watercourse with well-defined bed and banks, moderate entrenchment, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	1.2	0.2	1.7	0.3	8	-	Si,Or	524202	5620007	D-1
RA4-WC-02-REV03	2022-06-21	Colpitts creek	Lower Ogoki	Mapped	Medium	Yes	100	Medium-sized permanent watercourse, with poorly defined bed and banks, little to no entrenchment, and mostly stable incised channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	10	>1	10	-	1,500	-	Or,Si,Bo	521819	5624190	D-1
				Surveyed parameters for previously assessed Cliffs crossing WC2 (July 10, 2012), located approximately 70m downstream of RA4-WC-02 crossing location:						11	1	11.2	1.5	174	0.2	Or	521688	5624045	
RA4-WC-05	2022-06-26	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	83	Medium-sized permanent watercourse with fairly defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	10	1.3	11	-	-	-	Or,Si,Sa	519746	5628178	D-1
				Surveyed parameters for previously assessed Cliffs crossing WC3 (July 11, 2012), located approximately 12m upstream of RA4-WC-05 crossing location:						13.6	1.5	13.7	2	238	0.13	Or	519761	5628183	

Table D-4: Hydrological, Hydraulic and Geomorphic Characteristics of Project Watercourse Crossings - Surveyed Parameters at Crossing Location (June, July, and August 2022)

Crossing ID	Date Surveyed	Name of Watercourse	Tertiary Watershed	Identification as Mapped or Unmapped Waterbody	Category of Watershed Size	Previously Surveyed During the Cliffs Project	Drainage Area (km^2)	General Channel Characteristics	Geological or Biophysical Controls on Channel Form	Wetted Width (m)	Wetted Depth (m)	Bankfull Width (m)	Bankfull Depth (m)	Flow (L/s)	Relative Channel Slope (%)	Observed Substrate Material	Easting (Zone 16U)	Northing (Zone 16U)	Mapbook Figure Location
RA4-WC-17	2022-06-28	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	14	Large permanent watercourse with poorly defined bed and banks, little to no entrenchment (beaver activity contributing to flooding) and mostly stable channel conditions (i.e., densely vegetated with bedrock and cobble substrates, some evidence of sedimentation from flooding).	Peat/Bog Influenced	100	>1.5	30	-	-	-	Or,Si	522044	5645983	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC10 (July 13, 2012), located approximately 95m downstream of RA4-WC-17 crossing location:						>8	1.7	8	1.4	- (b)	0.31	Or	522068	5646003	
RA4-WC-19	2022-06-28	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	19	Medium-sized permanent meandering watercourse with fairly defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	8.5	-	8	-	95	-	Or,Si	523066	5649805	D-2
RA4-WC-19	2022-08-22	Unnamed Tributary	Lower Ogoki	Mapped	Medium	No	19	Small permanent watercourse with well-defined bed and banks, little to no entrenchment (flooded), and stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation such as undercut banks).	Peat/Bog Influenced	15	1.2	6	>1.5	95	-	Or	523052	5649781	D-2
RA4-WC-21	2022-08-24	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	12	Large-sized permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	-	-	-	1.4	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or,Si	521099	5656084	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC14 (July 16, 2012), located approximately 110m downstream of RA4-WC-21 crossing location:						>6	1.1	3.3	0.6	- (a)	0.4	Or	521041	5656063	
RA4-WC-22	2022-06-22	Unnamed Tributary	Lower Ogoki	Mapped	Medium	Yes	86	Medium-sized permanent meandering watercourse with fairly defined bed and banks, little to no entrenchment, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	Peat/Bog Influenced	7	0.7	7	-	-	-	Bo,Sa,Or,Gr,Si	520841	5657306	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC15 (July 17, 2012), located approximately 95m downstream of RA4-WC-22 crossing location:						13	1	13.9	1.4	- (a)	<0.5	Bo, Be, Sa, Si	520839	5657302	
RA4-WC-24	2022-06-27	Unnamed Tributary	Lower Ogoki	Mapped	Small	Yes	2	Small watercourse connecting two waterbodies with poorly defined bed and banks, no to little entrenchment, and mostly stable flooded channel conditions (i.e., densely vegetated with limited erosion).	Peat/Bog Influenced	6	0.5	6	-	-	-	Or,Si	519798	5659784	D-2
				Surveyed parameters for previously assessed Cliffs crossing WC17 (July 16, 2012), located approximately 30m downstream of RA4-WC-24 crossing location:						>2	0.57	1.8	0.3	- (a)	<0.5	Or	519938	5659791	
RA4-WC-41	2022-06-25	Gourlie Creek	Upper Albany – Makokibatan	Mapped	Medium	No	956	Large permanent watercourse with well defined bed and banks, notable entrenchment and mostly stable channel conditions (i.e., densely vegetated with silt and sand substrates).	Peat/Bog Influenced	31	>1.1	34	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Sa,Si	526644	5715946	D-4
RA4-WC-45	2022-06-27	Unnamed Tributary	Upper Albany – Makokibatan	Mapped	Medium	No	26	Medium-sized permanent watercourse with a defined channel through muskeg, unconfined flooded bank, mostly stable channel conditions (i.e., densely vegetated).	Peat/Bog Influenced	100	1.2	7	1.3	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Or	530819	5722961	D-4
RA4-WC-55	2022-06-27	Wabassi River	Upper Albany – Makokibatan	Mapped	Large	No	1656	Large permanent watercourse with well defined bed and banks, notable entrenchment and mostly stable channel conditions (i.e., densely vegetated with silt and sand substrates).	Bedrock or Alluvial-Type Influences	40	>1	43	>1	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Not measured (Unable to safely retrieve measurement due to deep water conditions)	Co, Gr, Sa,Si	538999	5735944	D-6

Note(s):
a) Trace flow, could not be measured with the available equipment.
b) Geometry and flow measurement not taken; unable to safely take measurement (large river).
Be = Bedrock; Bo = Boulder; Co = Cobble; Gr = Gravel; Or = Organic; Sa = Sand; Si = Silt.

RA4-WC-12
HARROGATE LAKE
ESSER LAKE
OGOKI RIVER
RA1-WC-02
MCCAW LAKE
RA4B-WC-02
RA1-WC-01
RA4-WC-05
PAINTER LAKE
DEBAERE LAKE
RA4-WC-02
ORVISS LAKE
COLPITTS LAKE
BURY LAKE
PIGMENT LAKE
RA4-WC-00
CRONY LAKE
RENWICK LAKE
ZURBRIGG LAKE
BURNABY LAKE
SAGA LAKE
KAPIKOTONGWA RIVER
PERCY LAKE
LITTLE CURRENT RIVER
JUNGFRAU LAKE
LITTLE JUNGFRAU LAKE
FARRELL LAKE
MURIEL RIVER
RUNWAY LAKE

Map Location

Legend

- SURVEYED WATER CROSSINGS

Construction Disturbance Area

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- ROAD
- WATERCOURSE
- WATERBODY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surveyed Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure D-1

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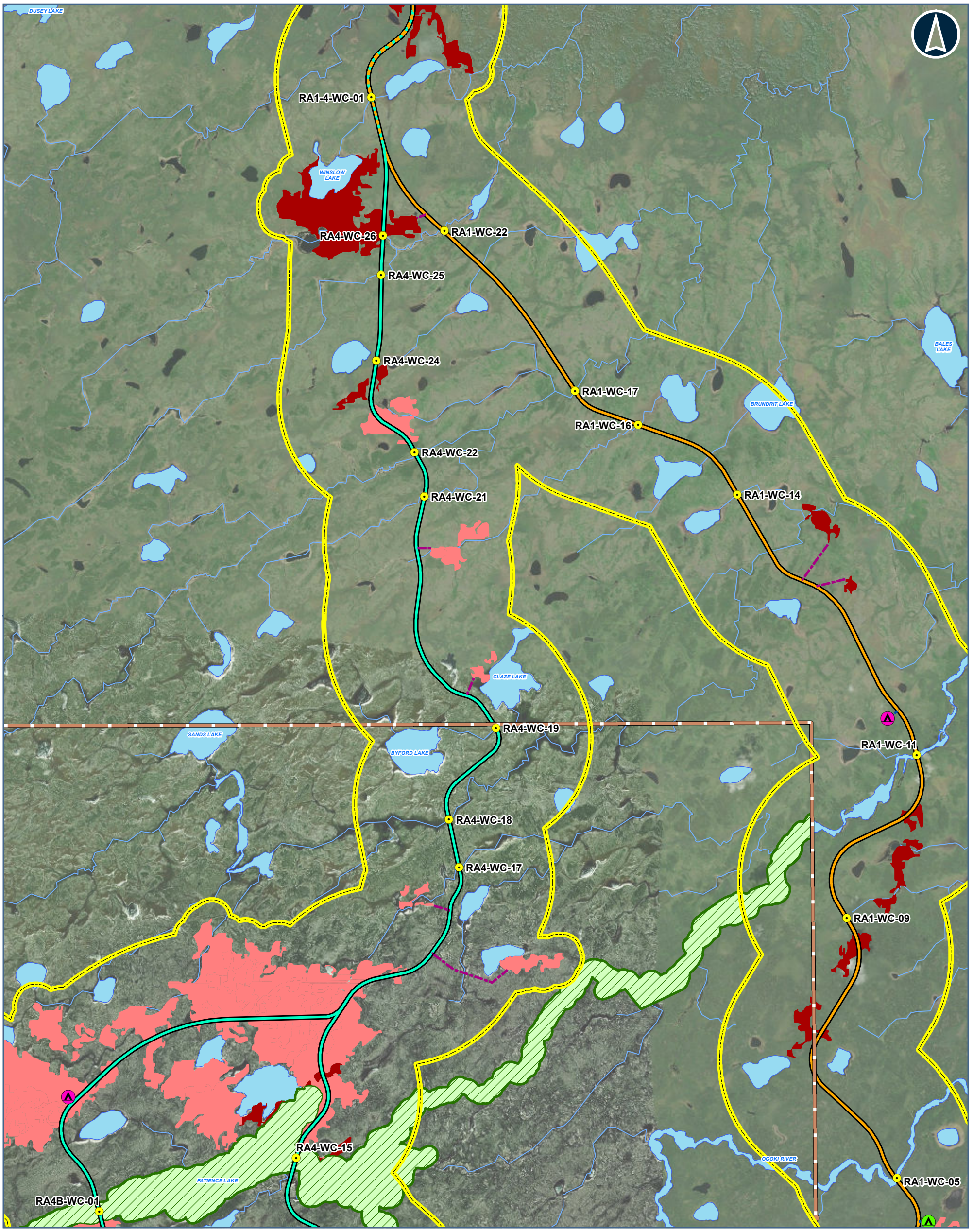

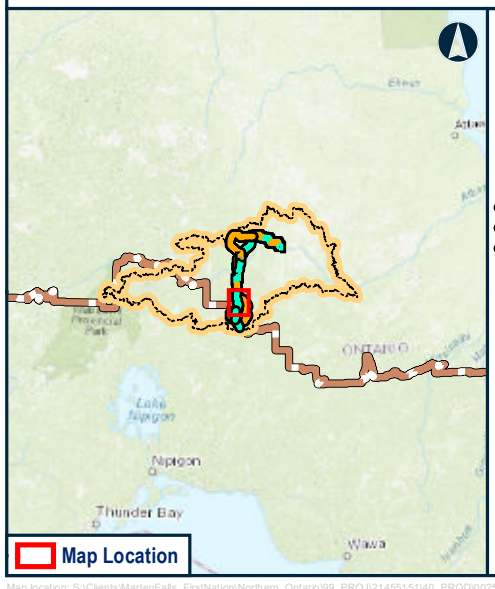

Legend

- SURVEYED WATER CROSSINGS

Construction Disturbance Area

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- WATERCOURSE
- WATERBODY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surveyed Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure D-2

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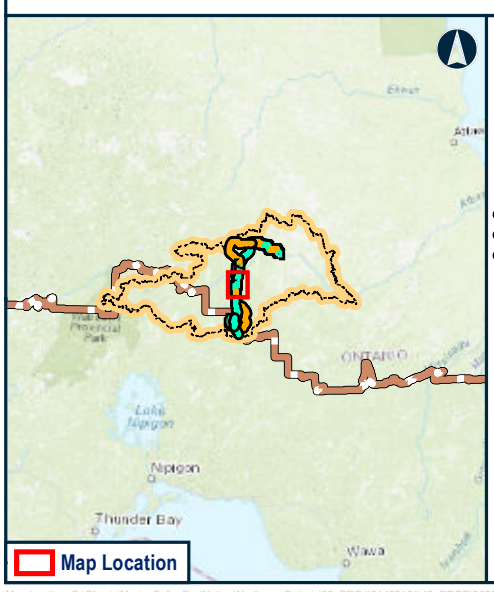
RA1-WC-27
RA1-WC-26
RA4-WC-31
TEABEAU LAKE
ALBANY RIVER
TOLFREE LAKE
RA1-WC-23
RA4-WC-27
SUWALA LAKE
RA1-4-WC-07
DUSEY RIVER
RA1-4-WC-02
TANASE LAKE
DUSEY LAKE



Legend

- SURVEYED WATER CROSSINGS

Construction Disturbance Area

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- WATERCOURSE
- WATERBODY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surveyed Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure D-3

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RA1-WC-51
WABASSI RIVER
VENTON LAKE
MAXEY LAKE
RA4-WC-45
RA1-WC-41
TREBELL LAKE
RA4-WC-42
RA4-WC-41
RA1-WC-32
RA1-WC-30
SAARIMAKI LAKE
RA4-WC-37
ALBANY RIVER
RA4-WC-34
RA1-WC-28

Map Location

Legend

- SURVEYED WATER CROSSINGS

Construction Disturbance Area

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- WATERCOURSE
- WATERBODY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surveyed Water Crossings

0 2.25 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure D-4

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GARVEY LAKE

SLADE LAKE

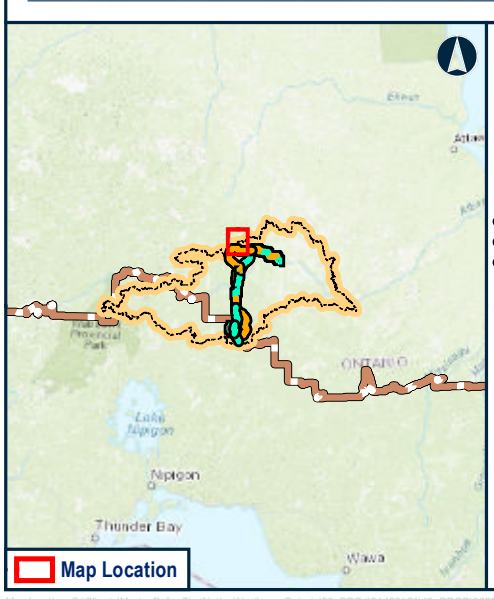
MABIE LAKE

OXTOBY LAKE

RA1-WC-57

RA1-WC-67

RA1-WC-66



Legend

- SURVEYED WATER CROSSINGS
- **Construction Disturbance Area**
- ***POTENTIAL CAMP SITE (Size)***
  - 50 PERSONS
  - 200 PERSONS
- **COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE**
  - ALTERNATIVE 1
  - ALTERNATIVE 4
  - ALTERNATIVE 1 AND ALTERNATIVE 4
  - APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
  - APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- **POTENTIAL AGGREGATE SOURCE**
  - BEDROCK
  - SAND AND GRAVEL
- FAR NORTH BOUNDARY
- WATERCOURSE
- WATERBODY
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surveyed Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure D-5

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GURDEN LAKE

GITTINS LAKE

RA1-4-WC-19

RA1-4-WC-10

RA1-4-WC-21

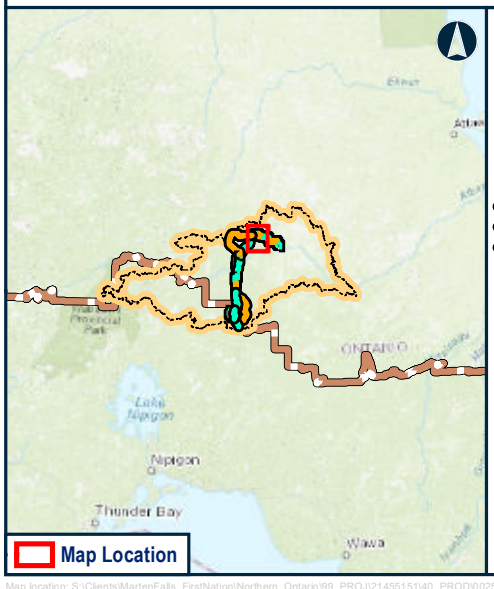
RA4-WC-58

RA4-WC-57

RA4-WC-55

WABASSI RIVER

ALBANY RIVER



Legend

- SURVEYED WATER CROSSINGS

Construction Disturbance Area

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- FAR NORTH BOUNDARY
- WATERCOURSE
- WATERBODY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

Data Source:
Base Data: Provided by MNRF 2022; Route Infrastructure - Provided by AECOM 2024. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surveyed Water Crossings

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:100,000 * when printed 11"x17"
Rev:0	

Figure D-6

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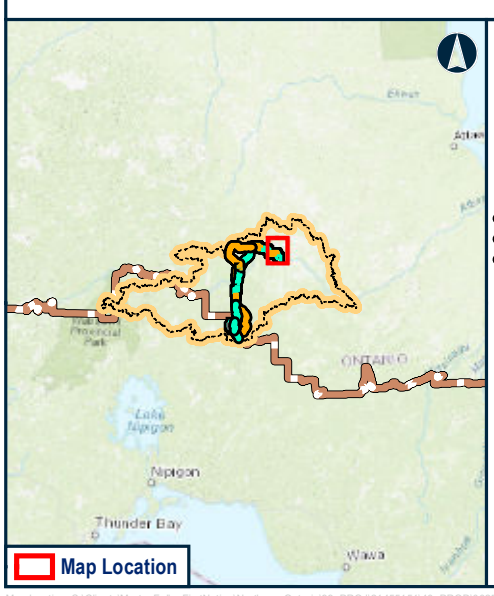
Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\2145151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0003.mxd
Date Saved: 2/11/2026 12:14:56 PM User Name: gld_rduval

SEBERT LAKE
GURDEN LAKE
TIFFIN LAKE
RA1-4-WC-33
RA1-4-WC-35
RA1-4-WC-36
RA1-4-WC-37
ALBANY RIVER



Legend

- SURVEYED WATER CROSSINGS

Construction Disturbance Area

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- FAR NORTH BOUNDARY
- ROAD
- WATERCOURSE
- WATERBODY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA (2.5 KM)
- AQUATIC REGIONAL STUDY AREA

Data Source:
Base Data: Provided by MNRF 2022; Route Infrastructure - Provided by AECOM 2024. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Surveyed Water Crossings

0 2.25 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:100,000 * when printed 11"x17"
Rev:0	

Figure D-7

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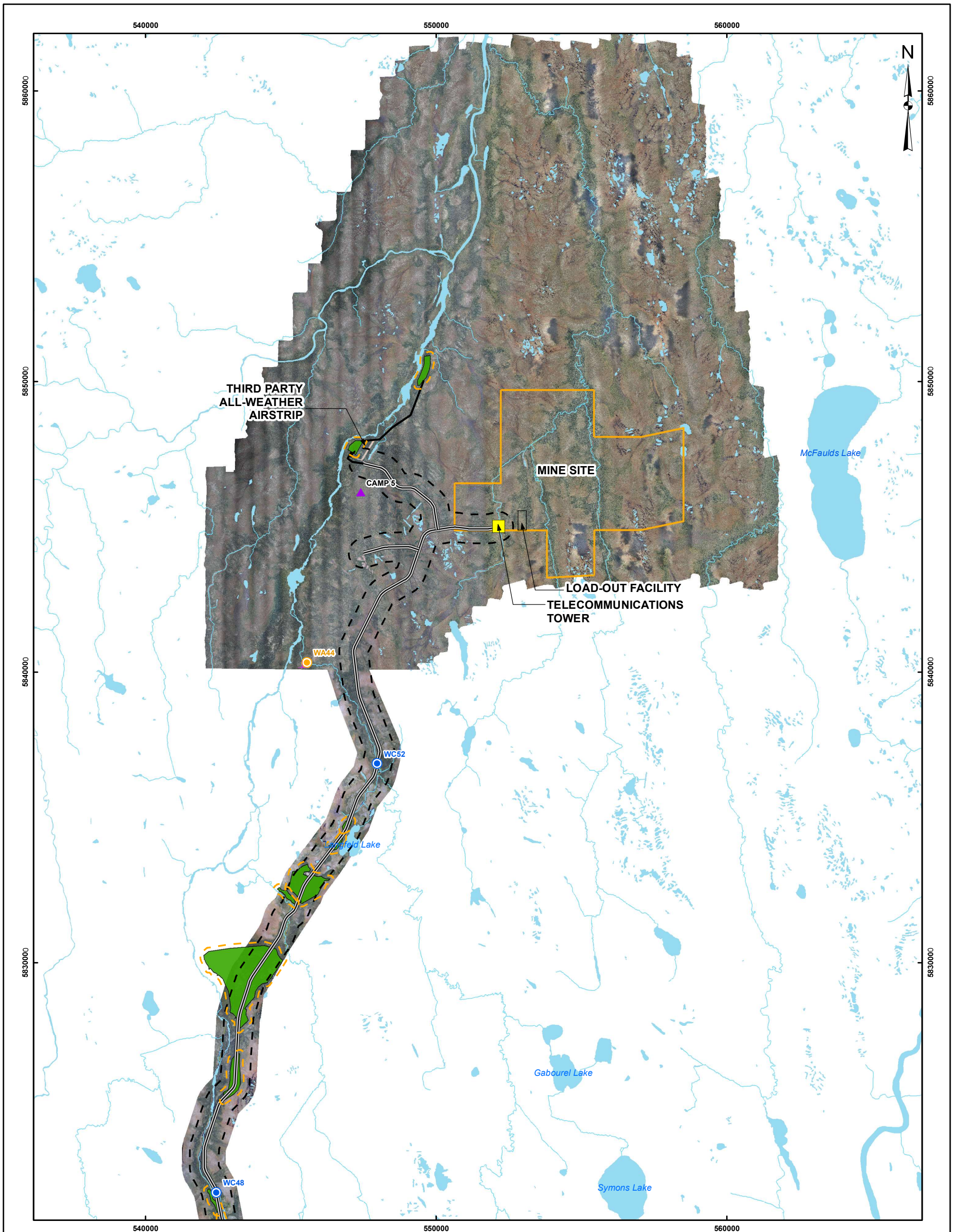
Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0003.mxd
Date Saved: 2/11/2026 12:14:56 PM User Name: gld_rduval

Attachment E – Cliffs Chromite Project Information



LEGEND

- River/Stream
- Waterbody
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Construction Camp Location
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Mine Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5

SCALE 1:125,000 KILOMETRES

NOTE

1. Pit and quarry locations are subject to change pending final engineering design

2. Given the differences in anticipated effects associated with each respective component of the ITS, varying Local Study Areas were identified for the All-weather Access Road, the aggregate borrow pits and rock quarries, and the Cavell Transload Facility.

REFERENCE

Base Data - MNR NRVIS, obtained 2004, CanVec 2006
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2008
Typical general arrangement illustration provided by the Engineering Team
Aggregate Sites Provided by Cliffs Natural Resources (Sept. 2012)
Imagery Provided by Cliffs Natural Resources and KBM Resources (Recieved Nov 2010 and Jan 2013)
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

DRAFT

PROJECT

CLIFFS CHROMITE PROJECT

TITLE

LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
DESIGN	CGE	14 Nov. 2008	FIGURE: 2.2.2-1A	
GIS	SC	19 Sep. 2013		
CHECK	AL	19 Sep. 2013		
REVIEW	DB	19 Sep. 2013		

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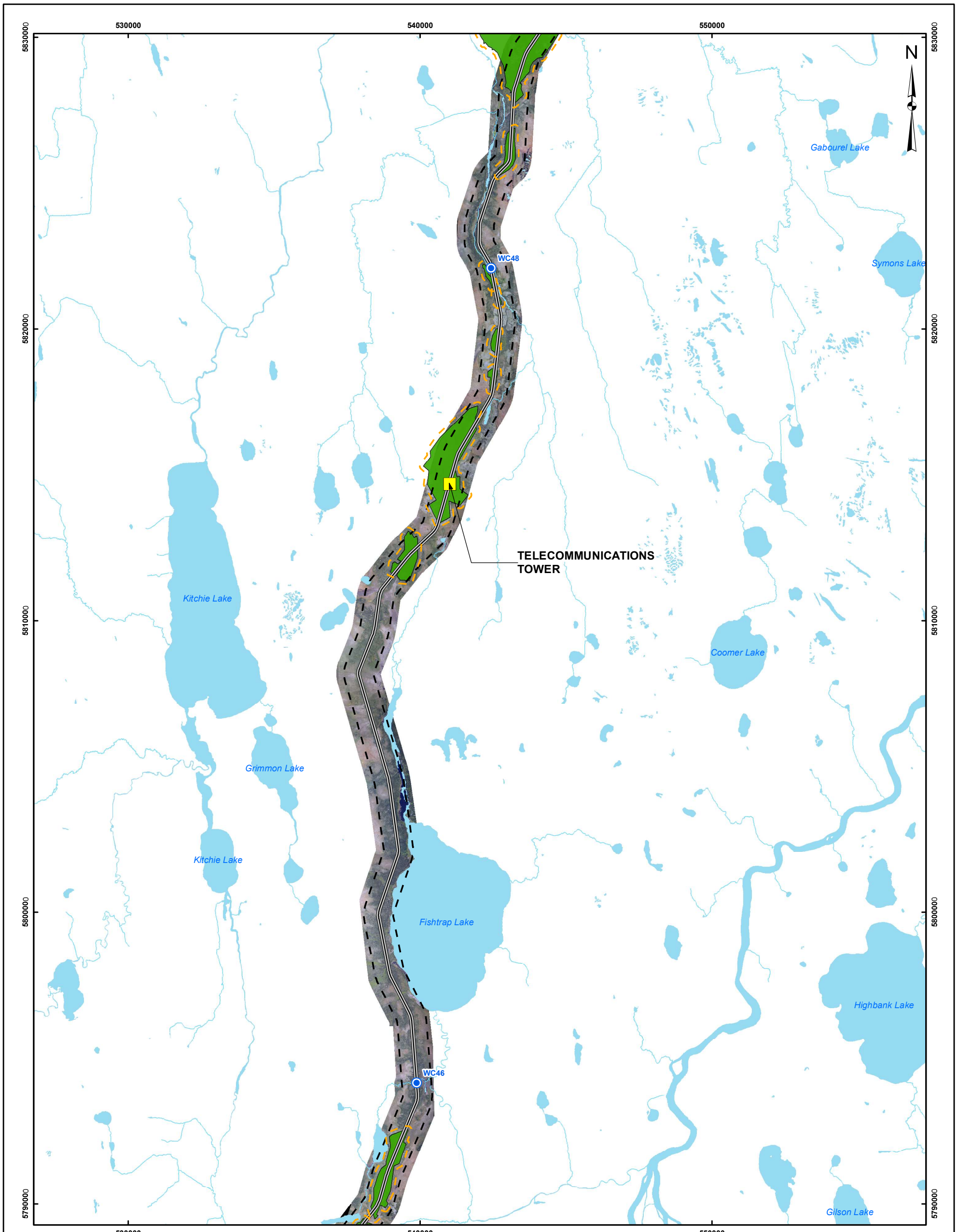

LEGEND

- River/Stream
- Waterbody
- Sampled Water Crossing
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5
SCALE 1:125,000 KILOMETRES

NOTE

1. Pit and quarry locations are subject to change pending final engineering design

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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

DRAFT

PROJECT

CLIFFS

CLIFFS CHROMITE PROJECT

TITLE

LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
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GIS	SC	19 Sep. 2013		
CHECK	AL	19 Sep. 2013		
REVIEW	DB	19 Sep. 2013		

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520000 530000 540000

5790000 5780000 5770000 5760000

N

WC46

Lamon Lake

Kingsland Lake

Attawapiskat River

WA33

Frankfurth Lake

WC45

McKenna Lake

CAMP 4

MAINTENANCE DEPOT AND TELECOMMUNICATION TOWER

WC42

Attawapiskat River

Ludlow Lake

Seabrook Lake

Slade Lake

Dainty Lake

520000 530000 540000

LEGEND

- River/Stream
- Waterbody
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Maintenance Depot
- Construction Camp Location
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5

SCALE 1:125,000 KILOMETRES

NOTE

1. Pit and quarry locations are subject to change pending final engineering design

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Imagery Provided by Cliffs Natural Resources and KBM Resources (Recieved Nov 2010 and Jan 2013)
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

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PROJECT

CLIFFS

CLIFFS CHROMITE PROJECT

TITLE

LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
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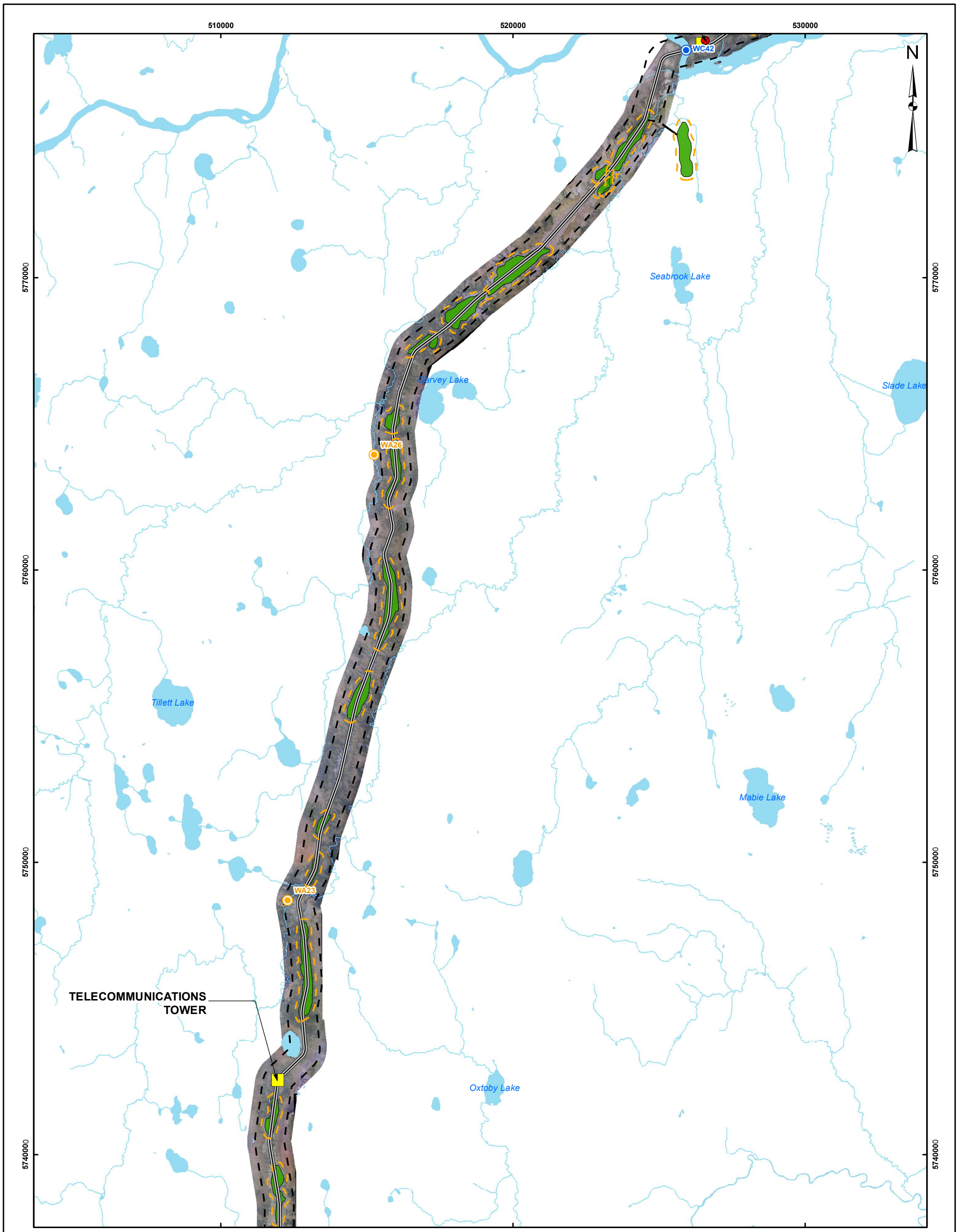

LEGEND

- River/Stream
- Waterbody
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Maintenance Depot
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5
SCALE 1:125,000 KILOMETRES

NOTE

1. Pit and quarry locations are subject to change pending final engineering design

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Imagery Provided by Cliffs Natural Resources and KBM Resources (Recieved Nov 2010 and Jan 2013)
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

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PROJECT
CLIFFS
CLIFFS CHROMITE PROJECT

TITLE
LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
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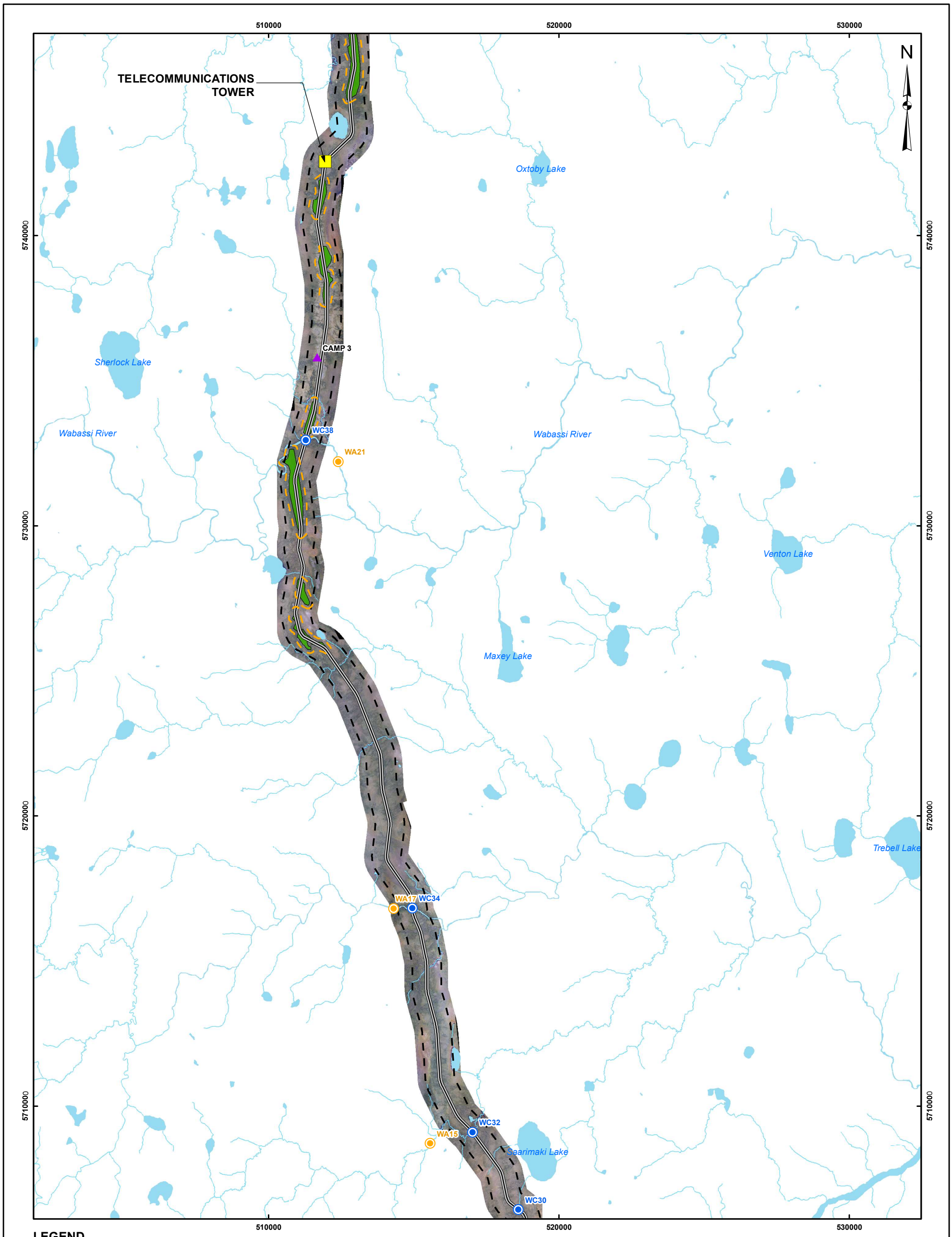

LEGEND

- River/Stream
- Waterbody
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Pit Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries
- Construction Camp Location
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)

5 2.5 0 5
SCALE 1:125,000 KILOMETRES

NOTE

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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

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PROJECT
CLIFFS
CLIFFS CHROMITE PROJECT

TITLE
LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
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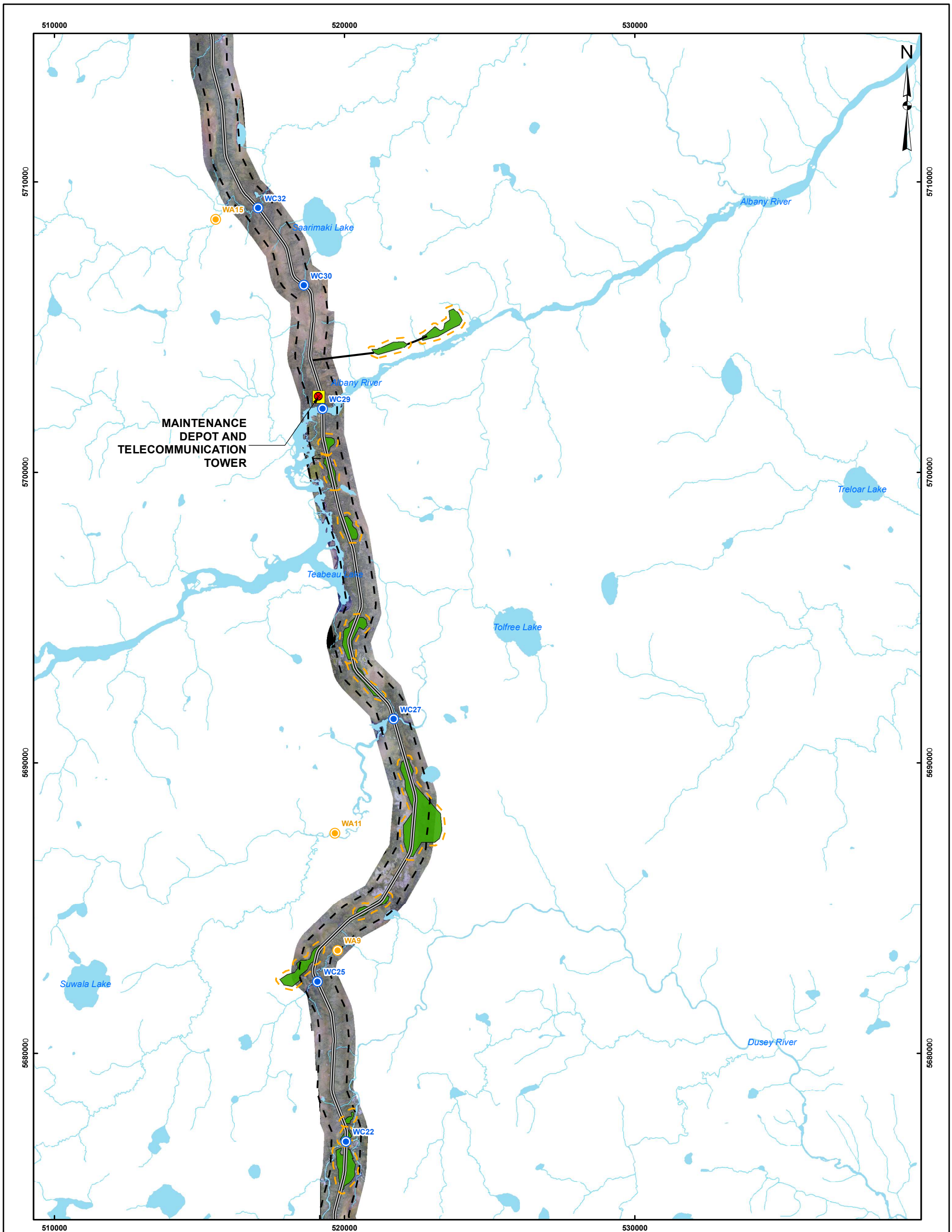

LEGEND

- River/Stream
- Waterbody
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Maintenance Depot
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5
SCALE 1:125,000 KILOMETRES

NOTE

1. Pit and quarry locations are subject to change pending final engineering design

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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

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PROJECT
CLIFFS
CLIFFS CHROMITE PROJECT

TITLE
LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
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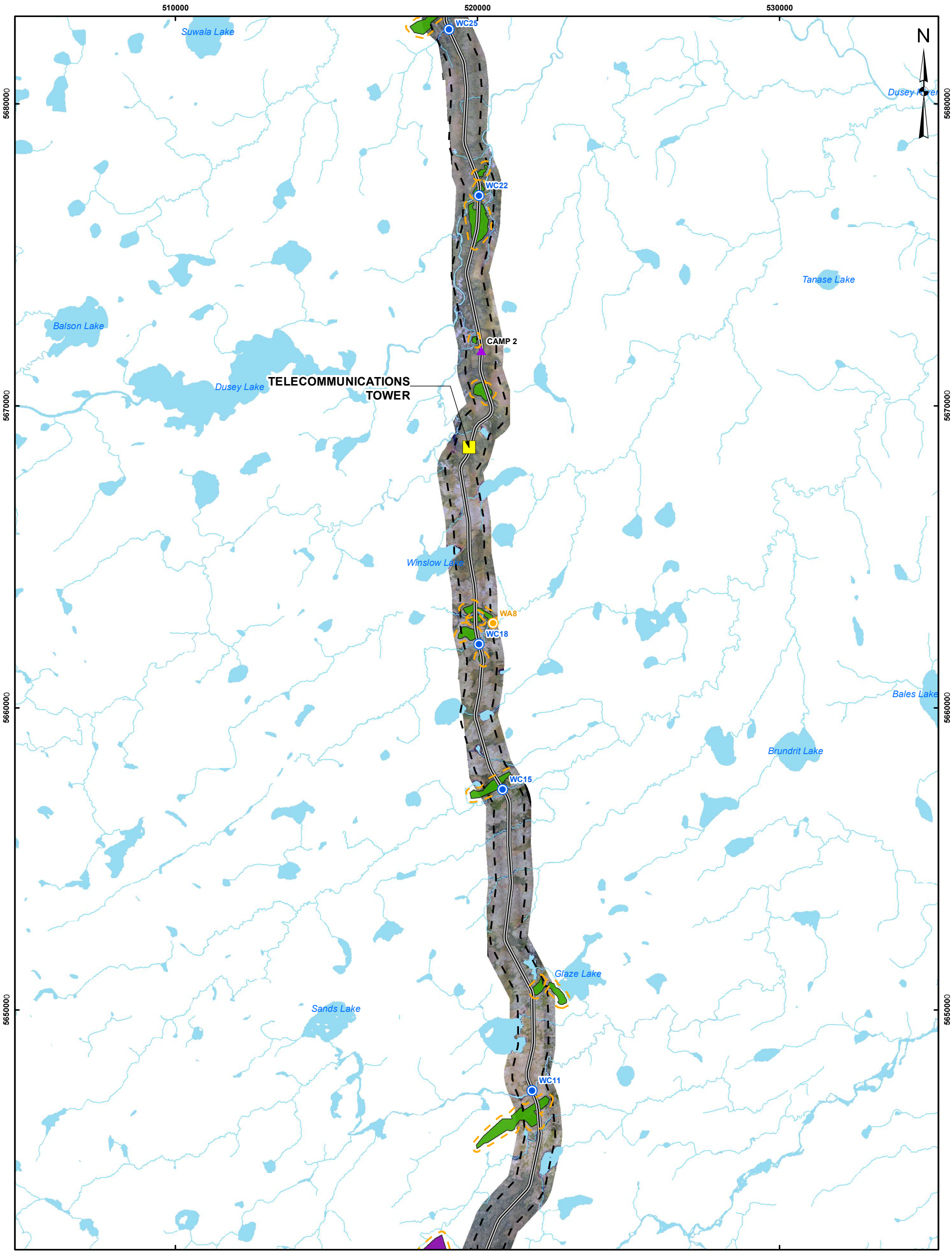

LEGEND

- River/Stream
- Waterbody
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Construction Camp Location
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Quarry Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5

SCALE 1:125,000 KILOMETRES

NOTE

1. Pit and quarry locations are subject to change pending final engineering design

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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

DRAFT

PROJECT

CLIFFS CHROMITE PROJECT

TITLE

LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
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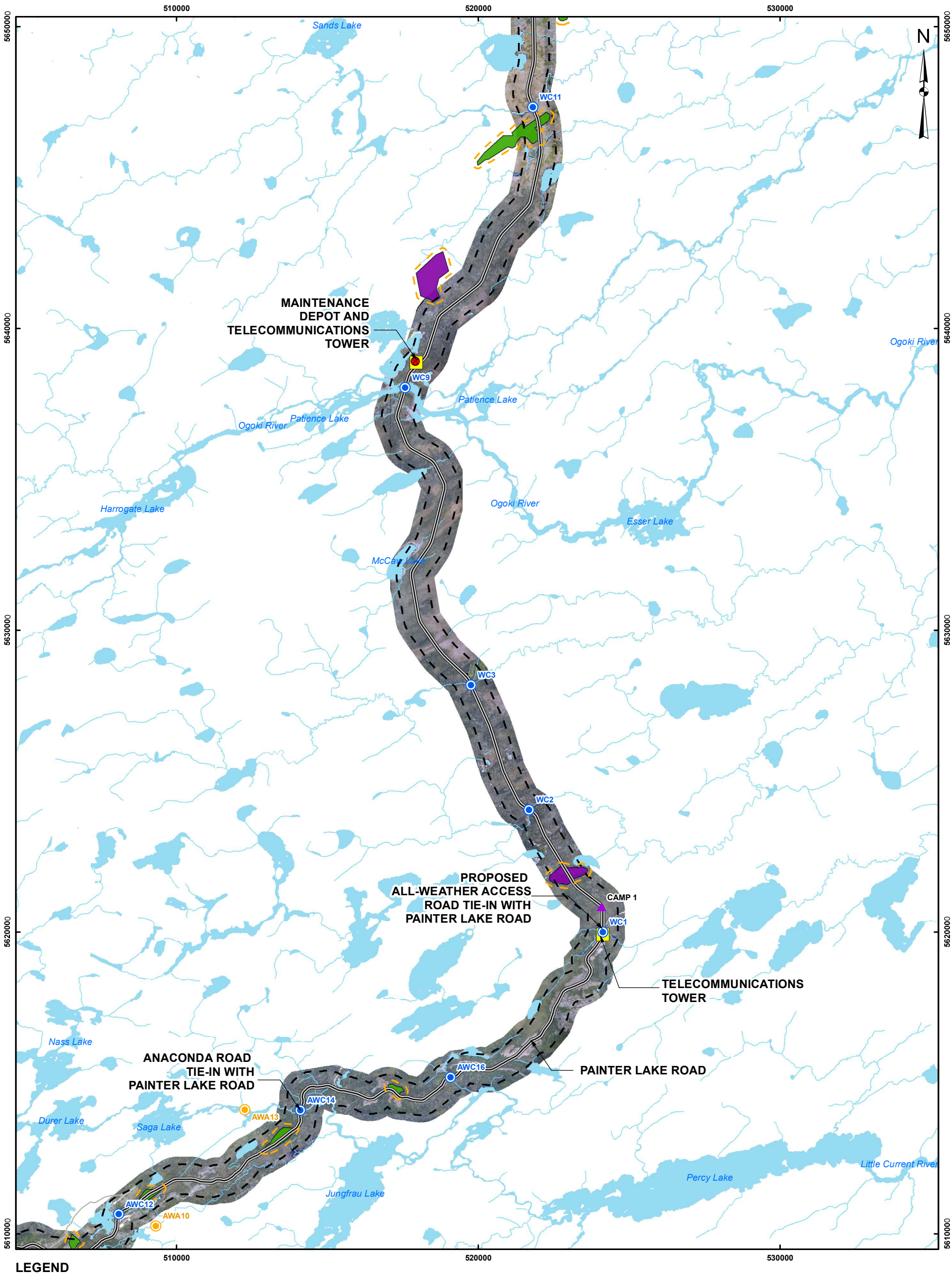

LEGEND

- River/Stream
- Waterbody
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Maintenance Depot
- Construction Camp Location
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Quarry Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5

SCALE 1:125,000 KILOMETRES

NOTE

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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

DRAFT

PROJECT

CLIFFS CHROMITE PROJECT

TITLE

LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
DESIGN	CGE	14 Nov. 2008	FIGURE: 2.2.2-1H	
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REVIEW	DB	19 Sep. 2013		

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490000 500000 510000

5610000 5600000 5590000 5580000

Kapikotongwa River
Tester Lake
Melchett Lake
Briarcliffe Lake
Nass Lake
Durer Lake
Saga Lake
Chaucer Lake
Jungfrau Lake
Skibi Lake
Terrier Lake
Little Current River
Terrier River
Superb Lake
Kupfer Lake
Melly Lake
O'Sullivan Lake

ANACONDA ROAD TIE-IN WITH PAINTER LAKE ROAD

ANACONDA ROAD

TELECOMMUNICATIONS TOWER

Aroland First Nation

AWA6
AWA10
AWA13
AWC11
AWC12
AWC14

N

LEGEND

- River/Stream
- Waterbody
- First Nation Community
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Quarry Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5
SCALE 1:125,000 KILOMETRES

NOTE

1. Pit and quarry locations are subject to change pending final engineering design

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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

DRAFT

PROJECT
CLIFFS
CLIFFS CHROMITE PROJECT

TITLE
LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
DESIGN	CGE	14 Nov. 2008	FIGURE: 2.2.2-1I	
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480000 490000 500000

5590000 5580000 5570000 5560000

N

Abamasagi Lake

Superb Lake

TELECOMMUNICATIONS TOWER

Kupfer Lake

Melly Lake

AWA6

ANACONDA ROAD

O'Sullivan Lake

AWC2

Aroland First Nation

CAVELL TRANSLOAD FACILITY

TELECOMMUNICATIONS TOWER

Idsordi Lake

TRSLD1 TRSLD2 TRSLD3 TRSLD4 TRSLD5

Cavell

Aroland

Kawashkagama Lake

480000 490000 500000

LEGEND

- Community
- Existing Road
- CN Transcontinental Rail Line
- River/Stream
- Waterbody
- First Nation Community
- Sampled Waterbody Assessment Location (Aquatic Biology and/or Water Quality)
- Sampled Water Crossing
- Water and Sediment Quality Sampling Locations
- Telecommunications Tower
- All-weather Access Road (100m Right-of-Way)
- Access Roads (Temporary)
- Pit Site
- Quarry Site
- Local Study Area – All-weather Access Road
- Local Study Area – Aggregate Borrow Pits and Quarries

5 2.5 0 5

SCALE 1:125,000 KILOMETRES

NOTE

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DRAFT

PROJECT

CLIFFS

CLIFFS CHROMITE PROJECT

TITLE

LOCAL STUDY AREA AND WATER CROSSING LOCATIONS - INTEGRATED TRANSPORTATION SYSTEM

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1118-0050			SCALE AS SHOWN	REV. 0.0
DESIGN	CGE	14 Nov. 2008	FIGURE: 2.2.2-1J	
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CHECK	AL	19 Sep. 2013		
REVIEW	DB	19 Sep. 2013		

G:\Projects\2012\12-1118-0050_Cliffs_EA\GIS\MXDs\Reporting\TSDs\V4\Hydrology\ITS\LSA_WaterCrossings_ITS.mxd

Table 6.2.2-1: Minor Navigable Water Classification - New Water Crossings along Proposed All-weather Access Road

Water Crossing ID	NAD 83 UTM Zone 15N [a]		Drainage Area (km^2)	Mean Annual Flow (L/s)	Field Flow Measure-ment (L/s)	Average Bankfull Width (m)	Average Bankfull Depth (m)	Mean Channel Slope (%)	Channel Sinuosity	Number of Natural Obstacles	Minor Navigable Water
	East	North									
AWC5[b]	490044	5586912	240.0	2,520	- [g]	25.0	2.0	- [d]	1.5	2	No
AWC12	508087	5610650	7.3	77	0 [h]	1.1	0.3	- [d]	1	1	Yes
WC1	524133	5620004	5.0	53	0 [h]	2.3	0.8	0.33	1.6	0	Yes
WC2	521688	5624045	107.8	1,131	174	13	1.4	0.2	1.8	5+	No
WC3	519761	5628183	80.0	840	238	14.5	1.8	0.13	1.1	0	No
WC4[e]	518011	5632278	2.4	25	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC5[e]	518541	5633311	1.3	14	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC6	518546	5635528	8.3	87	4	4.4	1.0	- [d]	1	1	No
WC7	517334	5636948	0.3	3	0 [h]	2.2	1.3	- [d]	1.3	0	No
WC8	517415	5637506	11.8	124	0 [h]	7	0.9	- [d]	1.2	5+	No
WC9	517579	5638042	15,771.0	40,913	- [g]	>100	>3.0	0.1	1.1	0	No
WC10	522068	5646003	16.4	172	0 [h]	9.1	1.3	0.31	1.1	2	No
WC11	521815	5647338	89.3	938	0 [h]	10.9	1.3	0.24	1.3	3	No
WC12	521841	5649760	16.5	173	0 [h]	4.5	1.0	- [d]	1.2	3	No
WC13[f]	521109	5654467	6.5	68	- [f]	- [f]	- [f]	0.31	1	2	- [g]
WC14	521025	5656076	11.7	123	0 [h]	5	0.9	0.4	1.5	3	No
WC15	520839	5657302	71.9	755	0 [h]	11	1.2	- [d]	1.1	5+	No
WC16	520322	5658334	1.1	12	0 [h]	2.1	0.7	- [d]	1.1	2	No
WC17	519938	5659791	2.6	27	0 [h]	1.6	1.0	- [d]	1	0	Yes
WC18	520060	5662108	16.5	173	0 [h]	4.6	0.8	0.16	1.1	5+	No
WC19	519935	5663158	28.0	294	0 [h]	6.9	0.6	- [d]	1.4	3	No
WC20	519604	5666837	5.3	56	0 [h]	2.3	0.8	- [d]	1.1	5+	Yes
WC21	519898	5669205	0.8	8	0 [h]	0.9	0.6	- [d]	1	-	Yes
WC22	520051	5676958	421.7	4,428	1,778	42.9	1.9	0.32	1.3	2	No

Table 6.2.2-1: Minor Navigable Water Classification - New Water Crossings along Proposed All-weather Access Road (Continued)

Water Crossing ID	NAD 83 UTM Zone 15N [a]		Drainage Area (km^2)	Mean Annual Flow (L/s)	Field Flow Measure-ment (L/s)	Average Bankfull Width (m)	Average Bankfull Depth (m)	Mean Channel Slope (%)	Channel Sinuosity	Number of Natural Obstacles	Minor Navigable Water
	East	North									
WC23[e]	519752	5678174	0.7	7	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC24[e]	519628	5680125	0.6	6	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC25	519059	5682468	19.1	201	0 [h]	9.9	1.1	0.36	1.2	1	No
WC26	519837	5684281	1.6	17	0 [h]	1.4	0.4	- [d]	1	5+	Yes
WC27	521688	5691500	335.9	3,527	- [g]	10	1.5	0.14	1.5	0	No
WC28[e]	519687	5699406	2.0	21	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC29	519242	5702193	30,210.0	200,705	- [g]	>50	>3	0.08	1.2	3	No
WC30[e]	518602	5706436	0.6	6	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC31[e]	517756	5708096	0.9	9	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC32	517020	5709101	90.0	945	0 [h]	10	1.4	- [d]	1.2	1	No
WC33	515442	5714732	3.7	39	0 [h]	12.1	0.7	- [d]	1	5+	No
WC34	514943	5716821	579.2	6,081	758	36.3	1.7	0.2	1.2	3	No
WC35	513677	5722560	14.0	147	0 [h]	3.9	0.9	- [d]	1.2	5+	No
WC36	512354	5725169	56.3	591	0 [h]	5.6	1.4	- [d]	1	0	No
WC37[e]	511150	5728301	1.2	13	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC38	511271	5732949	1,036.1	10,879	- [g]	>20	>3.0	0.09	1.4	0	No
WC39	511637	5734487	26.2	275	0 [h]	4.8	1.0	- [d]	1.4	5+	Yes
WC40	512897	5749140	50.7	532	0 [h]	9.5	1.8	- [d]	1.1	0	No
WC41	524965	5777011	3.8	40	0 [h]	2.9	0.5	- [d]	1	3+	Yes
WC42	525924	5777778	26,490.0	278,145	- [g]	>50	>3.0	0.07	1.2	0	No
WC43[e]	527288	5778338	4.4	46	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
WC44	532315	5783452	6.4	67	29	0.7	0.3	- [d]	1.2	0	Yes
WC45	532685	5785342	4.7	49	20	3	0.4	0.32	1.2	3	Yes

Table 6.2.2-1: Minor Navigable Water Classification - New Water Crossings along Proposed All-weather Access Road (Continued)

Water Crossing ID	NAD 83 UTM Zone 15N [(a)]		Drainage Area (km^2)	Mean Annual Flow (L/s)	Field Flow Measure-ment (L/s)	Average Bankfull Width (m)	Average Bankfull Depth (m)	Mean Channel Slope (%)	Channel Sinuosity	Number of Natural Obstacles	Minor Navigable Water
	East	North									
WC46	539874	5794153	19.3	203	564	11.7	0.4	0.21	1.1	4	No
WC47[(c)]	538893	5798187	2.0	21	- [(c)]	- [(c)]	- [(c)]	- [(c)]	- [(c)]	- [(c)]	- [(c)]
WC48	542434	5822086	79.7	837	1,102	12.1	1.5	- [(d)]	1.1	1	No
WC49	544958	5831655	82.6	867	781	11.5	1.1	0.2	1.1	0	No
WC50[(e)]	547093	5835119	2.9	30	- [(e)]	- [(e)]	- [(e)]	- [(d)]	1	- [(e)]	- [(e)]
WC51[(e)]	547620	5836111	1.0	11	- [(e)]	- [(e)]	- [(e)]	- [(d)]	1	- [(e)]	- [(e)]
WC52	547969	5836842	193.3	2,030	2,206	15.2	1.9	0.13	1.2	0	No
WC53 [(c)]	547718	5844154	0.5	5	- [(c)]	- [(c)]	- [(c)]	- [(c)]	- [(c)]	- [(c)]	- [(c)]

Note:

(a) UTM coordinates at All-weather Access Road water crossing
(b) Existing Painter Lake Road/Anaconda Road crossing (ID AWA6) visited, 700 m upstream of proposed new crossing
(c) Not visited during field surveys due to scheduling constraints
(d) Very flat area, channel slope could not be determined from topographic data
(e) Site could not be assessed in the field; no defined channel found
(f) Site could not be assessed due to extensive flooding
(g) Flow measurement not taken; dry area or unable to safely take measurement (mainly in large rivers)
(h) Trace flow, could not be measured with the available equipment

Table 6.2.2-2: Minor Navigable Water Classification - Existing Water Crossings along Proposed All-Weather Access Road

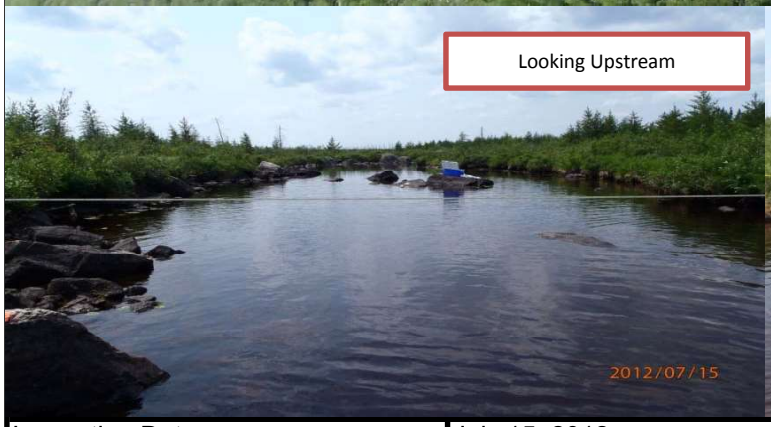
Water Crossing ID	NAD 83 UTM Zone 15N [a]		Drainage Area (km^2)	Mean Annual Flow (L/s)	Field Flow Measure-ment (L/s)	Average Bankfull Width (m)	Average Bankfull Depth (m)	Mean Channel Slope (%)	Channel Sinuosity	Number of Natural Obstacles	Minor Navigable Water
	East	North									
AWC1 [c]	496929	5571667	3.6	38	- [c]	- [c]	- [c]	- [d]	1	0	- [c]
AWC2	494900	5575472	84.1	883	233	5	0.7	- [d]	1.6	3	No
AWC3 [b]	490533	5584619	0.8	8	- [c]	- [c]	- [c]	- [c]	- [c]	- [c]	- [c]
AWC4 [f]	490280	5586187	4.9	51	- [f]	- [f]	- [f]	- [d]	1	2	- [f]
AWC6 [e]	491003	5589952	0.7	7	- [e]	- [e]	- [e]	- [d]	1	- [e]	- [e]
AWC7	491847	5591625	7.0	74	6	1.2	0.2	- [d]	1.1	1	Yes
AWC8	494535	5594720	1.3	14	- [g]	2.1	0.3	- [d]	1	0	Yes
AWC9	495442	5595327	3.8	40	7	0.8	0.3	- [d]	1	0	Yes
AWC10	500446	5601071	20.4	214	7	1.1	0.1	- [d]	2.6	5+	Yes
AWC11 [c]	502477	5603836	7.9	83	- [c]	- [c]	- [c]	- [c]	- [c]	1	- [c]
AWC13	512137	5612200	2.4	25	0 [h]	1.1	0.2	- [d]	1.2	5+	Yes
AWC14	514110	5614099	1,572.5	16,511	- [g]	20.0	0.5	- [d]	1	2	No
AWC15	514678	5614878	14.4	151	0 [h]	1.6	0.7	- [d]	1	0	No
AWC16	519082	5615181	6.4	67	16	2	0.1	- [d]	1.1	5+	Yes

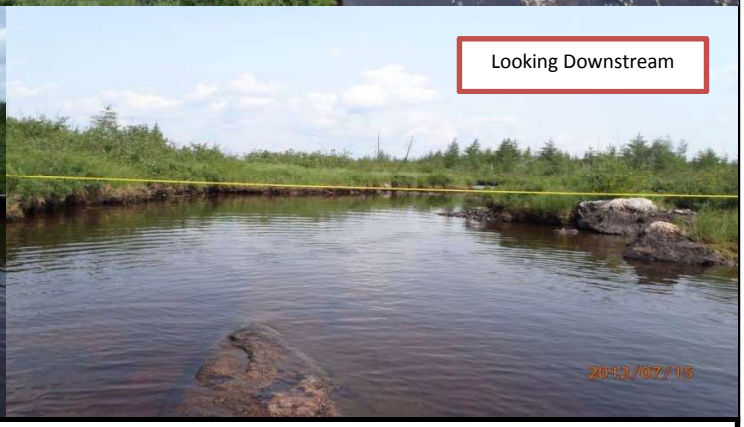
Note:

(a) UTM coordinates at All-weather Access Road water crossing
(b) Not visited during field surveys due to scheduling constraints
(c) Lake with no defined channel
(d) Very flat area, channel slope could not be determined from topographic data
(e) Site could not be assessed in the field; no defined channel found
(f) Site could not be assessed due to extensive flooding
(g) Flow measurement not taken; dry area or unable to safely take measurement (mainly in large rivers)
(h) Trace flow, could not be measured with the available equipment

WATER CROSSING SURVEYS WC11

September 2013
Report No. GAL-006-TSD-V3.1
GOL10CLF-0826-07-124-0008-002_B





Inspection Date:	July 15, 2012		
Site ID:	WC11		
Location Description:	Large stream on bedrock		
UTM Coordinates of crossing:	16U 521814.996 E	5647338 N	
UTM Coordinates of cross section:	16U 521814.996 E	5647338 N	
Personnel Present:	DV, JM, SN		
Weather Conditions:	Partly Cloudy, calm		

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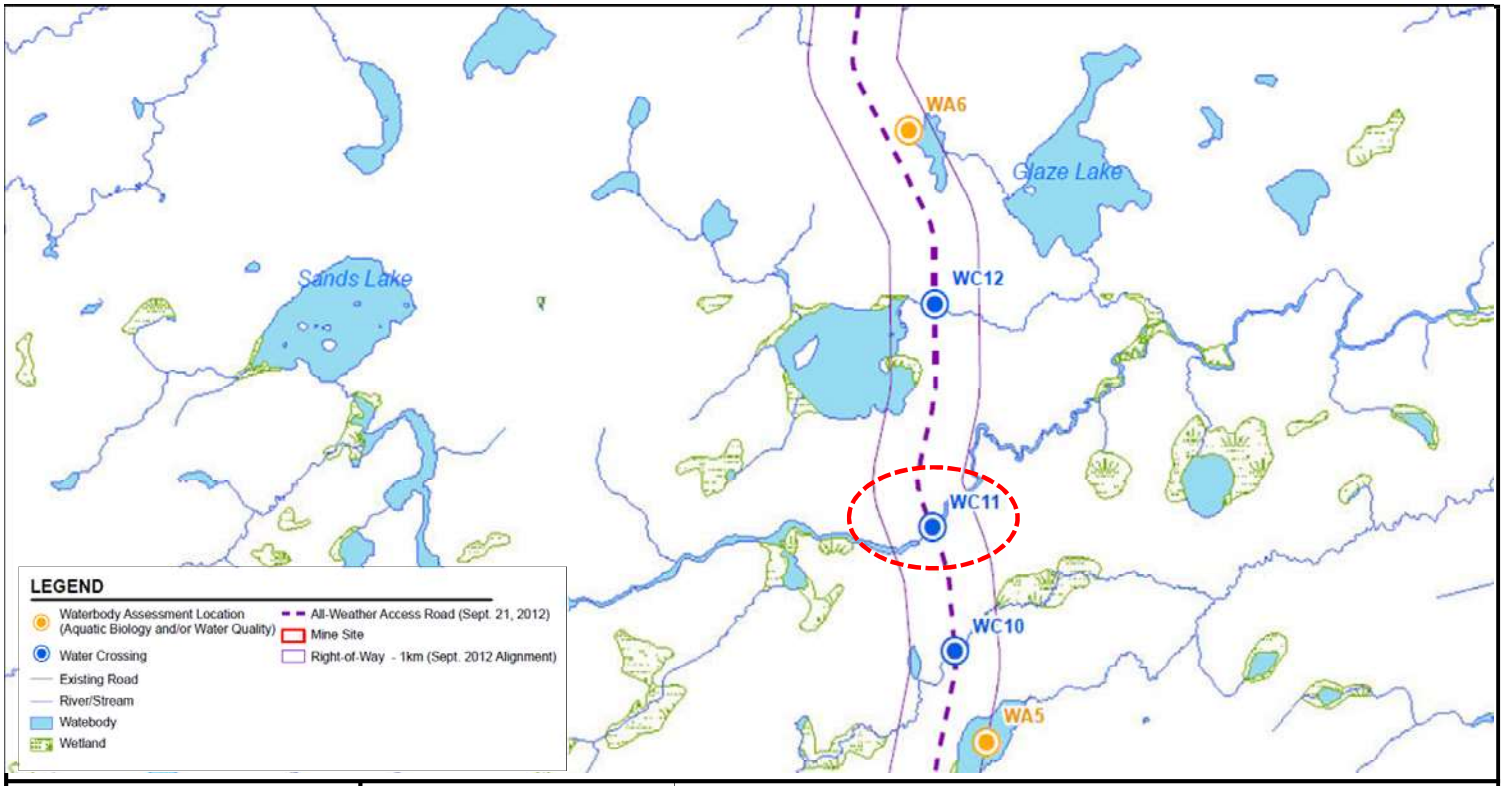
Water Crossing Surveys WC11

PROJECT:	11-1118-0063 (2050)	DATE:	July-2012	Cliffs Chromite Project	SHEET 1



Current Metering Section:	Surface Geology[1]	Bedrock (Foliated Tonalite Suite)
	General Section Description:	Entrenched, riffle/pool channel
	Hydraulic Control:	Low gradient, with some large obstructing boulders
	Thalweg Comments:	Thalweg is consistently in the center of the river, channel bottom is consistent.
	Sinuosity[2,3]:	1.32 (moderate sinuosity)
	Bed Slope[2]:	0.24%
	Entrenchment Ratio[3]:	3.52 (slightly entrenched)
	Fluvial Geomorphology:	Large River Clearing in a wetland with sparse trees and thick bush.
Basic Observations at Crossing	Depth at time of observation:	0.7 m
	Width at time of observation:	8.8 m
	Bankfull Depth, D_2	1.2 m
	Bankfull Width, W_2	11.9 m
	Floodplain Observations:	~15m of floodplain until treeline, consisting of long frasses, shrubs and small trees. The treeline follows the stream closely leaving a constant amount of floodplain
Substrate: (L & R looking downstream)	Left Bank:	Loose organics with mixed soils and gravel
	Bed:	gravel, cobbles, and scattered boulders around the crossing with increasing amounts of organics up and downstream ~200m
	Right Bank:	Loose organics with mixed soils and gravel

Additional Comments:
- Scattered boulders cause obstructions within the waterway
- Flow in channel was very low due to the gradient of the channel bed and was undetectable with the equipment available.

Notes:
1. Source: Ontario Geological Survey 1997. Quaternary Geology, Seamless Coverage of the Province of Ontario. Data Set 14.7
2. This is an approximate value based on limited topographical information. Base data from MNR NRVIS (obtained 2004, CANMAP v2006.4, CanVec) and LiDAR Data - Provided by Cliffs Resources (November, 2010). Datum: NAD 83 Coordinate System: UTM Zone 16N
3. Ranking determined from the Rosgen Classification Tables (Rosgen, D. (1996). Applied River Morphology. Wildlife Hydrology, Pagosa Springs, CO.)

Water Chemistry

Sample taken (Y/N):	Yes	
Temperature:	25.85	°C
Conductivity:	102	uS/cm
Temp. Corrected Conductivity:	-	mS/cm[c]
DO:	-	%
	6.7	mg/L
pH:	7.5	
ORP:	147	
Pressure:	-	mmHg
Readings taken at:	10:45:00 AM	########

Golder Associates

Water Crossing Surveys
WC11

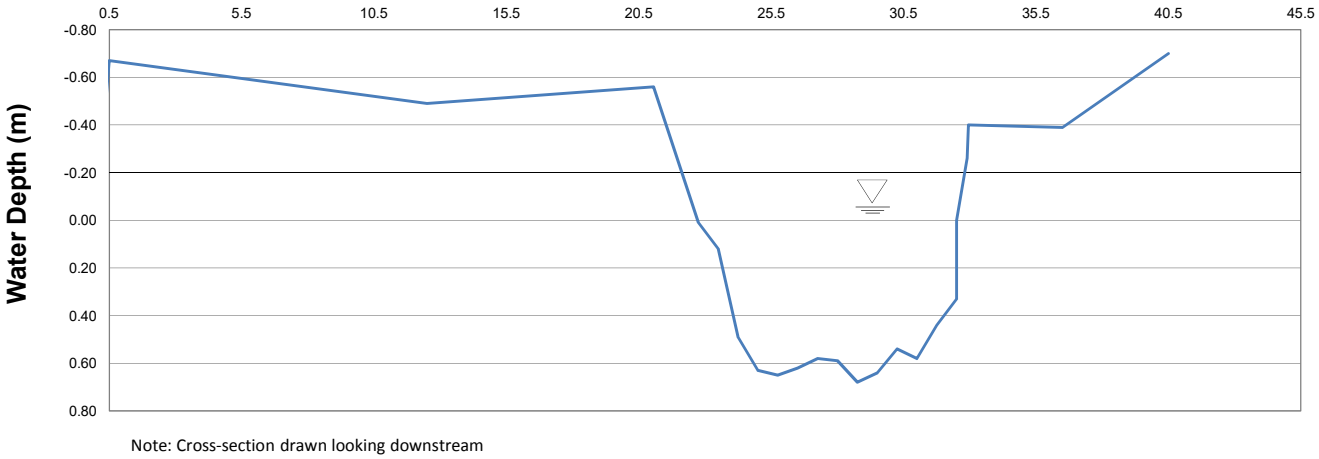
PROJECT:	11-1118-0063 (2050)	DATE:	July-2012	Cliffs Chromite Project	SHEET 2

Survey At Crossing

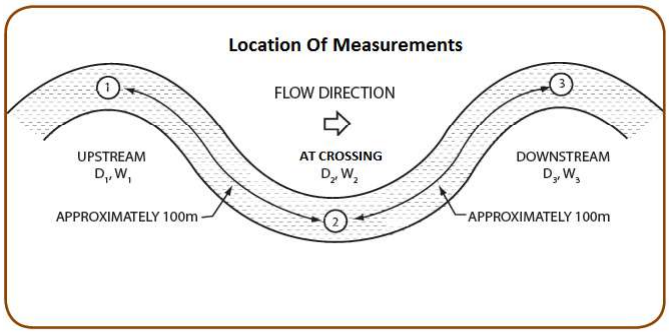
Cross Section Survey beyond Left and Right Bankfull			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
BM	-0.500	Benchmark	Large Rock
0.5	-0.670		Treeline (right)
12.5	-0.490	floodplain	
21.1	-0.560	Right Bankfull	
22.75	0.010	Water level	
32.50	0.000	Water level	
32.90	-0.260	highwater mark	
32.95	-0.400	Left Bankfull	
36.50	-0.390	floodplain	
40.50	-0.700		Treeline (left)

Notes: + elevations are below the water surface
- elevations are above the water surface
Depths between left and right bankfull on Sheet 6

Channel Geometry



Note: Cross-section drawn looking downstream



Notes:
Flow in channel was very low due to the gradient of the channel bed and was undetectable with the equipment available.

Golder Associates

Water Crossing Surveys WC11

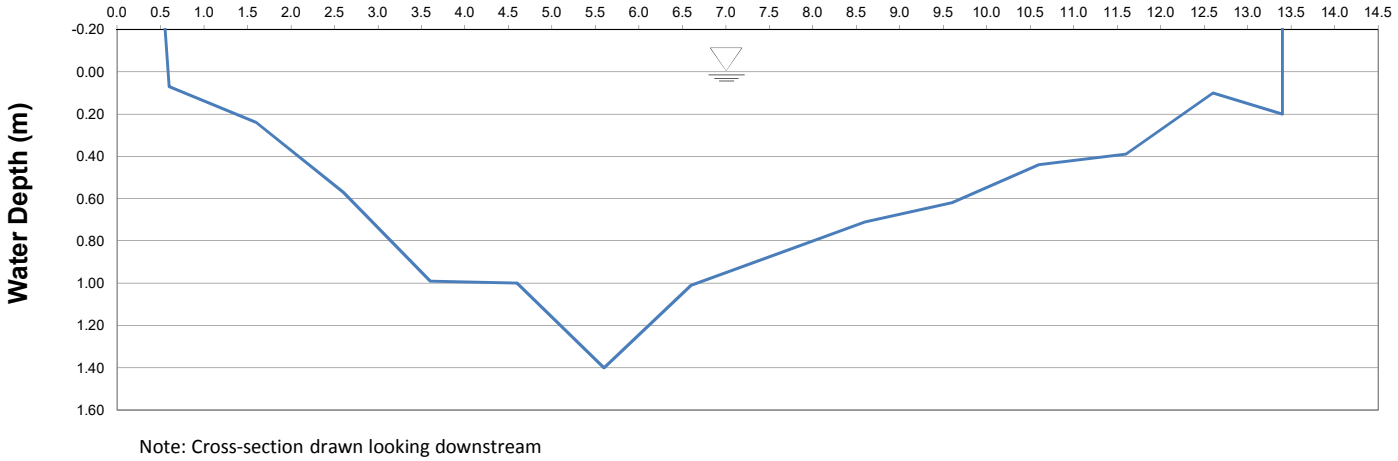
PROJECT:	11-1118-0063 (2050)	DATE:	July-2012	Cliffs Chromite Project	SHEET 3

Upstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.50	-0.510	Left Bankfull	
0.50	-0.610	Highwater mark	
0.60	0.070		
1.60	0.240		
2.60	0.570		
3.60	0.990		
4.60	1.000		
5.6	1.40		
6.6	1.01		
7.60	0.86		
8.60	0.71		
9.60	0.62		
10.60	0.44		
11.60	0.39		
12.60	0.10		
13.40	0.20		
13.40	-0.50	Highwater mark	
13.40	-0.65	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry



Note: Cross-section drawn looking downstream

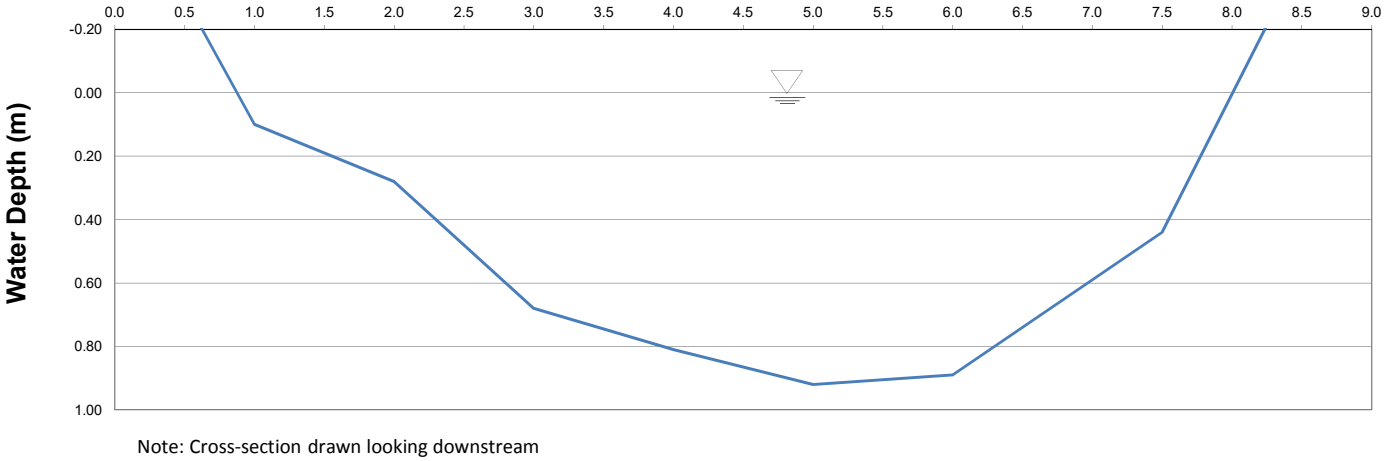
Cross Section Characteristics		Notes & Obstructions:
Bankfull Width, W1	12.9 m	
Bankfull Depth, D1	2.1 m	

Downstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.50	-0.410	Left Bankfull	
0.50	-0.300	Highwater mark	
1.00	0.100		
2.00	0.280		
3.00	0.680		
4.00	0.810		
5.00	0.920		
6.0	0.89		
7.5	0.44		
8.4	-0.30	Highwater mark	
8.350	-0.450	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry



Note: Cross-section drawn looking downstream

Cross Section Characteristics		Notes & Obstructions:
Bankfull Width, W3	7.9 m	
Bankfull Depth, D3	1.4 m	

Flow Assessment Monitoring Sheet

Flow data was collected using: ☐ Electromagnetic meter ☐ Propeller meter

Brand:
Model:

Flow Measurements - Natural Cross Sections				
Distance (m)	Water Depth (m)	Velocity[1]		Comments
		60% or 80% of depth (m/s)	20% of depth (m/s)	
21.05	-0.56	-	-	Left Bankfull
22.75	0.01	-	-	Edge Water surface
23.50	0.12	-	-	
24.25	0.49	-	-	
25.00	0.63	-	-	
25.75	0.65	-	-	
26.50	0.62	-	-	
27.25	0.58	-	-	
28.00	0.59	-	-	
28.75	0.68	-	-	
29.50	0.64	-	-	
30.25	0.54	-	-	
31.00	0.58	-	-	
31.75	0.44	-	-	
32.50	0.33	-	-	
32.50	0.00	-	-	Edge Water Surface
32.90	-0.26	-	-	
32.95	-0.40	-	-	Right Bankfull

1. 20%, 60% and 80% of depth is measured from the surface downwards.

Calculated Flow	**Undetectable**

Notes:
- Flow in channel was very low due to the gradient of the channel bed and was undetectable with the equipment available.

WATER CROSSING SURVEYS WC18

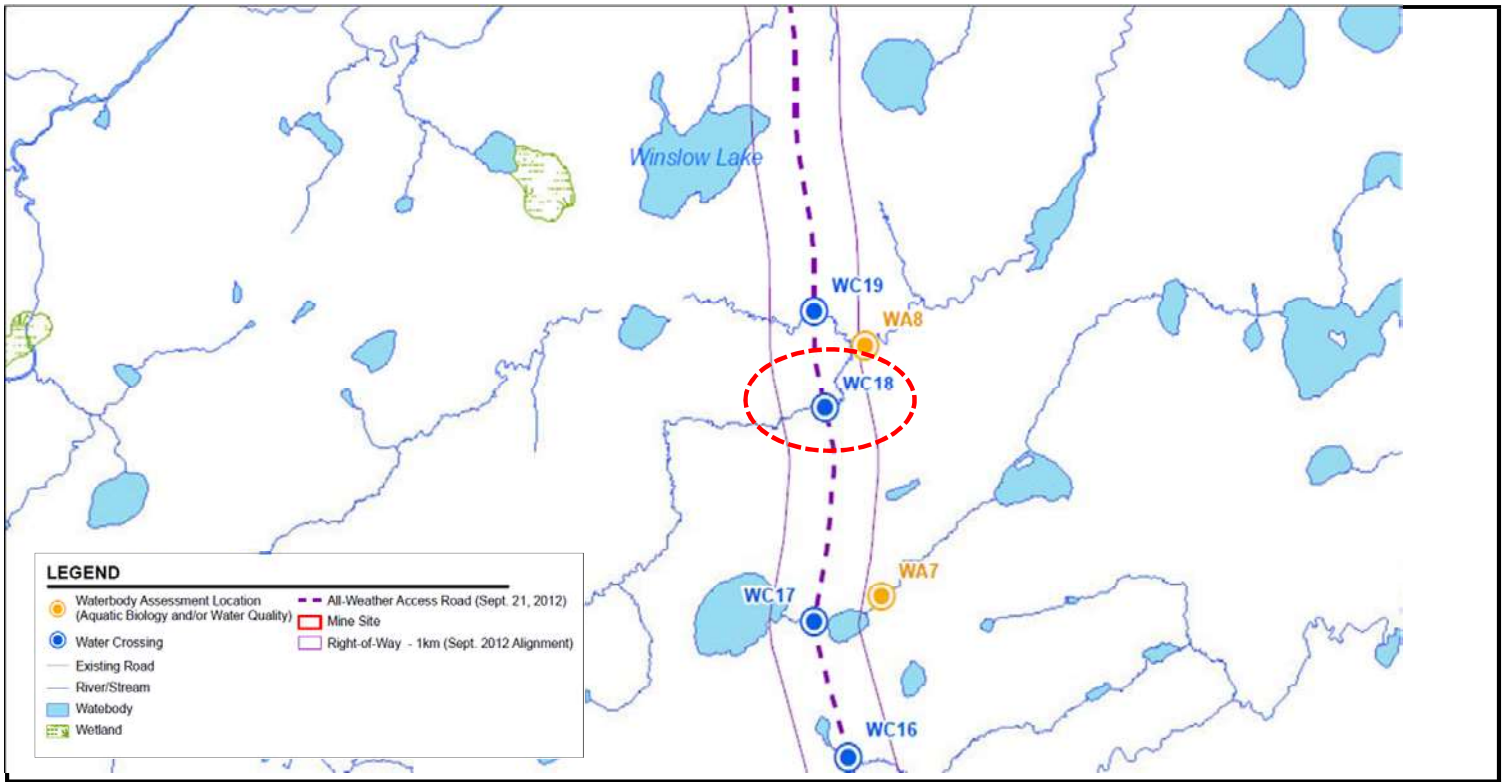
September 2013
Report No. GAL-006-TSD-V3.1
GOL10CLF-0826-07-124-0008-002_B

Inspection Date:	July 31, 2012		
Site ID:	WC18		
Location Description:	A mid sized tributary to a river that flows into the Dusey River		
UTM Coordinates of crossing:	16U	520060 E	5662108 N
UTM Coordinates of cross section:	16U	520060 E	5662108 N
Personnel Present:	DV/JM/EC		
Weather Conditions:	Sunny, calm		

Golder Associates

Water Crossing Surveys WC18

PROJECT:	11-1118-0063 (2050)	DATE:	July-2012	Cliffs Chromite Project	SHEET 1



Current Metering Section:	Surface Geology[1]	Till: undifferentiated, predominantly sand to silty to silt matrix.
	General Section Description:	Mid-sized meandering stream with stable banks
	Hydraulic Control:	Many obstructions and beaver dams (every ~50m)
	Thalweg Comments:	Thalweg located often near the center and some times towards the right side of the stream.
	Sinuosity[2,3]:	1.14 (low sinuosity)
	Bed Slope[2]:	0.16%
	Entrenchment Ratio[3]:	1.48 (moderately entrenched)
	Fluvial Geomorphology:	Braided river located in thick bush with few trees.
Basic Observations at Crossing	Depth at time of observation:	0.4 m
	Width at time of observation:	3.2 m
	Bankfull Depth, D_2	1.0 m
	Bankfull Width, W_2	4.3 m
	Floodplain Observations:	Consists of long grass, some shrubs, and occasional tree. Treeline follows the meanders of the channel, which is centered in the floodplain
Substrate: (L & R looking downstream)	Left Bank:	Loose organics
	Bed:	Loose organics, some gravel, few boulders, some vegetation
	Right Bank:	Loose organics

Additional Comments:
- Flow in channel was very low due to the gradient of the channel bed and was undetectable with the equipment available.

Notes:
1. Source: Ontario Geological Survey 1997. Quaternary Geology, Seamless Coverage of the Province of Ontario. Data Set 14.7
2. This is an approximate value based on limited topographical information. Base data from MNR NRVIS (obtained 2004, CANMAP v2006.4, CanVec) and LiDAR Data - Provided by Cliffs Resources (November, 2010). Datum: NAD 83 Coordinate System: UTM Zone 16N
3. Ranking determined from the Rosgen Classification Tables (Rosgen, D. (1996). Applied River Morphology. Wildlife Hydrology, Pagosa Springs, CO.)

Water Chemistry

Sample taken (Y/N):	Yes	
Temperature:	18.88	°C
Conductivity:	159	uS/cm
Temp. Corrected Conductivity:	-	mS/cm[c]
DO:	-	%
	4.9	mg/L
pH:	7.6	
ORP:	122	
Pressure:	-	mmHg
Readings taken at:	10:00:00 AM	########

Golder Associates

Water Crossing Surveys WC18

PROJECT:	11-1118-0063 (2050)	DATE:	July-2012	Cliffs Chromite Project	SHEET 2

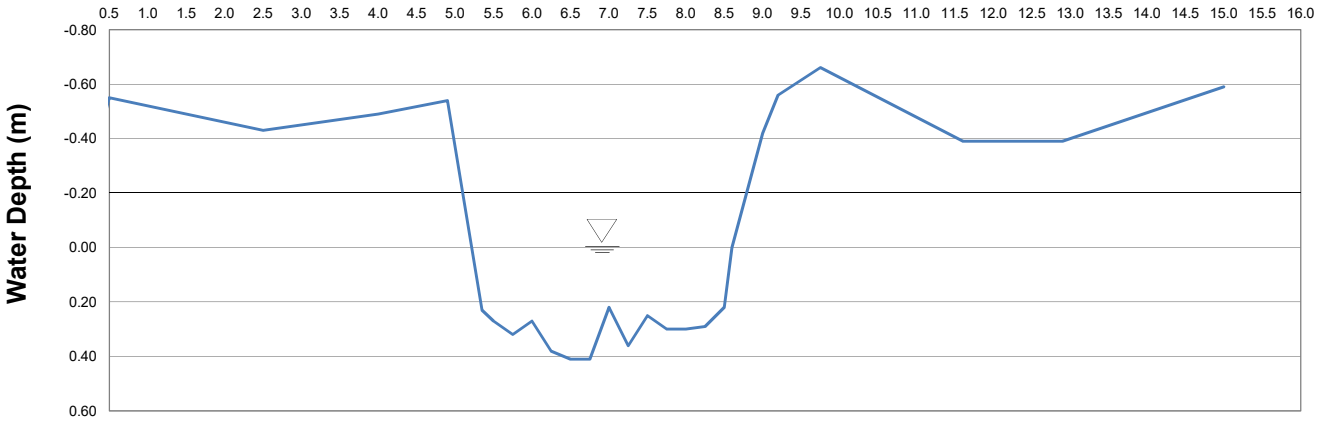
Survey At Crossing

Cross Section Survey beyond Left and Right Bankfull			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
BM	-0.18	Benchmark	on rock ~8m downstream
0.50	-0.55	Treeline	
2.50	-0.43		
4.0	-0.49		
4.9	-0.54	Left Bankfull	
8.6	0.00	Water level	
9.00	-0.42	Highwater Mark	
9.20	-0.56	Right Bankfull	
9.75	-0.66		
11.60	-0.39		
12.90	-0.39		
15.00	-0.59	Treeline	

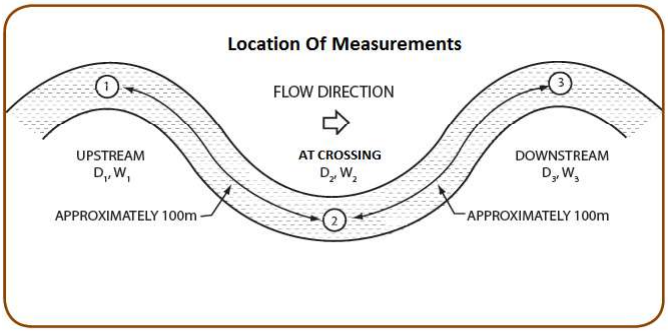
Notes: + elevations are below the water surface
- elevations are above the water surface
Depths between left and right bankfull on Sheet 6

Channel Geometry

Distance (m)



Note: Cross-section drawn looking downstream



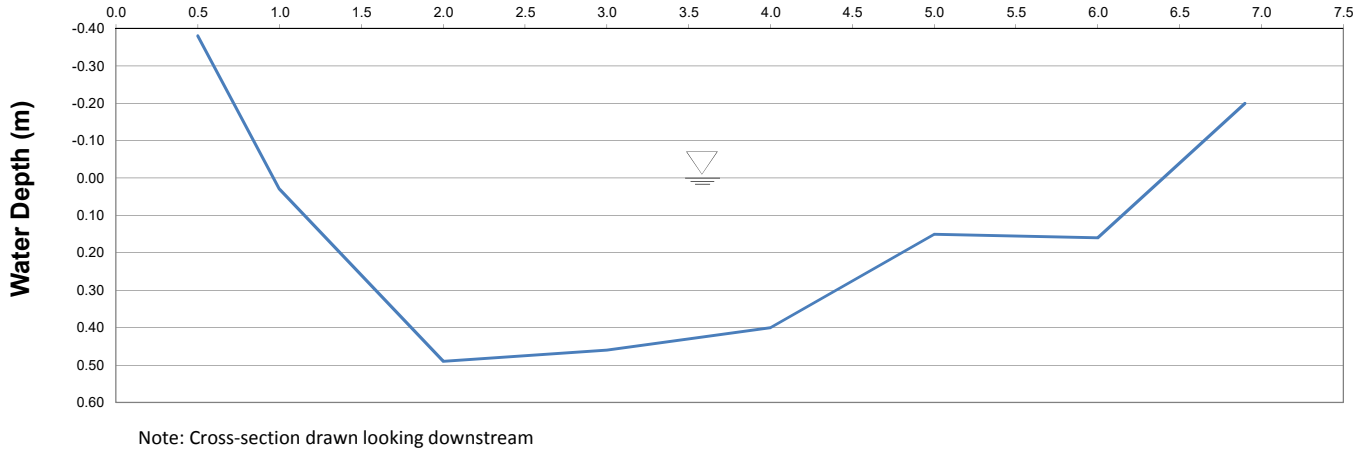
Notes:

Upstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.5	-0.38	Left Bankfull	Highwater mark
1.0	0.03		
2.0	0.49		
3.0	0.46		
4.0	0.40		
5.0	0.15		
6.0	0.16		
6.4	0.00		
6.9	-0.20	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry



Note: Cross-section drawn looking downstream

Cross Section Characteristics		Notes & Obstructions:
Bankfull Width, W1	6.4 m	
Bankfull Depth, D1	0.9 m	

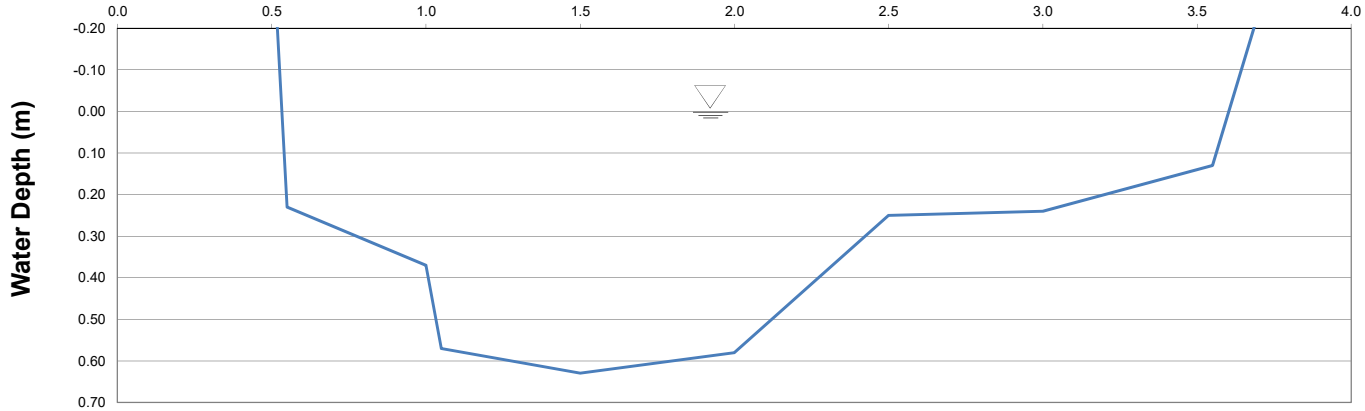
Downstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.50	-0.450	Left Bankfull	Highwater mark
3.8	-0.360	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry

Distance (m)



Note: Cross-section drawn looking downstream

Cross Section Characteristics		Notes & Obstructions:
Bankfull Width, W3	3.2 m	
Bankfull Depth, D3	1.0 m	

Flow Assessment Monitoring Sheet

Flow data was collected using: ☐ Electromagnetic meter ☐ Propeller meter

Brand:
Model:

Flow Measurements - Natural Cross Sections				
Distance (m)	Water Depth (m)	Velocity[1]		Comments
		60% or 80% of depth (m/s)	20% of depth (m/s)	
4.90	-0.54	-	-	Left Bankfull
5.35	0.23	-	-	
5.50	0.27	-	-	
5.75	0.32	-	-	
6.00	0.27	-	-	
6.25	0.38	-	-	
6.50	0.41	-	-	
6.75	0.41	-	-	
7.00	0.22	-	-	
7.25	0.36	-	-	
7.50	0.25	-	-	
7.75	0.30	-	-	
8.00	0.300	-	-	
8.25	0.29	-	-	
8.50	0.22	-	-	
8.60	0.00	-	-	
9.00	-0.42	-	-	
9.20	-0.56	-	-	Right Bankfull

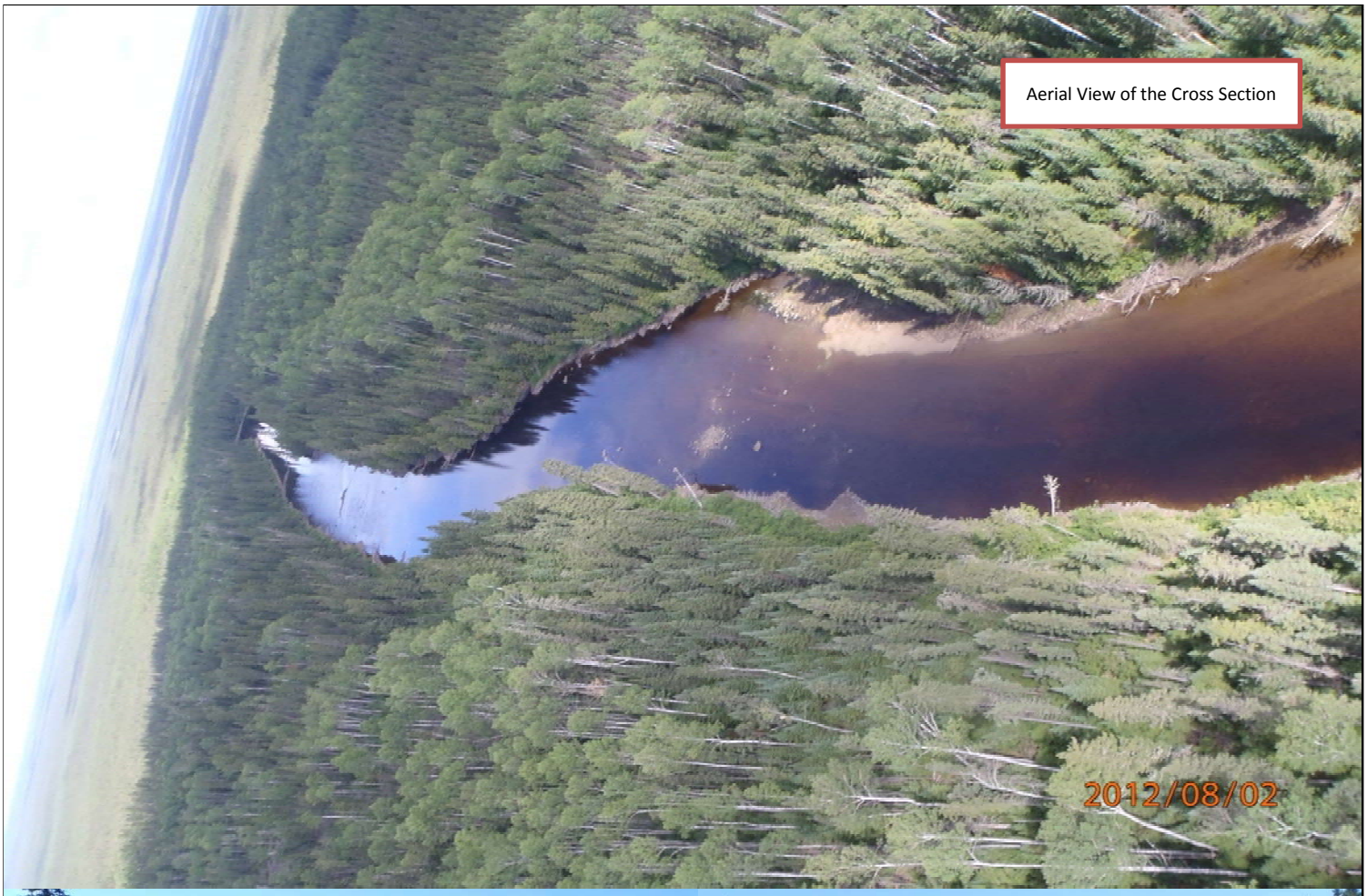
1. 20%, 60% and 80% of depth is measured from the surface downwards.

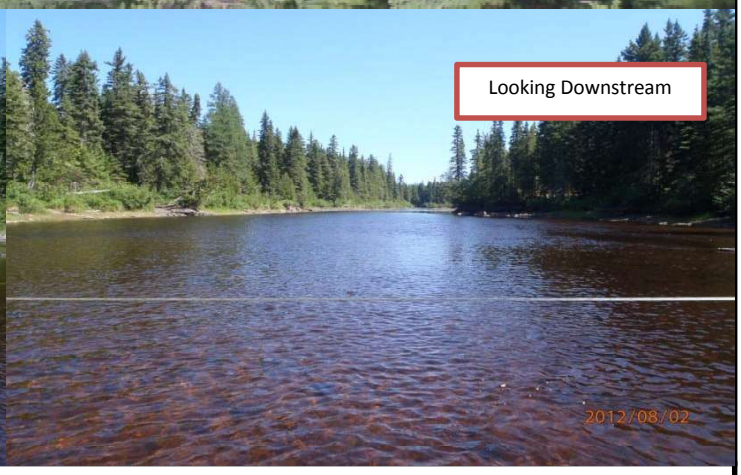
Calculated Flow	**No detectable flow**

Notes:
- Flow in channel was very low due to the gradient of the channel bed and was undetectable with the equipment available.

WATER CROSSING SURVEYS WC22

September 2013
Report No. GAL-006-TSD-V3.1
GOL10CLF-0826-07-124-0008-002_B



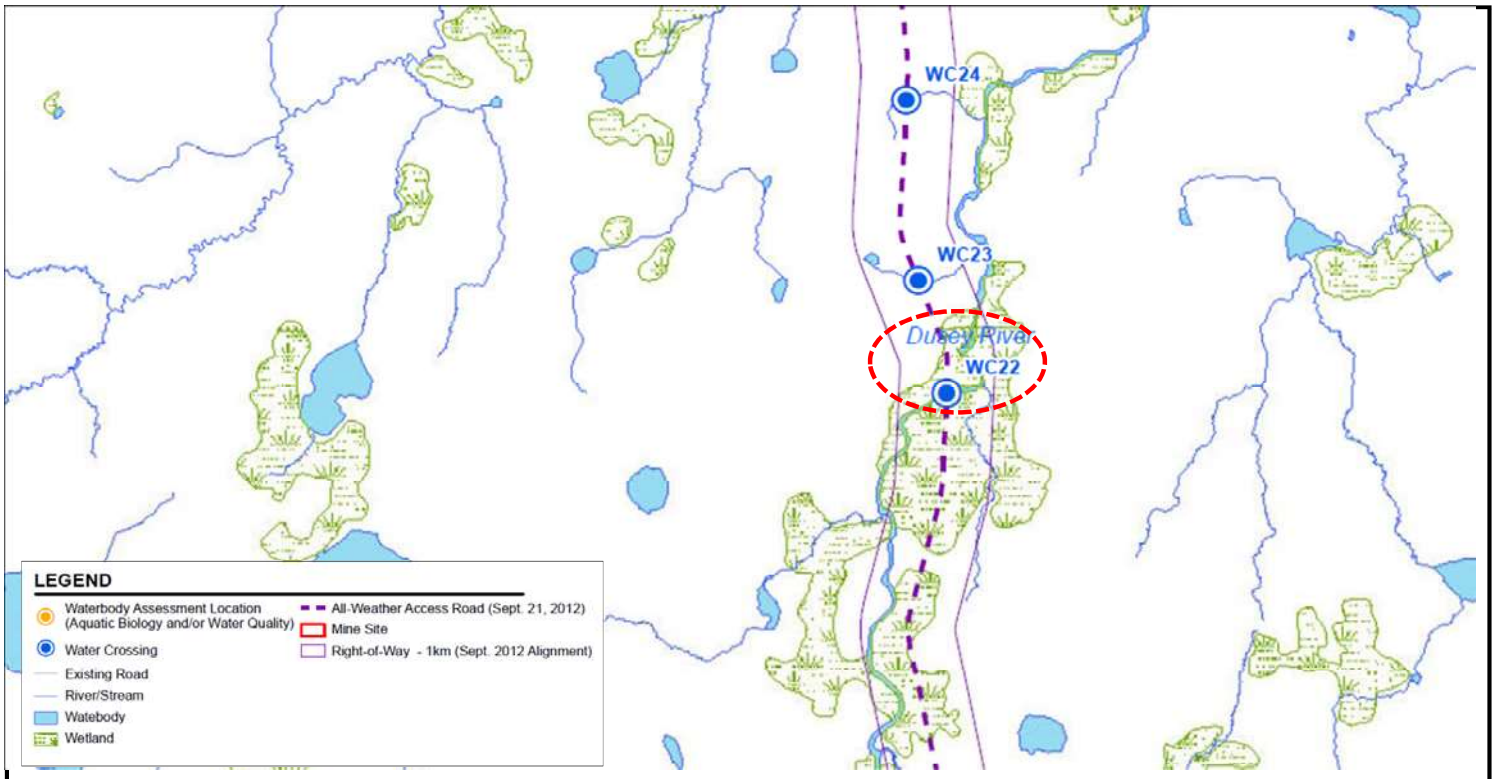


Inspection Date:	August 2, 2012			
Site ID:	WC22			
Location Description:	Dusey River			
UTM Coordinates of crossing:	16U	520051 E	5676958.04 N	
UTM Coordinates of cross section:	16U	520051 E	5676958.04 N	
Personnel Present:	DV/JM/EC			
Weather Conditions:	Overcast, slight breeze			

Golder Associates

Water Crossing Surveys WC22

PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 1



Current Metering Section:	Surface Geology[1]	Organic deposits: peat, muck and marl.
	General Section Description:	Large intermediate stream, moderately entrenched, stable banks
	Hydraulic Control:	Flow seems to be controlled by gradient of the river, with occasional rocky obstuction
	Thalweg Comments:	Channel is roughly bowl shaped with a minimal thalweg near the center of the stream.
	Sinuosity[2,3]:	1.29 (moderate sinuosity)
	Bed Slope[2]:	0.32%
	Entrenchment Ratio[3]:	1.04 (entrenched)
	Fluvial Geomorphology:	Large river immediately surrounded by dense coniferous forest.
Basic Observations at Crossing	Depth at time of observation:	0.7 m
	Width at time of observation:	34.3 m
	Bankfull Depth, D_2	2.0 m
	Bankfull Width, W_2	44.9 m
	Floodplain Observations:	Little to no floodplains, treeline starts immediately at banks. Treeline on both banks follows the river and has consistent width.
Substrate: (L & R looking downstream)	Left Bank:	Gravel and fines, some organics
	Bed:	Gravel, cobbles, boulders, and some sand
	Right Bank:	Gravel and fines, some organics

Additional Comments:

Obstructions limited to rocky shoulds and boulders

Water Chemistry

Sample taken (Y/N):	Yes	
Temperature:	19.68	°C
Conductivity:	88	uS/cm
Temp. Corrected Conductivity:	-	mS/cm[c]
DO:	-	%
	8.21	mg/L
pH:	7.6	
ORP:	119	
Pressure:	-	mmHg
Readings taken at:	12:00:00 AM 02/08/2012	

Notes:

1. Source: Ontario Geological Survey 1997. Quaternary Geology, Seamless Coverage of the Province of Ontario. Data Set 14.7
2. This is an approximate value based on limited topographical information. Base data from MNR NRVIS (obtained 2004, CANMAP v2006.4, CanVec) and LiDAR Data - Provided by Cliffs Resources (November, 2010). Datum: NAD 83 Coordinate System: UTM Zone 16N
3. Ranking determined from the Rosgen Classification Tables (Rosgen, D. (1996). Applied River Morphology. Wildlife Hydrology, Pagosa Springs, CO.)

Golder Associates

Water Crossing Surveys WC22

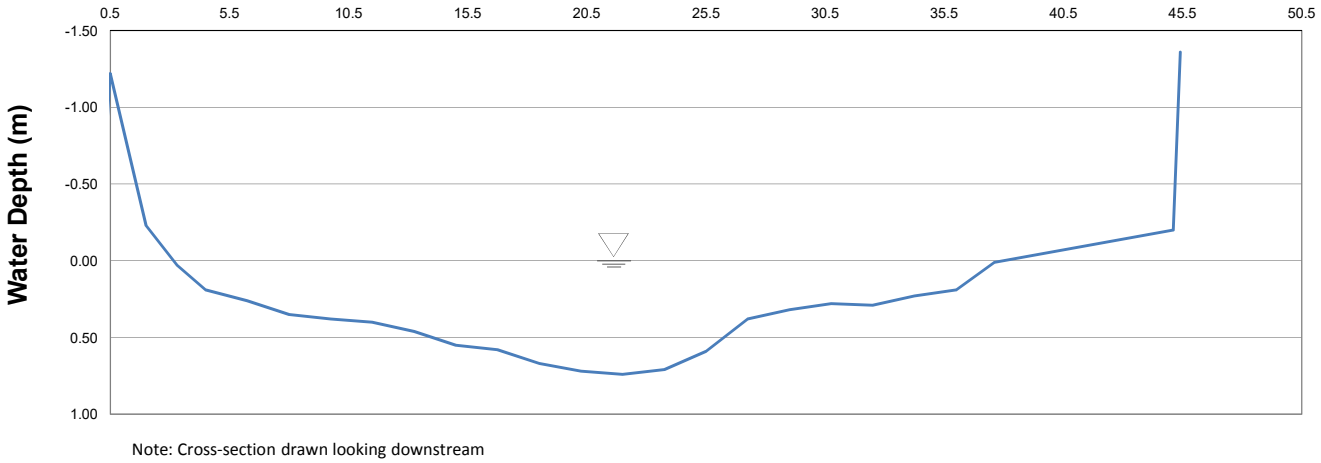
PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 2

Survey At Crossing

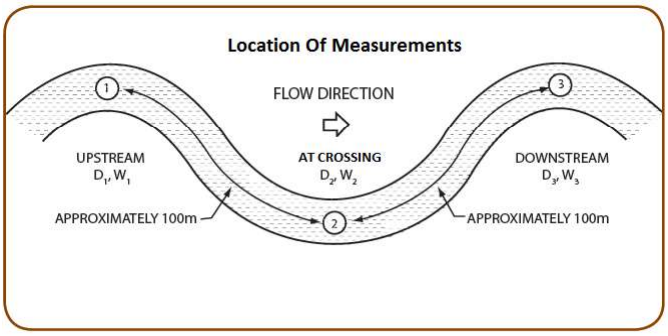
Cross Section Survey beyond Left and Right Bankfull			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.50	-1.220	Left Bankfull	
0.50	-1.170	Highwater mark	
2.00	-0.230		
3.3	0.03	waters edge	
37.6	0.01	waters edge	
45.10	-0.200		
45.40	-1.310	Highwater mark	
45.40	-1.360	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface
Depths between left and right bankfull on Sheet 6

Channel Geometry



Note: Cross-section drawn looking downstream



Notes:

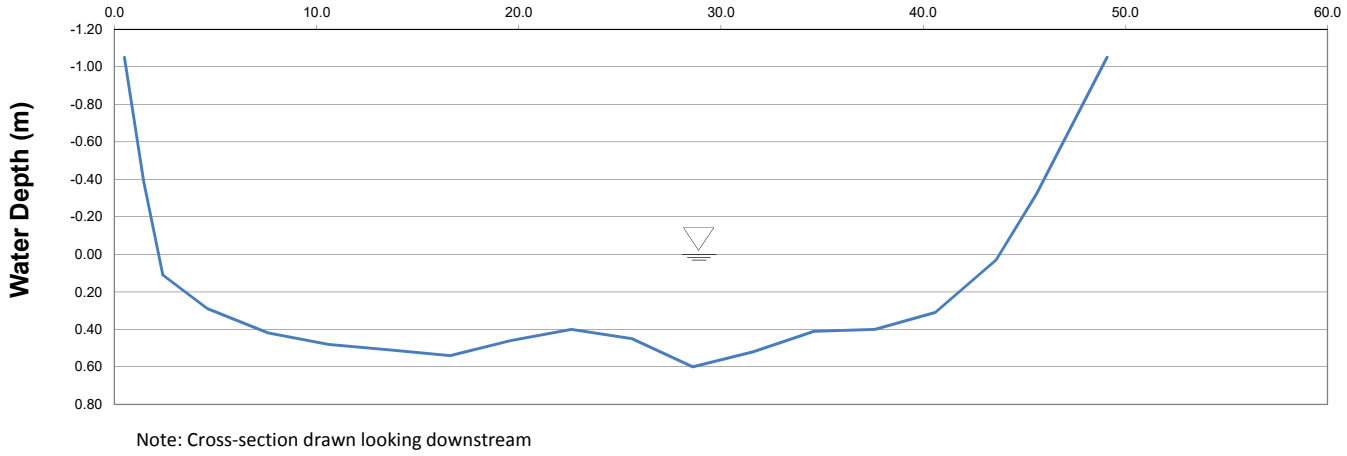
Golder Associates				Water Crossing Surveys WC22	
PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 3

Upstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.50	-1.050	Left Bankfull	High watermark
1.45	-0.390		
2.40	0.110		
4.60	0.290		
7.60	0.420		
10.6	0.480		
13.60	0.510		
16.6	0.54		
19.6	0.46		
22.60	0.40		
25.60	0.45		
28.60	0.60		
31.60	0.52		
34.60	0.41		
37.60	0.40		
40.60	0.31		
43.60	0.03		
45.60	-0.32		
49.10	-1.05	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry



Note: Cross-section drawn looking downstream

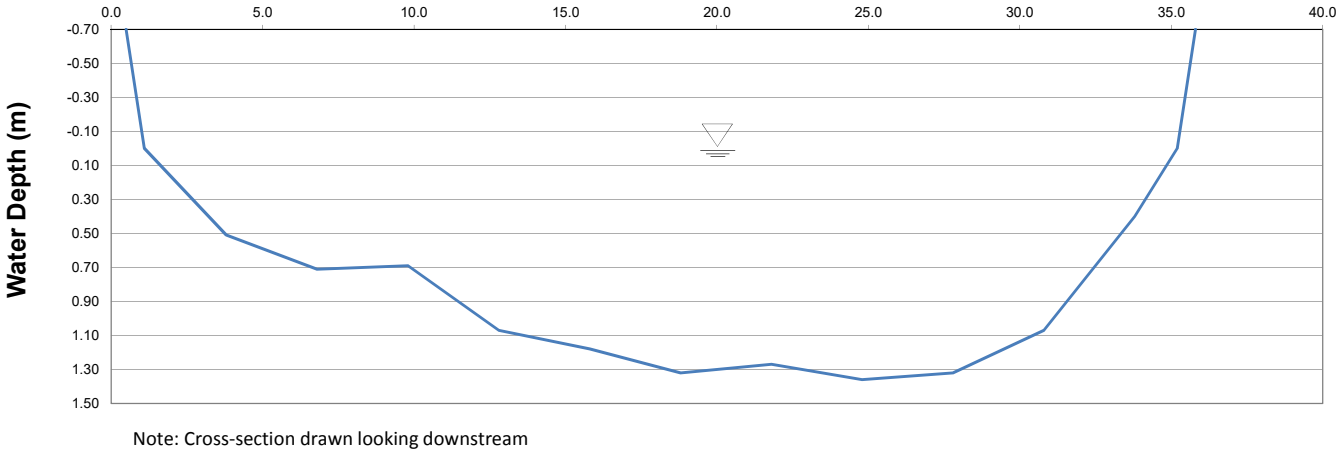
Cross Section Characteristics		Notes & Obstructions:
Bankfull Width, W_1	48.6 m	
Bankfull Depth, D_1	1.7 m	

Downstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.5	-0.700	Left bankfull	High watermark
1.1	0.000	Water edge	
3.8	0.510		
6.8	0.710		
9.8	0.690		
12.8	1.070		
15.8	1.180		
18.8	1.32		
21.8	1.27		
24.8	1.36		
27.8	1.320		
30.8	1.070		
33.8	0.400		
35.2	0.000	Water edge	
35.8	-0.700	Right bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry



Note: Cross-section drawn looking downstream

Cross Section Characteristics		Notes & Obstructions:
Bankful Width, W_3	35.3 m	
Bankful Depth, D_3	2.1 m	

Flow Assessment Monitoring Sheet

Flow data was collected using: ☐ Electromagnetic meter ☑ Propeller meter

Brand: Price
Model: 1210 AA Meter

Flow Measurements - Natural Cross Sections

Distance (m)	Water Depth (m)	Rotations/60s[1]		Comments
		60% or 80% of depth (1/s)	20% of depth (1/s)	
0.6	-1.36	-	-	Left Bankfull
0.9	-0.2	-	-	
8.4	0.01		0.005	
10	0.19		0.050	
11.75	0.23		0.039	
13.5	0.29		0.028	
15.25	0.28		0.095	
17	0.32		0.150	
18.75	0.38		0.195	
20.5	0.59	0.217	0.095	
22.25	0.71	0.262	0.095	
24	0.74	0.251	0.050	
25.75	0.72	0.240	0.117	
27.5	0.67	0.150	0.128	
29.25	0.58	0.240	0.095	
31	0.55	0.162	0.072	
32.75	0.46		0.072	
34.5	0.4		0.061	
36.25	0.38		0.039	
38	0.35		0.072	
39.75	0.26		0.084	
41.5	0.19		0.050	
42.7	0.03		0.005	
44	-0.23	-	-	
45.5	-1.22	-	-	Right Bankfull

Calculated Flow[2]	**1,778 L/s**

Notes:
1) 20%, 60% and 80% of depth is measured from the surface downwards.
2) Calculated using the mid-section method.

WATER CROSSING SURVEYS WC25

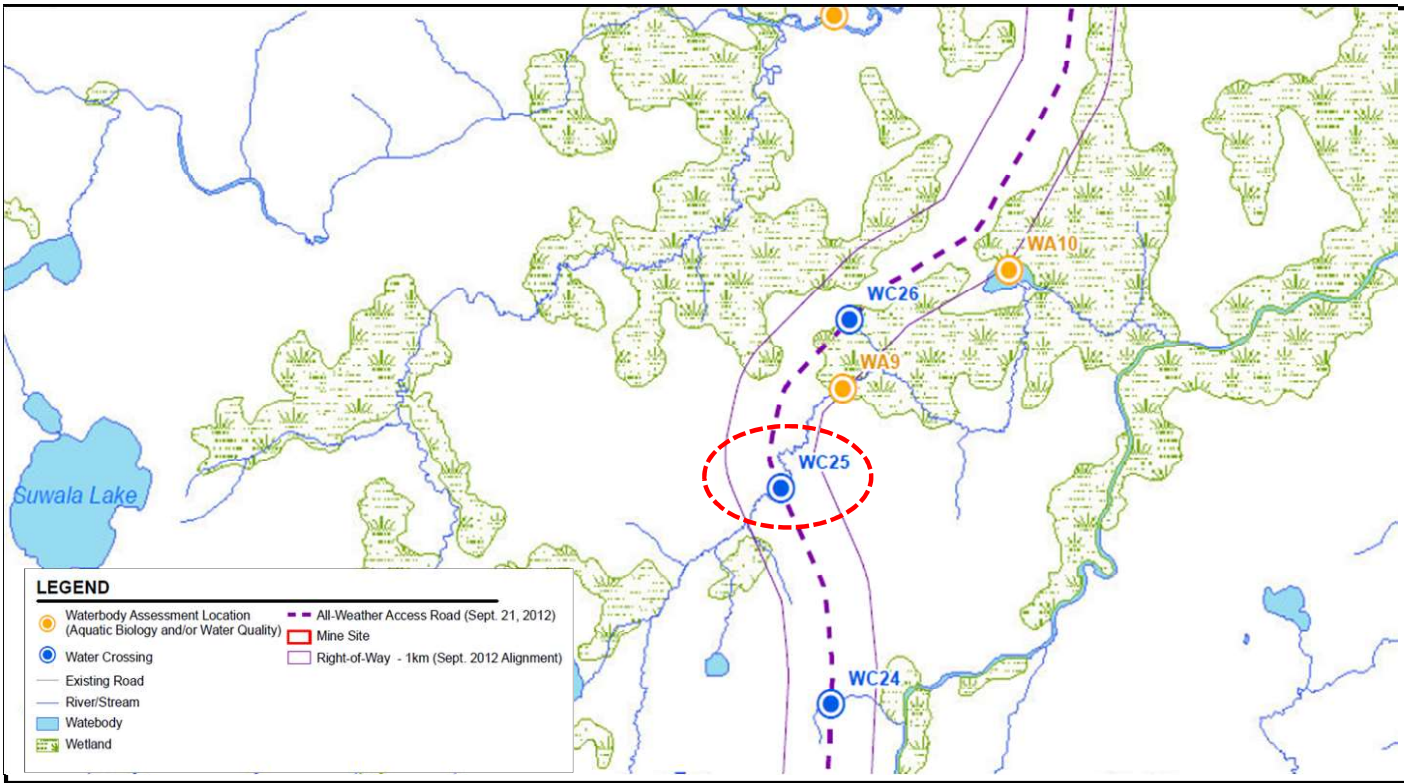
September 2013
Report No. GAL-006-TSD-V3.1
GOL10CLF-0826-07-124-0008-002_B

Inspection Date:	August 3, 2012		
Site ID:	WC25		
Location Description:	Mid-size meandering stream, a tributary to the Dusey River		
UTM Coordinates of crossing:	16U	519059 E	5682468 N
UTM Coordinates of cross section:	16U	519059 E	5682468 N
Personnel Present:	DV/JM/EC		
Weather Conditions:	Partly cloudy, slight breeze		

Golder Associates

Water Crossing Surveys WC25

PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 1



Current Metering Section:	Surface Geology[1]	Organic deposits: peat, muck and marl.
	General Section Description:	Mid-size meandering stream, with a low gradient and stable banks
	Hydraulic Control:	Large beaver dam, large meanders and some small islands
	Thalweg Comments:	Thalweg appears to be braided, changing from a single thalweg to two and then back again.
	Sinuosity[2,3]:	1.16 (low sinuosity)
	Bed Slope[2]:	0.36%
	Entrenchment Ratio[3]:	4.14 (slightly entrenched)
	Fluvial Geomorphology:	River in large wetland clearing within a sparse forest.
Basic Observations at Crossing	Depth at time of observation:	1.8 m
	Width at time of observation:	15.0 m
	Bankfull Depth, D_2	1.5 m
	Bankfull Width, W_2	15.6 m
	Floodplain Observations:	Consists of long grass and dead trees, flooded to treeline ~20m on both banks. Channel meanders across the entire floodplain, treeline follows the general shape of the braids.
Substrate: (L & R looking downstream)	Left Bank:	Loose organics
	Bed:	Loose organics with some vegetation
	Right Bank:	Loose organics

Additional Comments:
- 0.90cm on the secchi disk test
- Flow in channel was very low due to upstream and downstream beaver dams. Flow was undectable with the equipment available.

Notes:
1. Source: Ontario Geological Survey 1997. Quaternary Geology, Seamless Coverage of the Province of Ontario. Data Set 14.7
2. This is an approximate value based on limited topographical information. Base data from MNR NRVIS (obtained 2004, CANMAP v2006.4, CanVec) and LiDAR Data - Provided by Cliffs Resources (November, 2010). Datum: NAD 83 Coordinate System: UTM Zone 16N
3. Ranking determined from the Rosgen Classification Tables (Rosgen, D. (1996). Applied River Morphology. Wildlife Hydrology, Pagosa Springs, CO.)

Water Chemistry

Sample taken (Y/N):	Yes	
Temperature:	19.06	°C
Conductivity:	90	uS/cm
Temp. Corrected Conductivity:	-	mS/cm[c]
DO:	-	%
	2.67	mg/L
pH:	6.8	
ORP:	149	
Pressure:	-	mmHg
Readings taken at:	12:30:00 PM 03/08/2012	

Golder Associates

Water Crossing Surveys
WC25

PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 2

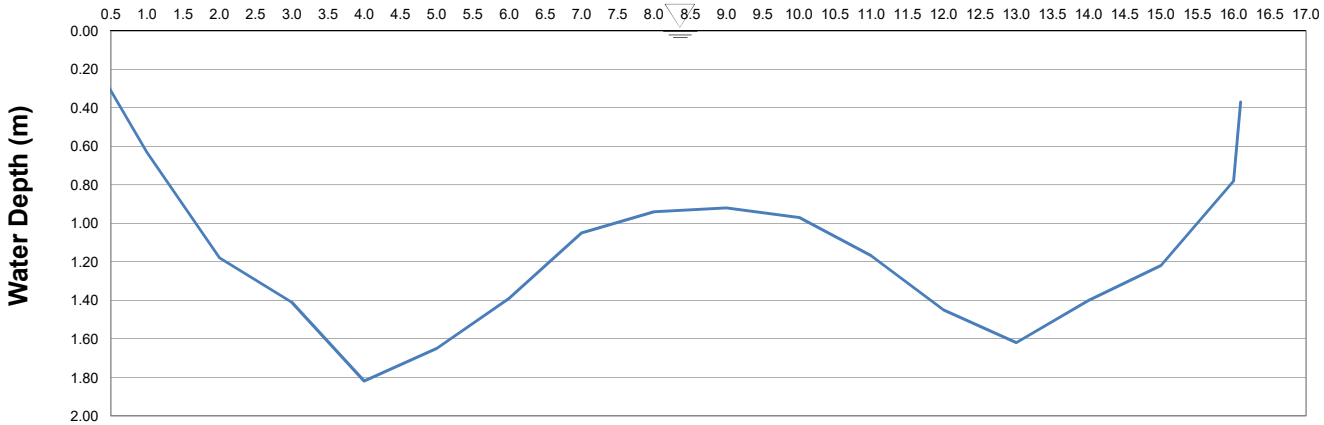
Survey At Crossing

Cross Section Survey beyond Left and Right Bankfull			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.50	0.31	Left Bankfull	
1.00	0.63		
2.00	1.18		
3.00	1.41		
4.00	1.82		
5.00	1.65		
6.00	1.39		
7.0	1.05		
8.0	0.94		
9.0	0.92		
10.00	0.97		
11.00	1.17		
12.00	1.45		
13.00	1.62		
14.00	1.40		
15.00	1.22		
16.00	0.78		
16.10	0.37	Right Bankfull	

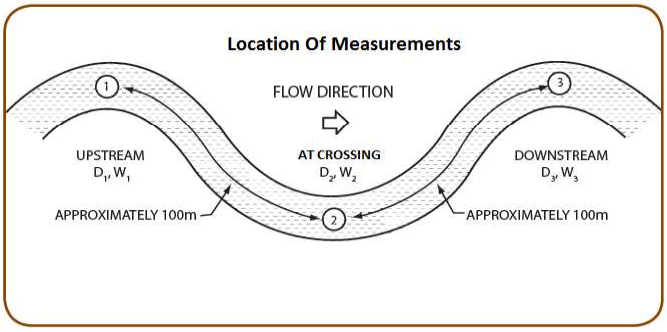
Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry

Distance (m)



Note: Cross-section drawn looking downstream



Notes:
Flooded area because of beaver activity. Therefore the waterlevel was above the channel bankflow levels.

Golder Associates

Water Crossing Surveys
WC25

PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 3

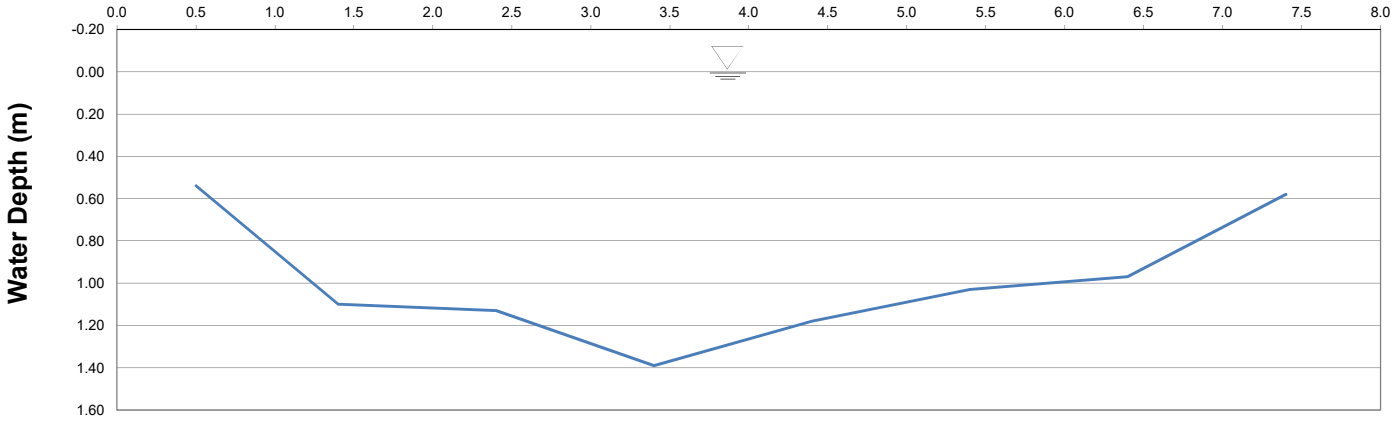
Upstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.50	0.540	Left Bankfull	
1.40	1.100		
2.40	1.130		
3.40	1.390		
4.40	1.180		
5.40	1.030		
6.40	0.970		
7.4	0.58	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry

Distance (m)



Note: Cross-section drawn looking downstream

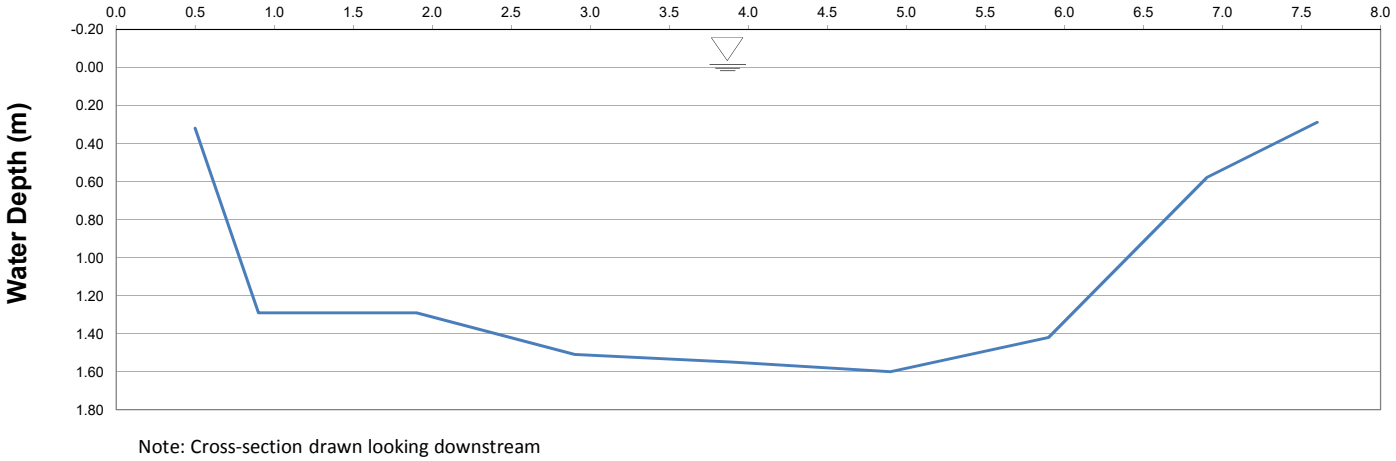
Cross Section Characteristics		Notes & Obstructions:
Bankfull Width, W_1	6.9 m	Flooded area because of beaver activity. Therefore the waterlevel was above the channel bankflow levels.
Bankfull Depth, D_1	0.9 m	

Downstream Survey

Cross Section Survey			
Bank Station from LB (m)	**Depth (m)**	**Name**	**Description**
0.5	0.32	Left Bankfull	
0.9	1.29		
1.9	1.29		
2.9	1.51		
3.9	1.55		
4.9	1.60		
5.9	1.42		
6.9	0.58		
7.6	0.29	Right Bankfull	

Notes: + elevations are below the water surface
- elevations are above the water surface

Channel Geometry



Note: Cross-section drawn looking downstream

Cross Section Characteristics		Notes & Obstructions:
Bankfull Width, W_3	7.1 m	Flooded area because of beaver activity. Therefore the waterlevel was above the channel bankflow levels.
Bankfull Depth, D_3	1.3 m	

WATER CROSSING SURVEYS WC27

September 2013
Report No. GAL-006-TSD-V3.1
GOL10CLF-0826-07-124-0008-002_B

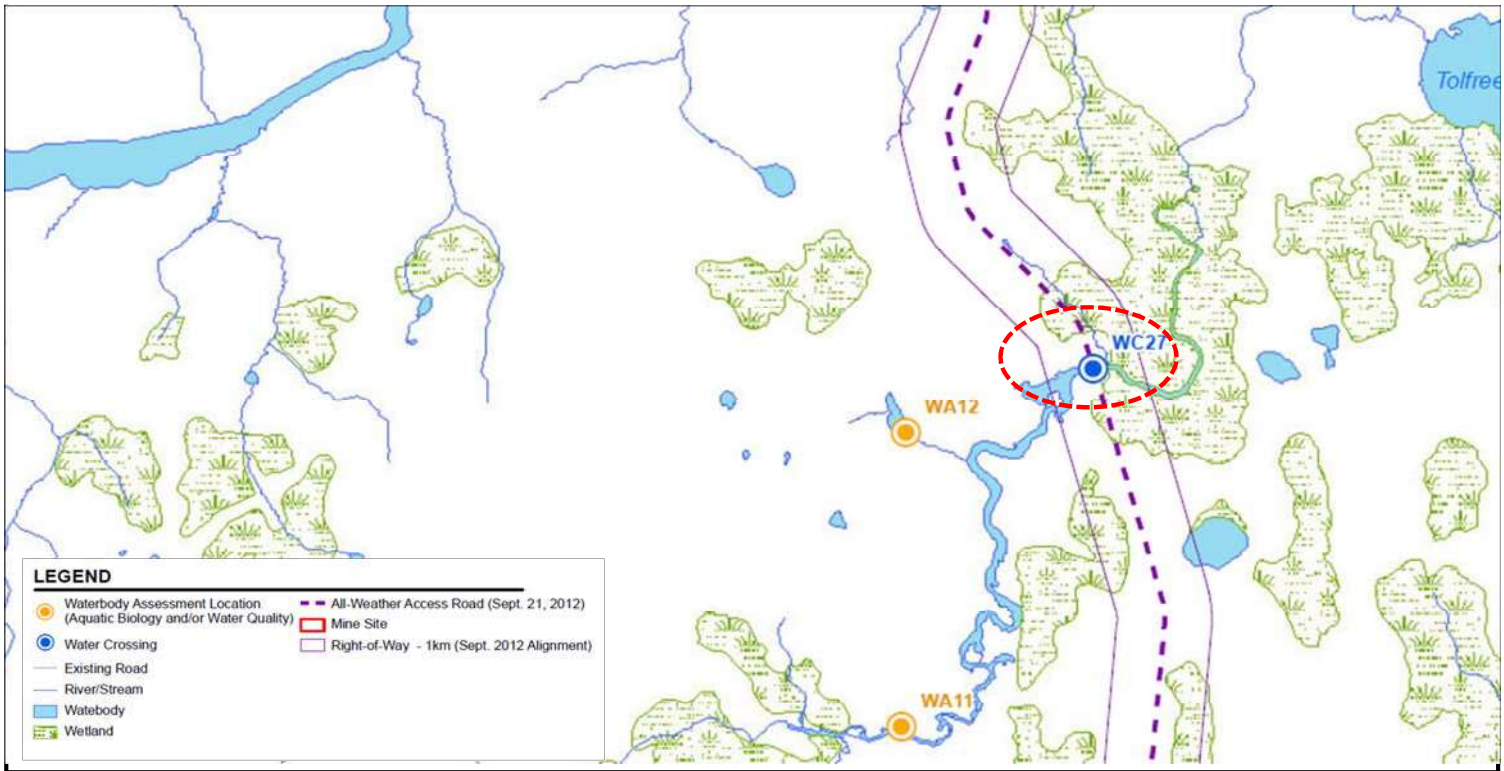
Golder Associates CLIFFS

Inspection Date:	August 4, 2012				
Site ID:	WC27				
Location Description:	Tributary to the Albany River				
UTM Coordinates of crossing:	16U	521688	E	5691500	N
UTM Coordinates of cross section:	16U		E		N
Personnel Present:	DV/JM/EC				
Weather Conditions:	Partial clouds, sunny				

Golder Associates

Water Crossing Surveys WC27

PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 1



Current Metering Section:	Surface Geology[1]	Organic deposits: peat, muck and marl
	General Section Description:	Large river with flat stable banks small flood plain bordered by coniferous forest which follows river
	Hydraulic Control:	Likely slope controlled. No major obstructions, river appears too large for any wildlife damming
	Thalweg Comments:	-
	Sinuosity[2,3]:	1.5 (moderate sinuosity)
	Bed Slope[2]:	0.14%
	Entrenchment Ratio[3]:	1.43 (moderately entrenched)
	Fluvial Geomorphology:	Large river clearing surrounded by dense coniferous forest.
Basic Observations at Crossing	Depth at time of observation:	- m
	Width at time of observation:	- m
	Bankfull Depth, D_2	- m
	Bankfull Width, W_2	- m
	Floodplain Observations:	Floodplain appears wet and marshy with tall grasses on either side of the bank. Approx. 5m on the left bank and 10 m on the right bank
Substrate: (L & R looking downstream)	Left Bank:	Loose organics with thick vegetation and tall grasses
	Bed:	Silty and clayey with vegetated organics
	Right Bank:	Loose organics with some vegetation

Additional Comments:
- Channel is too large to measure the geometry or flow with equipment available.

Notes:
1. Source: Ontario Geological Survey 1997. Quaternary Geology, Seamless Coverage of the Province of Ontario. Data Set 14.7
2. This is an approximate value based on limited topographical information. Base data from MNR NRVIS (obtained 2004, CANMAP v2006.4, CanVec) and LiDAR Data - Provided by Cliffs Resources (November, 2010). Datum: NAD 83 Coordinate System: UTM Zone 16N
3. Ranking determined from the Rosgen Classification Tables (Rosgen, D. (1996). Applied River Morphology. Wildlife Hydrology, Pagosa Springs, CO.)

Water Chemistry

Sample taken (Y/N):	YES	
Temperature:	16.31	°C
Conductivity:	94	uS/cm
Temp. Corrected Conductivity:	-	mS/cm[c]
DO:	-	%
	6.79	mg/L
pH:	7.7	
ORP:	103	
Pressure:	-	mmHg
Readings taken at:		

Golder Associates

Water Crossing Surveys WC27

PROJECT:	11-1118-0063 (2050)	DATE:	August-2012	Cliffs Chromite Project	SHEET 2

TABLE 1
Comprehensive Analytical Results for Sediment Quality – Integrated Transportation System

Parameter	Unit	CCME CEQG[a]		MOE PSQG[a]		Major Water Crossing (>40 m) (Summer)													Major Water Crossings (>40 m) (Fall)				
						AWA6	WC9	WC9	WC22	WC22	WC27	WC29	WC29	WC34	WC34 (D)	WC38	WC42	WC42	AWA6	WC9	WC29	WC29 (D)	WC42
		Freshwater PEL	Freshwater ISQG	LEL	SEL	Aug-11	Jul-11	Jul-12	Jul-11	Aug-12	Aug-12	Jul-11	Aug-12	Aug-12	Aug-12	Aug-12	Jul-11	Aug-12	Sep-11	Sep-11	Sep-11	Sep-11	Sep-11
TOC	% wt	—	—	1	10	0.63	0.98	**3.5**	**2.42**		17.5	**9.5**		0.33	0.27	**2.78**	**3.17**	0.98	0.89	**1.32**	0.73	0.9	**2.06**
FOC	—	—	—	—	—	0.0063	0.0098	0.035	0.0242		0.175	0.095		0.0033	0.0027	0.0278	0.0317	0.0098	0.0089	0.0132	0.0073	0.009	0.0206
Sand	%	—	—	—	—	83.1	83.3		72.3			55.2				32.48	91.5		97.2	97.4	84.5	81.3	86.9
Silt	%	—	—	—	—	14.7	15.1		18.7			34.2				64.1	8.06		2.07	2.41	15.2	18.5	9.93
Clay	%	—	—	—	—	2.27	1.55		8.92			10.6				0.85	0.48		0.73	0.15	0.33	0.18	3.19
Texture	—	—	—	—	—	Loamy sand	Loamy sand		Sandy loam			Sandy loam				Silt loam	Sand		Sand	Sand	Loamy sand	Loamy sand	Sand
Moisture Content	%	—	—	—	—	25.2	32.7		50.1		86.7	81.7		22.1	22.3	38	19.8		20.5	22.3	27.1	31.1	40.1
Metals																							
Aluminum (Al)	mg/kg	—	—	—	—	4700	3850	5870	7970	5520	16000	9650	5130	7860	8080	6100	8540	4070	7630	5310	5480	6220	9870
Antimony (Sb)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	mg/kg	17	5.9	6	33	1.1	1.1	1.5	1.7	1.9	4.5	5.5	<1.0	4	3.4	1.8	5.5	2.6	2.4	1.4	2	2.4	**7.1**
Barium (Ba)	mg/kg	—	—	—	—	17.4	18	29.3	34.5	13.8	94.8	59.4	12	61.2	24.8	23.3	58.7	17.7	25.2	18.6	21	27.1	60.5
Beryllium (Be)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth (Bi)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron (B)	mg/kg	—	—	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	8.9	7.7	<5.0	<5.0	<5.0	<5.0	6.3	<5.0	7.7	<5.0	<5.0	<5.0	6.3
Cadmium (Cd)	mg/kg	3.5	0.6	0.6	10	<0.50	<0.50	<0.50	<0.50	<0.50	**1.13**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Calcium (Ca)	mg/kg	—	—	—	—	10200	2180	10300	5220	14000	15100	7860	2670	4850	4550	3850	11300	30100	71300	7060	2880	2790	7710
Chromium (Cr)	mg/kg	90	37.3	26	110	16.8	11.6	17.9	22.1	18.9	**31.5**	24.7	16.9	22.5	23.8	19.2	23.7	15.1	**32.2**	19.1	15.9	17.4	**33.8**
Cobalt (Co)	mg/kg	—	—	—	50	3.3	2.7	3.5	4.8	3.7	8.8	6.9	2.9	5.9	5.6	4.5	6.1	3.5	5.9	4.3	4.2	4.9	7
Copper (Cu)	mg/kg	197	35.7	16	110	4.6	2.1	5.4	4.3	3	9.5	**19.1**	1.9	4.7	2.7	3.8	6.4	3	8	4	8.1	10.2	14.7
Iron (Fe)	mg/kg	—	—	20000	40000	8880	6100	10300	13400	12300	**21900**	**21000**	9260	16700	17300	10800	18100	11600	16400	13400	10900	12100	**26400**
Lead (Pb)	mg/kg	91.3	35	31	250	3.1	3.2	5	3.9	3.1	10.2	8.4	2.3	2.7	2.7	3.3	4.8	2.4	4.3	3	3	3.8	5.4
Lithium (Li)	mg/kg	—	—	—	—	9.1	6.3	6.6	11.4	8.9	19	12.8	7.5	12.1	12.8	7.5	12.8	5.5	14.7	8.9	5.2	5.6	13.3
Magnesium (Mg)	mg/kg	—	—	—	—	5840	1890	4930	4460	5620	5350	4540	2780	5020	4840	3400	7280	7730	20700	4960	3340	3910	5990
Manganese (Mn)	mg/kg	—	—	460	1100	117	126	177	323	300	**1310**	328	89.7	**1560**	**787**	151	**1050**	193	413	220	406	437	**1330**
Mercury (Hg)	mg/kg	0.486	0.17	0.2	2	<0.050	<0.050	0.021	<0.050	<0.010	0.083	<0.050	<0.010	<0.010	<0.010	0.016	<0.050	<0.010	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum (Mo)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	mg/kg	50	500	16	75	8.6	6.3	9.1	11.3	10.1	**18**	**18.7**	8.5	13	13.4	10.2	13.3	7.9	**16.2**	9.8	9.6	11.5	**16.5**
Phosphorus (P)	mg/kg	—	—	—	—	391	443	534	441	363	832	896	482	408	378	445	656	402	420	457	435	440	845
Potassium (K)	mg/kg	—	—	—	—	470	330	450	850	370	1670	1170	340	500	520	530	1040	470	750	490	510	560	1270
Selenium (Se)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	mg/kg	—	—	—	0.5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Sodium (Na)	mg/kg	—	—	—	—	<100	<100	100	<100	<100	160	150	<100	110	<100	<100	130	<100	160	<100	<100	<100	180
Strontium (Sr)	mg/kg	—	—	—	—	12.3	7.8	14.4	11.7	17	28.3	18.1	9.8	16.7	16	12.9	18	24.8	53	14.4	9	9	19.2
Thallium (Tl)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tin (Sn)	mg/kg	—	—	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium (Ti)	mg/kg	—	—	—	—	542	489	666	739	806	607	640	734	911	999	712	735	582	831	790	667	700	975
Uranium (U)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	mg/kg	—	—	—	—	16.6	12.4	20.1	23	23.3	27.8	31.6	18.5	25.4	27.1	20.9	26.4	20.6	27	27.4	19.5	20.8	43.3
Zinc (Zn)	mg/kg	315	123	120	820	24.6	23.5	28.5	33.4	19.8	**166**	52	19.1	47.7	40.8	47	43.5	18.6	30.1	28.1	22.8	27	46.2
Polycyclic Aromatic Hydrocarbons (PAHs)																							
Acenaphthene	mg/kg	0.0889	0.00671	—	—		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene	mg/kg	0.128	0.00587	—	—		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Acridine	mg/kg	—	—	—	—		<0.80		<1.6		<6.0	<4.0				<0.80	<0.80		<0.80	<0.80	<0.80	<0.80	<0.80
Anthracene	mg/kg	0.245	0.0469	—	—		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene	mg/kg	0.385	0.0317	0.00032	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene	mg/kg	0.782	0.0319	0.00024	calculated		<0.020		<0.040		<0.15	<0.10				<0.020	<0.020		<0.020	<0.020	<0.020	<0.020	<0.020
Benzo(b)fluoranthene	mg/kg	—	—	0.00017	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene	mg/kg	—	—	0.00037	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene	mg/kg	—	—	—	—		<0.020		<0.040		<0.15	<0.10				<0.020	<0.020		<0.020	<0.020	<0.020	<0.020	<0.020
Chrysene	mg/kg	0.862	0.0571	0.00034	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Dibenzo(a,h)anthracene	mg/kg	0.135	0.00622	0.00006	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene	mg/kg	2.355	0.111	0.00075	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene	mg/kg	0.144	0.0212	0.00019	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-cd)pyrene	mg/kg	—	—	0.0002	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
1-Methylnaphthalene	mg/kg	—	—	—	—		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene	mg/kg	0.201	0.0202	—	—		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	0.062
Naphthalene	mg/kg	0.391	0.0346	—	—		<0.010		<0.020		<0.075	<0.050				<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
Phenanthrene	mg/kg	0.515	0.0419	0.00056	calculated		<0.030		<0.060		<0.23	<0.15				<0.030	<0.030		<0.030	<0.030	<0.030	<0.030	<0.030
Pyrene	mg/kg	0.875	0.053	0.00049	calculated		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050
Quinoline	mg/kg	—	—	—	—		<0.050		<0.10		<0.38	<0.25				<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050

Notes:

0.1	Italized values are greater than the CCME PEL criterion.
0.1	Underlined values are greater than the CCME ISQG criterion.
0.1	Bolded values are greater than the PSQG LEL criterion.
0.1	Values in red font are greater than the PSQG SEL criterion.

(a) Refer to Attachment 2.II.1 for details and notes on criteria.

TABLE 1
Comprehensive Analytical Results for Sediment Quality – Integrated Transportation System

Parameter	Unit	CCME CEQG[a]		MOE PSQG[a]		Minor Water Crossings (<40 m) (Summer)																		
						AWC2	AWC11	AWA10	AWA13	WC2	WC2	WC3	WC3	WC11	WC11	WC15	WC15	WC18	WA8	WC25	WA9	WA11	WC30	WA15	WC32
		Freshwater PEL	Freshwater ISQG	LEL	SEL	Aug-11	Aug-11	Aug-11	Jul-11	Jul-11	Jul-12	Jul-11	Jul-12	Jul-11	Jul-12	Jul-11	Jul-12	Jul-12	Jul-11	Aug-12	Jul-11	Jul-11	Aug-12	Jul-11	Aug-12
TOC	% wt	—	—	1	10	**1.81**	0.48	0.12	**1.43**	0.97	**2.18**	**5.7**	**3.72**	**4.46**	**1.51**	**5.56**	**2.95**	**5.55**	**8.27**	**8.73**	**5.9**	**10.9**	**9.23**	**2.49**	0.32
FOC	—	—	—	—	—	0.0181	0.0048	0.0012	0.0143	0.0097	0.0218	0.057	0.0372	0.0446	0.0151	0.0556	0.0295	0.0555	0.0827	0.0873	0.059	0.109	0.0923	0.0249	0.0032
Sand	%	—	—	—	—	89.9	95.9	95.9	93.6	95		95.8		77.1		64.7			33.5	2	68.4	20.1		79.5	9.48
Silt	%	—	—	—	—	6.65	3.21	3.36	4.84	3.86		4.17		14.5		22.3			38.6	74.58	16.4	65.5		17.4	51.03
Clay	%	—	—	—	—	3.42	0.87	0.7	1.58	1.16		<0.10		8.44		12.9			27.9	23.42	15.1	14.4		3.08	6.93
Texture	—	—	—	—	—	Sand	Sand	Sand	Sand	Sand		Sand		Sandy loam		Sandy loam			Clay loam	Silt loam	Sandy loam	Silt loam		Loamy Sand	Silty Gravel
Moisture Content	%	—	—	—	—	50.3	16.3	9.46	34.5	35.5		71.4		19.7		61.5		53.2	67.5	65.9	63.5	73.9	79.1	53.2	26.1
Metals																									
Aluminum (Al)	mg/kg	—	—	—	—	4930	7220	9320	4790	6400	6310	3740	4830	6610	9200	10300	7700	13300	17700	25500	11200	13100	13000	7500	13600
Antimony (Sb)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	mg/kg	17	5.9	6	33	2.4	2	2.1	1.3	1.3	1.1	<1.0	1.2	1.6	2.6	2.1	2.5	1.9	2.1	3.5	2.2	2.4	3.1	1.4	2
Barium (Ba)	mg/kg	—	—	—	—	31.9	26.3	31.8	20.6	35.9	24.8	16.1	27.1	26.2	16.4	57.2	41.5	58.1	78.4	138	65.7	75	75.9	37.4	69.4
Beryllium (Be)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.58	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth (Bi)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron (B)	mg/kg	—	—	—	—	<5.0	<5.0	5.2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.5	6.6	<5.0	7.4	8.9	13.7	6.5	7.4	12.7	<5.0	12.8
Cadmium (Cd)	mg/kg	3.5	0.6	0.6	10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.61**	<0.50	<0.50	<0.50	<0.50	<0.50
Calcium (Ca)	mg/kg	—	—	—	—	12700	22000	30200	2440	3960	3250	3600	6460	4550	5410	6480	6100	5910	6990	9750	4490	5250	59200	3350	79800
Chromium (Cr)	mg/kg	90	37.3	26	110	15.8	**29**	**35.2**	17.4	21.4	24.1	10.2	13.4	19	**32.6**	**26.4**	22.8	**30**	**38.3**	**50.2**	**26.4**	**30.9**	**32.8**	17.4	**35**
Cobalt (Co)	mg/kg	—	—	—	50	3.7	5.8	7.2	3.1	4.3	5	2.1	3.2	4.3	6.9	6.3	5.5	7.3	8.7	10.2	7	8.2	7.3	4.5	7.3
Copper (Cu)	mg/kg	197	35.7	16	110	5.1	**161**	9.4	2.8	4.2	3.5	2.2	4.3	4.3	4.7	7.1	4.7	6.7	9.8	9	5	5.8	14.6	2.9	14.8
Iron (Fe)	mg/kg	—	—	20000	40000	10500	19700	**20700**	10100	9170	10200	4780	6410	10800	**21800**	14500	14600	16000	**20800**	**26200**	14100	16400	17200	9450	18700
Lead (Pb)	mg/kg	91.3	35	31	250	3.1	4.9	3.9	4.1	4.2	3.5	2.4	5	4.2	3.3	6.1	3.2	5.5	7.2	9.3	5.3	5.9	6.8	3.5	6.4
Lithium (Li)	mg/kg	—	—	—	—	8.6	13.8	17.7	8.1	9.7	8.3	5.5	5.7	10.1	14.6	16.7	9.1	15.4	25.6	30.6	15.9	17.9	20.4	11.5	20.8
Magnesium (Mg)	mg/kg	—	—	—	—	5470	9580	13600	2520	3160	3570	1810	2260	3600	6550	4570	4120	4970	5960	7230	4180	4780	20900	3050	20200
Manganese (Mn)	mg/kg	—	—	460	1100	407	191	290	217	410	259	79.9	122	421	309	312	**1150**	279	**507**	**580**	**810**	**919**	456	297	**468**
Mercury (Hg)	mg/kg	0.486	0.17	0.2	2	<0.050	<0.050	<0.050	<0.050	<0.050	0.018	<0.050	0.037	<0.050	0.018	<0.050	0.026	0.026	0.051	0.077	<0.050	<0.050	0.028	<0.050	0.016
Molybdenum (Mo)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	mg/kg	50	500	16	75	8.3	15.2	**18.7**	7.8	9.8	10.5	5.6	7.7	10.9	**18.4**	13.5	11.2	15.2	**19.2**	**22.6**	12.8	14.9	**20.4**	8.9	**20.2**
Phosphorus (P)	mg/kg	—	—	—	—	331	482	468	451	364	313	307	369	426	710	442	496	481	527	931	453	613	489	416	491
Potassium (K)	mg/kg	—	—	—	—	470	860	890	420	540	440	380	500	520	520	1010	770	1530	1670	2630	1340	1530	2680	730	2570
Selenium (Se)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	mg/kg	—	—	—	0.5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Sodium (Na)	mg/kg	—	—	—	—	<100	110	150	<100	<100	<100	<100	<100	<100	<100	100	<100	110	130	190	<100	110	300	<100	290
Strontium (Sr)	mg/kg	—	—	—	—	15.7	23.2	29.3	7.9	9.4	7.1	9.5	12.1	12.3	13.9	16.7	13.7	16.3	22.3	43.8	16.5	19.1	54.9	12.5	67
Thallium (Tl)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tin (Sn)	mg/kg	—	—	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium (Ti)	mg/kg	—	—	—	—	453	808	1040	545	593	644	414	467	744	1170	678	780	846	739	823	700	804	957	622	1010
Uranium (U)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	mg/kg	—	—	—	—	15	28.9	35.4	16.2	17.1	18.4	10.6	13.3	19.9	34.8	25	23.2	28.9	34	44.2	24.7	28.6	34.4	18.7	37.6
Zinc (Zn)	mg/kg	315	123	120	820	21.9	61.6	30.9	35.2	47.6	45.7	37.2	49.9	57	52.3	64.1	39.9	63.3	87.5	**125**	69.6	81.3	41.9	47.2	41.2
Polycyclic Aromatic Hydrocarbons (PAHs)																									
Acenaphthene	mg/kg	0.0889	0.00671	—	—				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Acenaphthylene	mg/kg	0.128	0.00587	—	—				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Acridine	mg/kg	—	—	—	—				<0.80	<0.80		<2.4		<0.80				<1.2		<1.6	<1.6	<2.4	<2.4		<0.80
Anthracene	mg/kg	0.245	0.0469	—	—				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Benz(a)anthracene	mg/kg	0.385	0.0317	0.00032	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Benzo(a)pyrene	mg/kg	0.782	0.0319	0.00024	calculated				<0.020	<0.020		<0.060		<0.020				<0.030		<0.040	<0.040	<0.060	<0.060		<0.020
Benzo(b)fluoranthene	mg/kg	—	—	0.00017	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Benzo(g,h,i)perylene	mg/kg	—	—	0.00037	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Benzo(k)fluoranthene	mg/kg	—	—	—	—				<0.020	<0.020		<0.060		<0.020				<0.030		<0.040	<0.040	<0.060	<0.060		<0.020
Chrysene	mg/kg	0.862	0.0571	0.00034	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Dibenzo(a,h)anthracene	mg/kg	0.135	0.00622	0.00006	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Fluoranthene	mg/kg	2.355	0.111	0.00075	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Fluorene	mg/kg	0.144	0.0212	0.00019	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Indeno(1,2,3-cd)pyrene	mg/kg	—	—	0.0002	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
1-Methylnaphthalene	mg/kg	—	—	—	—				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
2-Methylnaphthalene	mg/kg	0.201	0.0202	—	—				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Naphthalene	mg/kg	0.391	0.0346	—	—				<0.010	<0.010		<0.030		<0.010				<0.015		<0.020	<0.020	<0.030	<0.030		<0.010
Phenanthrene	mg/kg	0.515	0.0419	0.00056	calculated				<0.030	<0.030		<0.090		<0.030				<0.045		<0.060	<0.060	<0.090	<0.090		<0.030
Pyrene	mg/kg	0.875	0.053	0.00049	calculated				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050
Quinoline	mg/kg	—	—	—	—				<0.050	<0.050		<0.15		<0.050				<0.075		<0.10	<0.10	<0.15	<0.15		<0.050

Notes:

0.1	Italized values are greater than the CCME PEL criterion.
0.1	Underlined values are greater than the CCME ISQG criterion.
0.1	Bolded values are greater than the PSQG LEL criterion.
0.1	Values in red font are greater than the PSQG SEL criterion.

(a) Refer to Attachment 2.II.1 for details and notes on criteria.

TABLE 1
Comprehensive Analytical Results for Sediment Quality – Integrated Transportation System

Parameter	Unit	CCME CEQG[a]		MOE PSQG[a]		Minor Water Crossings (<40 m) (Summer)											Minor Water Crossings (<40 m) (Fall)								
						WA17	WA21	WA23	WA26	WC45	WC45 (D)	WA33	WC46	WC48	WC52	WA44	AWC2	AWC12	AWC14	AWA13	AWC16	AWC16 (D)	WC1	WA26	WA44
		Freshwater PEL	Freshwater ISQG	LEL	SEL	Jul-11	Jul-11	Jul-11	Jun-11	Aug-12	Aug-12	Jun-11	Aug-12	Aug-12	Aug-12	Jun-11	Sep-11	Oct-12	Oct-12	Sep-11	Oct-12	Oct-12	Oct-12	Sep-11	Sep-11
TOC	% wt	—	—	1	10	**6.25**	**8.47**	**2.82**		**7.13**	23.1		**4.51**	**3.97**	**7.37**		**6**	**1.21**	0.59	**1.71**	**3.96**	**1.23**	28.7	**9.6**	**5.96**
FOC	—	—	—	—	—	0.0625	0.0847	0.0282		0.0713	0.231		0.0451	0.0397	0.0737		0.06	0.0121	0.0059	0.0171	0.0396	0.0123	0.287	0.096	0.0596
Sand	%	—	—	—	—	64.8	29	94.2	14.4			59.1	10	63.79	6	60.9	40.2			82.1				7.4	26.6
Silt	%	—	—	—	—	29.6	58.3	5.27	74.8			33.2	88.43	14.81	89.21	27	46.8			17.8				82.2	59.1
Clay	%	—	—	—	—	5.58	12.7	0.54	10.8			7.7	1.57	1.65	4.79	12.1	13			0.13				10.4	14.3
Texture	—	—	—	—	—	Sandy loam	Silt loam	Sand	Silt loam			Sandy loam	Silt	Sandy loam	Silt	Sandy loam	Loam			Loamy sand				Silt	Silt loam
Moisture Content	%	—	—	—	—	78.9	78.1	42.2	58.1			89.3	70.2	24.2	55	59.4	65			31.7				78.2	62.2
Metals																									
Aluminum (Al)	mg/kg	—	—	—	—	11800	8680	7060	11900	4450	2080	3200	7530	9350	12100	9320	7180	8690	6480	6200	8870	8940	8370	11300	14600
Antimony (Sb)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	mg/kg	17	5.9	6	33	5.9	2.4	4.7	4.1	1.9	3.7	4.4	**18.4**	3.9	3	**6.4**	1.9	2.2	1.3	1.3	1.5	3.2	2	4.6	4.2
Barium (Ba)	mg/kg	—	—	—	—	93.2	55.4	37.8	95.8	28	42.9	48.9	63.7	45.1	62.7	82.6	43.2	34.5	18.2	26.1	50.8	39.7	91	80.1	99.7
Beryllium (Be)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth (Bi)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron (B)	mg/kg	—	—	—	—	7.1	5.8	<5.0	9.1	7.1	9.2	5.9	<5.0	<5.0	10.1	6.6	6.4	5.8	<5.0	<5.0	5.1	5.2	6.6	10.2	7.5
Cadmium (Cd)	mg/kg	3.5	0.6	0.6	10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Calcium (Ca)	mg/kg	—	—	—	—	6380	5870	3870	6960	46400	19900	12800	7890	6710	10500	9330	15100	17600	3530	2470	8450	9140	20700	10300	7990
Chromium (Cr)	mg/kg	90	37.3	26	110	**28.4**	20.8	21.3	**27.3**	12.3	4.9	8.2	18.4	**28.1**	**29.4**	24.4	21.5	**34.5**	24.7	**28.8**	24.9	**26.1**	17.9	25.7	**34.5**
Cobalt (Co)	mg/kg	—	—	—	50	10.6	5.7	5.4	8.5	3.6	1.6	2.6	7.6	7.2	7.4	9	4.5	6.4	4.4	4.5	5.5	6.5	4.9	7.5	9.2
Copper (Cu)	mg/kg	197	35.7	16	110	7.1	6.6	3.6	11.1	6.5	6.4	7.4	4.6	4.1	7.7	9	7.5	6.4	**17.2**	6	8.4	10.5	8.2	7.5	8.5
Iron (Fe)	mg/kg	—	—	20000	40000	**22400**	13600	16300	18800	6740	7700	10800	**26900**	17300	15300	19400	12400	17800	17300	13500	13100	14800	10300	19100	**20100**
Lead (Pb)	mg/kg	91.3	35	31	250	6.4	5.8	3.1	6.7	3.2	4.6	7.4	5.2	3.5	5.9	5.8	4.2	3.4	2.9	3.4	4.5	4.9	5.2	8.1	7.8
Lithium (Li)	mg/kg	—	—	—	—	17	12.2	11	17.6	6.2	<1.0	3.1	8.9	12.2	21.2	14.7	10.3	13.9	11.8	9.8	13.8	12.6	7.1	16.1	20.9
Magnesium (Mg)	mg/kg	—	—	—	—	5000	3900	3630	5450	24500	2300	1710	4510	5160	4770	6760	8290	9070	3790	3770	5410	6180	3060	4990	5630
Manganese (Mn)	mg/kg	—	—	460	1100	2770	**779**	396	**916**	143	235	341	**1050**	**620**	165	**842**	397	**951**	296	273	231	244	**986**	**593**	379
Mercury (Hg)	mg/kg	0.486	0.17	0.2	2	<0.050	0.052	<0.050	<0.050	0.014	0.037	0.073	0.038	0.021	0.025	<0.050	<0.050	0.012	<0.010	<0.050	0.018	0.019	0.075	0.072	0.055
Molybdenum (Mo)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	mg/kg	50	500	16	75	15.3	11.2	11	14.6	7.9	4.1	5.6	9.7	14.2	15.8	13.7	10.7	**16.3**	12.5	12.1	14.4	15.6	8.6	14.6	**18.3**
Phosphorus (P)	mg/kg	—	—	—	—	678	519	491	581	429	432	613	809	526	477	501	471	367	560	473	391	427	679	831	626
Potassium (K)	mg/kg	—	—	—	—	1220	990	580	1470	630	220	330	670	560	1500	1030	870	840	440	520	870	850	600	1250	1450
Selenium (Se)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	mg/kg	—	—	—	0.5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Sodium (Na)	mg/kg	—	—	—	—	120	110	<100	150	110	<100	110	<100	<100	210	130	120	120	100	<100	<100	110	<100	140	160
Strontium (Sr)	mg/kg	—	—	—	—	19.3	15.5	13.3	21.8	32.9	34.6	27.1	19.2	21.6	123	18.1	18.5	17	8.9	5.7	14	14.7	33	23.7	25.5
Thallium (Tl)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tin (Sn)	mg/kg	—	—	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium (Ti)	mg/kg	—	—	—	—	863	630	785	803	504	94.9	154	654	1010	751	696	655	965	734	676	720	755	319	563	797
Uranium (U)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0
Vanadium (V)	mg/kg	—	—	—	—	32.4	21.9	24.7	29.2	15.7	5.5	7.4	23.3	33.2	29.1	27	20.4	31	25	23.7	24.9	27.7	15.1	26.4	37.3
Zinc (Zn)	mg/kg	315	123	120	820	93.9	68.6	48.9	90	20.2	48.7	66.8	86.6	88.4	86.4	78.7	31.7	45.9	44.7	33.5	28.5	28	58.8	90	81.2
Polycyclic Aromatic Hydrocarbons (PAHs)																									
Acenaphthene	mg/kg	0.0889	0.00671	—	—	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	0.38			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Acenaphthylene	mg/kg	0.128	0.00587	—	—	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Acridine	mg/kg	—	—	—	—	<3.2	<0.80	<0.80	<1.6			<4.0	<2.4	<0.80	<1.2	<1.6	<2.4			<0.80	<1.2	<0.80	<6.0	<3.2	<1.6
Anthracene	mg/kg	0.245	0.0469	—	—	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Benz(a)anthracene	mg/kg	0.385	0.0317	0.00032	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Benzo(a)pyrene	mg/kg	0.782	0.0319	0.00024	calculated	<0.080	<0.020	<0.020	<0.040			<0.10	<0.060	<0.020	<0.030	<0.040	<0.060			<0.020	<0.030	<0.020	<0.15	<0.080	<0.040
Benzo(b)fluoranthene	mg/kg	—	—	0.00017	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Benzo(g,h,i)perylene	mg/kg	—	—	0.00037	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Benzo(k)fluoranthene	mg/kg	—	—	—	—	<0.080	<0.020	<0.020	<0.040			<0.10	<0.060	<0.020	<0.030	<0.040	<0.060			<0.020	<0.030	<0.020	<0.15	<0.080	<0.040
Chrysene	mg/kg	0.862	0.0571	0.00034	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.135	0.00622	0.00006	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Fluoranthene	mg/kg	2.355	0.111	0.00075	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Fluorene	mg/kg	0.144	0.0212	0.00019	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	0.33			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Indeno(1,2,3-cd)pyrene	mg/kg	—	—	0.0002	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
1-Methylnaphthalene	mg/kg	—	—	—	—	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	0.23			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
2-Methylnaphthalene	mg/kg	0.201	0.0202	—	—	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	0.44			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Naphthalene	mg/kg	0.391	0.0346	—	—	<0.040	<0.010	<0.010	<0.020			<0.050	<0.030	<0.010	<0.015	<0.020	1.99			<0.010	<0.015	<0.010	<0.075	<0.040	<0.020
Phenanthrene	mg/kg	0.515	0.0419	0.00056	calculated	<0.12	<0.030	<0.030	<0.060			<0.15	<0.090	<0.030	<0.045	<0.060	0.306			<0.030	<0.045	<0.030	<0.23	<0.12	<0.060
Pyrene	mg/kg	0.875	0.053	0.00049	calculated	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10
Quinoline	mg/kg	—	—	—	—	<0.20	<0.050	<0.050	<0.10			<0.25	<0.15	<0.050	<0.075	<0.10	<0.15			<0.050	<0.075	<0.050	<0.38	<0.20	<0.10

Notes:

0.1	Italized values are greater than the CCME PEL criterion.
0.1	Underlined values are greater than the CCME ISQG criterion.
0.1	Bolded values are greater than the PSQG LEL criterion.
0.1	Values in red font are greater than the PSQG SEL criterion.

(a) Refer to Attachment 2.II.1 for details and notes on criteria.

TABLE 1
Comprehensive Analytical Results for Sediment Quality – Integrated Transportation System

Parameter	Unit	CCME CEQG[a]		MOE PSQG[a]		Transload Facility (Summer)						Transload Facility (Fall)									
						TRSLD #1	TRSLD #2	TRSLD #3	TRSLD #4	TRSLD #4 (D)	TRSLD #5	TRSLD #1	TRSLD #1	TRSLD #2	TRSLD #2	TRSLD #3	TRSLD #3	TRSLD #4	TRSLD #4	TRSLD #5	TRSLD #5
		Freshwater PEL	Freshwater ISQG	LEL	SEL	Aug-11	Aug-11	Aug-11	Aug-11	Aug-11	Aug-11	Sep-11	Oct-12	Sep-11	Oct-12	Sep-11	Oct-12	Sep-11	Oct-12	Sep-11	Oct-12
TOC	% wt	—	—	1	10	**1.92**	**1.92**	0.83	0.38	0.22	0.54	**1.05**	**1.31**	**7.9**	**1.41**	**1.7**	<0.10	0.93	0.16	0.95	0.14
FOC	—	—	—	—	—	0.0192	0.0192	0.0083	0.0038	0.0022	0.0054	0.0105	0.0131	0.079	0.0141	0.017	<0.0010	0.0093	0.0016	0.0095	0.0014
Sand	%	—	—	—	—	60.8	74.2	92	97.4	98.1	98	13.4		43.9		76.1		86		92.4	
Silt	%	—	—	—	—	33.9	22.1	7.62	2.46	1.77	1.9	74.7		46.8		22.6		13.2		6.85	
Clay	%	—	—	—	—	5.29	3.71	0.34	0.17	0.14	<0.10	12		9.34		1.24		0.75		0.73	
Texture	—	—	—	—	—	Sandy loam	Loamy sand	Sand	Sand	Sand	Sand	Silt loam		Loam		Loamy sand		Sand		Sand	
Moisture Content	%	—	—	—	—	48.2	54.7	35	16.2	20.5	38.8	31.2		78.4		33.3		25.5		28.7	
Metals																					
Aluminum (Al)	mg/kg	—	—	—	—	3820	3510	3430	3940	3670	4290	6900	3300	5870	4760	3920	3410	3460	3730	4630	4910
Antimony (Sb)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	mg/kg	17	5.9	6	33	1.5	1.3	1.2	1.2	1.1	1.1	1.9	1.2	2.4	1.5	1.2	1.2	1.3	<1.0	<1.0	<1.0
Barium (Ba)	mg/kg	—	—	—	—	16.8	14.6	12.2	10.9	9.6	14.1	36.3	14.1	24.2	17.1	15.4	12.3	10.6	10.8	13.6	14.6
Beryllium (Be)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth (Bi)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron (B)	mg/kg	—	—	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	9.6	<5.0	5.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium (Cd)	mg/kg	3.5	0.6	0.6	10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Calcium (Ca)	mg/kg	—	—	—	—	7820	6940	18400	11200	8150	3060	81700	8660	7000	13500	18700	45000	13600	13100	1510	2890
Chromium (Cr)	mg/kg	90	37.3	26	110	12	11	11.6	15.4	13.4	11.9	21.1	11.4	17.7	13.4	12	11.3	13.9	12.1	11.3	11.7
Cobalt (Co)	mg/kg	—	—	—	50	2.5	2.3	2.3	2.7	2.4	2.5	4.6	2.7	3.7	3	2.7	2.4	2.5	2.6	2.2	2.4
Copper (Cu)	mg/kg	197	35.7	16	110	6.1	2.6	3.7	**211**	**125**	2.8	10.9	5.6	6.1	3.7	4.4	**16.8**	3.7	**210**	3	3
Iron (Fe)	mg/kg	—	—	20000	40000	6790	6060	6290	9600	8390	6850	11900	7000	8290	7890	6800	6550	8290	8160	6600	7050
Lead (Pb)	mg/kg	91.3	35	31	250	6.1	3.4	2.5	2.4	1.9	2.4	6.8	**75**	9.9	4.1	2.9	2.8	2.9	1.9	2.3	2.4
Lithium (Li)	mg/kg	—	—	—	—	5.3	5.2	5.3	5.6	5.2	5.2	10.8	5.1	8.5	6.5	6	5.5	4.9	5.2	6.4	5.1
Magnesium (Mg)	mg/kg	—	—	—	—	5280	4730	6180	3350	2470	1920	25000	4520	4630	7080	8330	12500	4600	2900	1560	1790
Manganese (Mn)	mg/kg	—	—	460	1100	100	130	121	83.3	72	74	379	144	131	172	139	156	91.9	82.6	59	67.3
Mercury (Hg)	mg/kg	0.486	0.17	0.2	2	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.016	<0.050	0.019	<0.050	0.011	<0.050	<0.010	<0.050	<0.010
Molybdenum (Mo)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	mg/kg	50	500	16	75	6.5	6	5.9	7	6.1	6.4	11.9	6.9	9.7	7	6.8	6	6.2	6.9	6.3	6.3
Phosphorus (P)	mg/kg	—	—	—	—	474	391	392	374	295	277	538	515	623	436	350	420	458	279	234	320
Potassium (K)	mg/kg	—	—	—	—	320	330	280	240	210	250	1140	360	700	440	450	350	280	240	290	270
Selenium (Se)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	mg/kg	—	—	—	0.5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Sodium (Na)	mg/kg	—	—	—	—	<100	<100	<100	<100	<100	<100	200	120	120	<100	<100	<100	<100	<100	<100	<100
Strontium (Sr)	mg/kg	—	—	—	—	12.2	9.9	18.3	13.6	11.9	7.1	64.5	15.4	14.1	12.3	18.2	30.7	14.9	11.8	5.8	6.5
Thallium (Tl)	mg/kg	—	—	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tin (Sn)	mg/kg	—	—	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium (Ti)	mg/kg	—	—	—	—	515	469	485	509	497	467	826	415	582	537	504	520	537	475	439	473
Uranium (U)	mg/kg	—	—	—	—	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	mg/kg	—	—	—	—	13.2	11.8	12.4	19.3	16.9	13.9	23.8	11.3	17.8	14.4	13.4	13.3	17.3	15.3	13.8	14.4
Zinc (Zn)	mg/kg	315	123	120	820	30.8	26.3	13.2	17.1	9.8	9.3	33.9	24.8	40.8	21.5	25.9	34.2	12.9	11.6	16.3	9.8
Polycyclic Aromatic Hydrocarbons (PAHs)																					
Acenaphthene	mg/kg	0.0889	0.00671	—	—	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	
Acenaphthylene	mg/kg	0.128	0.00587	—	—	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	
Acridine	mg/kg	—	—	—	—	<0.80	<1.6	<0.80	<0.80	<0.80	<0.80	<0.80		<3.2		<0.80		<0.80		<0.80	
Anthracene	mg/kg	0.245	0.0469	—	—	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	
Benz(a)anthracene	mg/kg	0.385	0.0317	0.00032	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		**0.191**	
Benzo(a)pyrene	mg/kg	0.782	0.0319	0.00024	calculated	<0.020	<0.040	<0.020	<0.020	<0.020	<0.020	<0.020		<0.080		<0.020		<0.020		**0.167**	
Benzo(b)fluoranthene	mg/kg	—	—	0.00017	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		**0.151**	
Benzo(g,h,i)perylene	mg/kg	—	—	0.00037	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		**0.076**	
Benzo(k)fluoranthene	mg/kg	—	—	—	—	<0.020	<0.040	<0.020	<0.020	<0.020	<0.020	<0.020		<0.080		<0.020		<0.020		0.159	
Chrysene	mg/kg	0.862	0.0571	0.00034	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		**0.175**	
Dibenzo(a,h)anthracene	mg/kg	0.135	0.00622	0.00006	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	
Fluoranthene	mg/kg	2.355	0.111	0.00075	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	**0.082**		<0.20		<0.050		<0.050		**0.338**	
Fluorene	mg/kg	0.144	0.0212	0.00019	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	
Indeno(1,2,3-cd)pyrene	mg/kg	—	—	0.0002	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		**0.088**	
1-Methylnaphthalene	mg/kg	—	—	—	—	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	
2-Methylnaphthalene	mg/kg	0.201	0.0202	—	—	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	
Naphthalene	mg/kg	0.391	0.0346	—	—	<0.010	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010		<0.040		<0.010		<0.010		<0.010	
Phenanthrene	mg/kg	0.515	0.0419	0.00056	calculated	<0.030	<0.060	<0.030	<0.030	<0.030	<0.030	<0.030		<0.12		<0.030		<0.030		**0.032**	
Pyrene	mg/kg	0.875	0.053	0.00049	calculated	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	**0.054**		<0.20		<0.050		<0.050		**0.258**	
Quinoline	mg/kg	—	—	—	—	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050		<0.20		<0.050		<0.050		<0.050	

Notes:

0.1	Italized values are greater than the CCME PEL criterion.
0.1	Underlined values are greater than the CCME ISQG criterion.
0.1	Bolded values are greater than the PSQG LEL criterion.
0.1	Values in red font are greater than the PSQG SEL criterion.

(a) Refer to Attachment 2.II.1 for details and notes on criteria.

Table 4.1.1-1: Summary of Surface Water Quality for Selected Parameters for the Major Water Crossings (Greater than 40 m)

Statistic[a]	pH[b]	Dissolved Oxygen (mg/L)	Phosphorus (mg/L)	Phenols (mg/L)	Hexavalent Chromium (mg/L)	Trivalent Chromium (mg/L)	Aluminum (mg/L)		Cadmium (mg/L)		Copper (mg/L)		Iron (mg/L)	
					Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
ODWS[c]	6.5-8.5	—	—	—	—	—	0.1	—	—	—	1	—	0.3	—
CCME[c][d]	6.5-9	>5.5	—	0.004	0.001	0.0089	0.005 – 0.1	—	Calculated	—	0.002 – 0.004	—	0.3	—
PWQO[c][d]	6.5-8.5	>4	0.03	0.005	0.001	0.0089	0.015 – 0.075	—	0.0001 – 0.0005	—	0.001 – 0.005	—	0.3	—
Total Number	15	16	18	18	18	18	18	18	18	18	18	18	18	18
Minimum	5.4	5.8	0.0062	<0.001	<0.001	<0.0005	0.027	0.0057	<0.000005	<0.000005	<0.0005	<0.0004	0.064	<0.005
Maximum	8.3	11	0.015	0.012	<0.001	<0.0009	0.091	0.026	<0.00001	0.000047	0.00078	0.0019	0.32	0.19
Mean	6.5	8.8	0.0096	0.0020	<0.001	0.00063	0.049	0.014	0.0000084	0.000017	0.00066	0.00086	0.14	0.053
Median	7.6	8.9	0.0092	0.001	<0.001	0.0005	0.046	0.014	0.000009	0.00001	0.0007	0.0007	0.11	0.037
95th Percentile	—	6.5[e]	0.014	0.005	<0.001	0.0009	0.071	0.024	0.00001	0.000044	0.00075	0.0015	0.29	0.17
Values not meeting ODWS	1	—	—	—	—	—	0	—	—	—	0	—	1	—
Values not meeting CCME	1	0	—	1	0	0	1	—	0	—	0	—	1	—
Values not meeting PWQO	1	0	0	1	0	0	2	—	0	—	0	—	1	—

Note:
"ODWS" = Ontario Drinking Water Standards.
"CCME" = Canadian Council of Ministers of the Environment Water Quality Guidelines.
"PWQO" = Provincial Water Quality Objectives.
"—" = Not applicable.

(a) Concentrations below an analytical detection limit were assigned a value of the detection limit.
(b) Average, median and 95th percentile values for pH were calculated by converting pH to numerical values (value = 10-pH), determining the statistic and then converting back to a pH value [pH = -log (value)].
(c) Only total metals were compared to the criteria.
(d) Certain criteria are calculated based on other parameters such as pH, hardness, etc.
(e) The criteria for dissolved oxygen are based on minimum values; as such, the 5th percentile is presented here (i.e., limit at which 95% of values are greater)

Table 4.1.2-1: Summary of Surface Water Quality for Selected Parameters for Minor Water Crossings (Less than 40 m)

Statistic[a]	pH[b]	Dissolved Oxygen (mg/L)	Phosphorus (mg/L)	Phenols (mg/L)	Hexavalent Chromium (mg/L)	Trivalent Chromium (mg/L)	Aluminum (mg/L)		Cadmium (mg/L)		Copper (mg/L)		Iron (mg/L)	
					Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
ODWS[c]	6.5-8.5	—	—	—	—	—	0.1	—	—	—	1	—	0.3	—
CCME[c][d]	6.5-9	>5.5	—	0.004	0.001	0.0089	0.005 – 0.1	—	Calculated	—	0.002 – 0.004	—	0.3	—
PWQO[c][d]	6.5-8.5	>4	0.03	0.005	0.001	0.0089	0.015 – 0.075	—	0.0001 – 0.0005	—	0.001 – 0.005	—	0.3	—
Total Number	37	40	44	44	44	44	44	44	44	44	44	44	44	44
Minimum	6.0	0.6	<0.005	<0.001	<0.001	<0.0005	0.011	0.0036	<0.000005	0.0000064	<0.0005	<0.0004	0.0064	<0.005
Maximum	9.0	13	0.051	0.015	0.0011	<0.0009	0.16	0.065	0.000026	0.000061	0.014	0.0047	1.48	0.82
Mean	6.9	7.6	0.013	0.002	0.001	0.00067	0.052	0.019	0.000009	0.000022	0.00099	0.00094	0.37	0.19
Median	7.3	7.6	0.011	0.001	0.001	0.0005	0.039	0.019	0.000009	0.000011	0.0007	0.00067	0.28	0.13
95th Percentile	—	2.6[e]	0.02	0.008	0.001	0.0009	0.12	0.039	0.00001	0.000044	0.0008	0.0015	1.1	0.64
Values not meeting ODWS	4	—	—	—	—	—	6	—	—	—	0	—	20	—
Values not meeting CCME	3	7	—	4	1	0	9	—	1	—	1	—	20	—
Values not meeting PWQO	4	4	1	3	1	0	13	—	0	—	1	—	20	—

Note:
"ODWS" = Ontario Drinking Water Standards.
"CCME" = Canadian Council of Ministers of the Environment Water Quality Guidelines.
"PWQO" = Provincial Water Quality Objectives.
"—" = Not applicable.

(a) Concentrations below an analytical detection limit were assigned a value of the detection limit.
(b) Average, median and 95th percentile values for pH were calculated by converting pH to numerical values (value = 10-pH), determining the statistic and then converting back to a pH value [pH = -log (value)].
(c) Only total metals were compared to the criteria.
(d) Certain criteria are calculated based on other parameters such as pH, hardness, etc.
(e) The criteria for dissolved oxygen are based on minimum values; as such, the 5th percentile is presented here (i.e., limit at which 95% of values are greater)

TABLE 2
Statistical Calculations for Surface Water Quality – Integrated Transportation System

Parameter	Unit	Receiving WQ Guidelines[a]			Major Water Crossings (>40m)										Minor Water Crossings (<40m)										Transload Facility									
		ODWS	*CCME CEQG*	PWQO	Count	ODWS	CCME	PWQO	Min	Max	Average	Median	Standard Deviation	95th %ile	Count	ODWS	CCME	PWQO	Min	Max	Average	Median	Standard Deviation	95th %ile	Count	ODWS	CCME	PWQO	Min	Max	Average	Median	Standard Deviation	95th %ile
Field Parameters																																		
Temperature	°C	—	—	±10	16	-	-	-	10.27	22.61	17.829	19.18	4.643	22.565	40	-	-	-	1.21	25.85	16.36	18.08	6.203	23.53	15	-	-	-	3.57	23.22	13.09	11.52	7.867	23.18
pH	—	6.5-8.5	6.5-9	6.5-8.5	15	1	1	1	5.37	8.26	6.479	7.55	0.7044	5.848	37	4	3	4	5.95	8.96	6.888	7.32	0.6506	6.171	15	3	0	3	6.82	8.88	7.585	7.72	0.5222	7.131
Conductivity	uS/cm	—	—	—	16	-	-	-	0.178	163	92.699	95	34.394	133	40	-	-	-	0.134	329	114.8	102.5	57.87	213.2	15	-	-	-	165	190	175.3	172	9.05	190.0
Dissolved Oxygen	mg/L	—	5.5-9.5	4-8	16	-	0	0	5.8	11.24	8.799	8.895	1.369	6.543	40	-	7	4	0.6	12.72	7.550	7.58	2.639	2.572	15	-	1	0	5.11	12.16	8.697	9.03	2.218	5.586
ORP	mV	—	—	—	13	-	-	-	-11.1	182.2	85.808	102.5	62.663	166.12	35	-	-	-	-170.2	173.5	64.72	89.1	91.52	159.8	15	-	-	-	-2.4	268.6	97.09	96.4	73.94	194.5
Physical-Chemical																																		
pH	—	6.5-8.5	6.5-9	6.5-8.5	18	0	0	0	7.46	8.26	7.822	7.88	0.1902	7.560	44	1	1	1	6.4	8.13	7.322	7.495	0.3337	6.977	16	0	0	0	7.03	8.39	7.818	8.02	0.2924	7.453
BOD[a]	mg/L	—	—	—	18	-	-	-	2	2	2	2	0	2	44	-	-	-	2	7.2	2.118	2	0.7839	2	16	-	-	-	2	2	2	2	0	2
COD	mg/L	—	—	—	18	-	-	-	17.2	76.1	33.494	28.65	14.693	57.485	44	-	-	-	10.6	89.8	44.68	44.25	12.72	61.01	16	-	-	-	3	29.9	19.82	22.2	7.513	28.85
True colour	TCU	5	Narrative		18	18	-	-	21.9	73.8	43.511	41.45	15.611	68.87	44	44	-	-	10.9	276	76.02	67.1	44.01	125.9	16	13	-	-	1	56.3	20.44	21.2	12.89	38.83
Turbidity	NTU	5	Narrative	—	8	0	-	-	1.05	3.29	1.735	1.545	0.7012	2.821	19	1	-	-	0.49	7.5	1.783	1.48	1.535	3.819	5	0	-	-	1.58	2.55	1.986	1.99	0.3956	2.472
DIC	mg/L	—	—	—	18	-	-	-	4	20	13.483	13.05	4.743	19.235	44	-	-	-	2	30.6	13.46	13.4	6.039	22.01	16	-	-	-	15.9	24.7	20.70	20.45	2.898	24.48
DOC	% wt	5	—	—	18	18	-	-	8.2	16.2	11.207	11.305	2.171	15.18	44	43	-	-	4.5	32.5	14.95	13.25	5.744	25.37	16	14	-	-	3.1	9.2	7.219	8.05	1.876	9.05
TOC	% wt	—	—	—	18	-	-	-	8.6	16.3	11.939	11.85	2.178	15.195	44	-	-	-	4.6	33	16.38	15.75	5.724	24.34	16	-	-	-	3.2	10.5	7.569	8.1	2.036	9.525
Acidity	mg/L	—	—	—	8	-	-	-	2	2.4	2.15	2.1	0.1773	2.4	19	-	-	-	2	10.6	3.632	3	1.993	6.460	5	-	-	-	2	2.8	2.560	2.8	0.3578	2.800
Alkalinity	mg($CaCO_3$)/L	30-500	—	-25%	18	1	-	-	26.6	89.3	53.656	51.1	13.852	85.9	44	4	-	-	19.5	133	56.08	54.5	22.54	96.55	16	0	-	-	79.2	102	90.33	90.1	7.482	101.3
Conductivity	µS/cm	—	—	—	18	-	-	-	58.9	178	110.906	106	26.024	170.35	44	-	-	-	48.8	258	115.3	111.5	41.84	192.1	16	-	-	-	160	201	179.8	178	12.79	201.0
Total Suspended Solids	mg/L	—	+5-25	—	18	-	-	-	2	11	3.139	2	2.579	9.385	44	-	-	-	2	42.7	5.616	2.8	7.890	23.44	16	-	-	-	2.2	36.2	13.03	8.75	10.68	32.45
Total Dissolved Solids	mg/L	500	—	—	18	0	-	-	39	130	84.722	84.5	21.930	123.2	44	0	-	-	59	158	101.3	99.5	22.67	140.1	16	0	-	-	96	134	113.6	112.5	10.54	131.75
TIC	% wt	—	—	—	8	-	-	-	6.5	19.35	13.819	12.45	4.451	19.158	19	-	-	-	4	23.4	15.79	15.2	5.647	23.22	5	-	-	-	24	27.6	24.88	24.1	1.539	27
Major Ions																																		
Calcium	mg/L	—	—	—	18	-	-	-	8.71	29.8	18.084	17.7	4.744	29.12	44	-	-	-	9.38	40.1	19.28	18.35	6.822	33.76	16	-	-	-	26.3	33	29.11	29.25	2.134	32.63
Chloride	mg/L	250	120	—	18	0	0	-	0.14	2	0.3667	0.285	0.4166	0.725	44	0	0	-	0.1	2	0.6905	0.36	0.7228	2	16	0	0	-	0.38	2	1.087	0.665	0.7415	2
Fluoride	mg/L	1.5	—	—	18	0	-	-	0.03	0.1	0.03511	0.03	0.01640	0.04815	44	0	-	-	0.03	0.1	0.04016	0.03	0.02206	0.1	16	0	-	-	0.03	0.1	0.06156	0.043	0.03145	0.1
Magnesium	mg/L	—	—	—	18	-	-	-	1.87	6.01	3.588	3.33	0.9614	5.823	44	-	-	-	1.54	9.13	3.745	3.505	1.520	6.241	16	-	-	-	5.37	6.79	5.930	5.705	0.5009	6.753
Potassium	mg/L	—	—	—	18	-	-	-	0.076	2	0.8046	0.4725	0.7728	2	44	-	-	-	0.05	2	0.5883	0.297	0.6774	2	16	-	-	-	0.382	2	0.9928	0.588	0.7132	2
Sodium	mg/L	200	—	—	18	0	-	-	0.516	4.61	1.411	0.693	1.244	4.177	44	0	-	-	0.36	2.78	0.9498	0.7075	0.6247	2	16	0	-	-	0.654	2	1.191	0.8965	0.5784	2
Sulphate	mg/L	500	—	—	18	0	-	-	0.3	2	0.6983	0.65	0.4405	1.354	44	0	-	-	0.3	2.31	0.6089	0.3	0.6017	2	16	0	-	-	0.58	2	1.318	1.17	0.5763	2
Carbonate (CO_3^{2-})	mg/L	—	—	—	18	-	-	-	5	5	5	5	0	5	44	-	-	-	5	5	5	5	0	5	16	-	-	-	5	5	5	5	0	5
Bicarbonate ($H(CO_3)$)	mg/L	—	—	—	18	-	-	-	26.6	107	60.422	56.3	18.945	103.6	44	-	-	-	19.5	160	63.08	57.55	27.34	117.1	16	-	-	-	94	115	102.5	100.5	5.988	113.5
Hardness	mg(CaCO3)/L	80-100	—	—	18	16	-	-	30.6	99.2	59.972	58.2	15.565	96.65	44	41	-	-	29.8	138	63.59	60.45	23.12	110.1	16	4	-	-	87.8	109	97.06	97.9	6.729	107.5
Cyanide (free)	mg/L	0.2	0.005	0.005	12	0	0	0	0.005	0.005	0.005	0.005	0	0.005	34	0	0	0	0.005	0.005	0.005	0.005	0	0.005	11	0	0	0	0.005	0.005	0.005	0.005	0	0.005
Cyanide (total)	mg/L	—	—	—	12	-	-	-	0.002	0.002	0.002	0.002	0	0.002	34	-	-	-	0.002	0.002	0.002	0.002	0	0.002	11	-	-	-	0.002	0.002	0.002	0.002	0	0.002
Nutrients																																		
Nitrate-N (a)	mg/L	10	13	—	18	0	0	-	0.03	0.263	0.05367	0.03	0.05915	0.1491	44	0	0	-	0.03	0.164	0.04798	0.03	0.03350	0.1017	16	0	0	-	0.03	0.268	0.08213	0.0855	0.06454	0.1908
Nitrite-N (a)	mg/L	1	0.06	—	18	0	2	-	0.02	0.1	0.02889	0.02	0.02587	0.1	44	0	5	-	0.02	0.1	0.02909	0.02	0.02568	0.1	16	0	7	-	0.02	0.239	0.06369	0.02	0.06100	0.1348
Total Kjeldahl Nitrogen (TKN)	mg/L	—	—	—	13	-	-	-	0.363	2.32	0.9701	0.615	0.6608	2.092	26	-	-	-	0.464	2.54	1.127	0.938	0.5806	2.358	10	-	-	-	0.312	2.5	1.268	1.069	0.8487	2.455
Ammonia-N	mg/L	—	—	—	18	-	-	-	0.02	1.44	0.3090	0.0255	0.4809	1.228	44	-	-	-	0.02	1.71	0.2907	0.0265	0.4756	1.381	16	-	-	-	0.02	2.3	0.5574	0.109	0.8120	2.263
Un-ionized ammonia	mg/L	—	0.019	0.02	18	-	0	0	0.00001652	0.01728	0.002714	0.000375	0.004919	0.01115	44	-	0	0	0.000003	0.005616	0.0008983	0.00032689	0.001355	0.004259	16	-	0	0	0.00006549	0.01058	0.002923	0.00244	0.002994	0.007643
ortho-Phosphate	mg/L	—	—	—	13	-	-	-	0.005	0.6	0.2338	0.005	0.3013	0.6	26	-	-	-	0.005	0.6	0.1652	0.005	0.2691	0.6	10	-	-	-	0.005	0.6	0.3025	0.3025	0.3136	0.6
Phosphorus	mg/L	—	Narrative	0.03	18	-	-	0	0.0062	0.0148	0.009611	0.0092	0.002531	0.01404	44	-	-	1	0.005	0.051	0.01253	0.0111	0.007635	0.02340	16	-	-	1	0.005	0.0433	0.01223	0.0107	0.009627	0.02658
Organics																																		
Oil and Greases	mg/L	—	—	physical non detect	18	-	-	-	2	2	2	2	0	2	42	-	-	-	2	2	2	2	0	2	16	-	-	-	2	2	2	2	0	2
Phenols	mg/L	—	0.004	0.005	18	-	1	1	0.001	0.0118	0.001983	0.001	0.002584	0.00483	44	-	4	3	0.001	0.0146	0.002093	0.001	0.002603	0.007745	16	-	5	4	0.001	0.0129	0.003300	0.001	0.003721	0.009750
Polycyclic Aromatic Hydrocarbons (PAHs)																																		
Acenaphthene	µg/L	—	5.8	—	10	-	0	-	0.02	0.02	0.02	0.02	0	0.02	22	-	0	-	0.02	0.02	0.02	0.02	0	0.02	5	-	0	-	0.02	0.02	0.02	0.02	0	0.02
Acridine	µg/L	—	4.4	—	10	-	0	-	4	4	4	4	0	4	22	-	0	-	4	4	4	4	0	4	5	-	0	-	4	4	4	4	0	4
Anthracene	µg/L	—	0.012	0.0008	10	-	10	10	0.02	0.02	0.02	0.02	0	0.02	22	-	22	22	0.02	0.02	0.02	0.02	0	0.02	5	-	5	5	0.02	0.02	0.02	0.02	0	0.02
Benz(a)anthracene	µg/L	—	0.018	0.0004	10	-	10	10	0.02	0.02	0.02	0.02	0	0.02	22	-	22	22	0.02	0.02	0.02	0.02	0	0.02	5	-	5	5	0.02	0.02	0.02	0.02	0	0.02
Benzo(a)pyrene	µg/L	0.00001	0.015	—	10	10	0	-	0.005	0.005	0.005	0.005	0	0.005	22	22	0	-	0.005	0.005	0.005	0.005	0	0.005	5	5	0	-	0.005	0.005	0.005	0.005	0	0.005
Chrysene	µg/L	—	—	0.0001	10	-	-	10	0.02	0.02	0.02	0.02	0	0.02	22	-	-	22	0.02	0.02	0.02	0.02	0	0.02	5	-	-	5	0.02	0.02	0.02	0.02	0	0.02
Fluoranthene	µg/L	—	0.04	0.0008	10	-	0	10	0.02	0.02	0.02	0.02	0	0.02	22	-	0	22	0.02	0.02	0.02	0.02	0	0.02	5	-	1	5	0.02	0.048	0.0256	0.02	0.01252	0.04240
Fluorene	µg/L	—	3	0.2	10	-	0	0	0.02	0.02	0.02	0.02	0	0.02	22	-	0	0	0.02	0.02	0.02	0.02	0	0.02	5	-	0	0	0.02	0.027	0.0214	0.02	0.003130	0.02560
Naphthalene	µg/L	—	1.1	7	10	-	0	0	0.02	0.024	0.0204	0.02	0.001265	0.0222	22	-	0	0	0.02	0.027	0.0203	0.02	0.001492	0.02	5	-	0	0	0.02	0.02	0.02	0.02	0	0.02
Phenanthrene	µg/L	—	0.4	0.03	10	-	0	0	0.02	0.02	0.02	0.02	0	0.02	22	-	0	0	0.02	0.02	0.02	0.02	0	0.02	5	-	0	1	0.02	0.234	0.0628	0.02	0.09570	0.1912
Pyrene	µg/L	—	0.025	—	10	-	0	-	0.02	0.02	0.02	0.02	0	0.02	22	-	0	-	0.02	0.02	0.02	0.02	0	0.02	5	-	1	-	0.02	0.027	0.0214	0.02	0.003130	0.02560
Quinoline	µg/L	—	3.4	10	10	-	0	0	0.04	0.04	0.04	0.04	0	0.04	22	-	0	0	0.04	0.04	0.04	0.04	0	0.04	5	-	0	0	0.04	0.04	0.04	0.04	0	0.04
1+2-Methylnaphthalenes	µg/L	—	—	—	10	-	-	-	0.028	0.028	0.028	0.028	0	0.028	22	-	-	-	0.028	0.028	0.028	0.028	0	0.028	5	-	-	-	0.028	0.028	0.028	0.028	0	0.028
1-Methylnaphthalene	µg/L	—	—	—	10	-	-	-	0.02	0.02	0.02	0.02	0	0.02	22	-	-	-	0.02	0.02	0.02	0.02	0	0.02	5	-	-	-	0.02	0.02	0.02	0.02	0	0.02
2-Methylnaphthalene	µg/L	—	—	—	10	-	-	-	0.02	0.02	0.02	0.02	0	0.02	22	-	-	-	0.02	0.02	0.02	0.02	0	0.02	5	-	-	-	0.02	0.02	0.02	0.02	0	0.02
Micro-organisms																																		
Escherichia coli	per 100mL	not detectable	—	100	18	-	-	0	0	60	14.167	11	16.575	51.5	43	-	-	1	0	180	23	16	29.32	55.7	16	-	-	0	0	64	12.19	5	18.83	55
Total coliforms	per 100mL	not detectable	—	—	15	-	-	-	330	2400	1222	1200	717.299	2400	25	-	-	-	56	2400	1235	1200	726.4	2400	14	-	-	-	52	1600	516.6	300	536.6	1470

TABLE 2
Statistical Calculations for Surface Water Quality – Integrated Transportation System

Parameter	Unit	Receiving WQ Guidelines[a]			Major Water Crossings (>40m)									Minor Water Crossings (<40m)										Transload Facility									
		ODWS	*CCME CEQG*	PWQO	Count	ODWS	CCME	PWQO	Min	Max	Average	Median	Standard Deviation	95th %ile	Count	ODWS	CCME	PWQO	Min	Max	Average	Median	Standard Deviation	95th %ile	Count	ODWS	CCME	PWQO	Min	Max	Average	Median	Standard Deviation	95th %ile
Total Metals																																	
Aluminum	mg/L	0.1	0.005-0.1	0.015-0.075	18	0	1	2	0.0274	0.0913	0.04884	0.04555	0.01431	0.0709	44	6	9	13	0.0105	0.164	0.05171	0.03895	0.03669	0.1247	16	4	4	5	0.0034	0.223	0.07238	0.0408	0.07292	0.2080
Antimony	mg/L	0.006	—	0.02	18	0	-	0	0.00003	0.000196	0.00008078	0.0001	0.00004498	0.0001484	44	0	-	0	0.000024	0.00531	0.0001879	0.000083	0.0007908	0.0001	16	0	-	0	0.00003	0.0001	0.00006325	0.0000565	0.00002912	0.0001
Arsenic	mg/L	0.025	0.005	0.1	18	0	0	0	0.00041	0.00104	0.0006423	0.000556	0.0002056	0.0009533	44	0	0	0	0.00031	0.00361	0.0009175	0.000705	0.0006320	0.002236	16	0	0	0	0.00031	0.000941	0.0006145	0.0006115	0.0002492	0.0009335
Barium	mg/L	1	—	—	18	0	-	-	0.00314	0.00811	0.005836	0.00626	0.001423	0.007371	44	0	-	-	0.00223	0.0652	0.007704	0.00593	0.009196	0.01217	16	0	-	-	0.00491	0.00973	0.007251	0.007245	0.001267	0.008913
Beryllium	mg/L	—	—	0.011-1.1	18	-	-	0	0.000005	0.00006	0.00003917	0.00004	0.00002341	0.00006	44	-	-	0	0.000005	0.00006	0.00004316	0.00004	0.00001896	0.00006	16	-	-	0	0.000005	0.00006	0.00003569	0.00004	0.00002228	0.00006
Bismuth	mg/L	—	—	—	18	-	-	-	0.00002	0.0002	0.0001084	0.00005	0.00008509	0.0002	44	-	-	-	0.00002	0.0002	0.0001027	0.00005	0.00008646	0.0002	16	-	-	-	0.00002	0.0002	0.00008563	0.00005	0.00008066	0.0002
Boron	mg/L	5	1.5-29	0.2	18	0	0	0	0.0022	0.01	0.004226	0.003445	0.002275	0.01	44	0	0	0	0.002	0.151	0.007138	0.0033	0.02226	0.008100	16	0	0	0	0.0021	0.0098	0.005132	0.004575	0.002678	0.009575
Cadmium	mg/L	0.005	calculated	0.0001-0.0005	18	0	0	0	0.000005	0.00001	0.000008356	0.000009	0.000002135	0.00001	44	0	1	0	0.000005	0.000026	0.000009352	0.000009	0.000003060	0.00001	16	0	0	0	0.000005	0.00001	0.000008275	0.000009	0.000002005	0.00001
Chromium (III)	mg/L	—	0.0089	0.0089	18	-	0	0	0.0005	0.0009	0.0006283	0.0005	0.0001802	0.0009	44	-	0	0	0.0005	0.0009	0.0006664	0.0005	0.0001970	0.0009	16	-	0	0	0.0005	0.0009	0.0006675	0.0005	0.0001982	0.0009
Chromium (VI)	mg/L	—	0.001	0.001	18	-	0	0	0.001	0.001	0.001	0.001	0	0.001	44	-	1	1	0.001	0.0011	0.001002	0.001	0	0.001	16	-	0	0	0.001	0.001	0.001	0.001	0	0.001
Chromium (total)	mg/L	0.05	—	—	18	0	-	-	0.0005	0.0009	0.0006283	0.0005	0.0001802	0.0009	44	0	-	-	0.0005	0.0009	0.0006664	0.0005	0.0001970	0.0009	16	0	-	-	0.0005	0.0009	0.0006675	0.0005	0.0001982	0.0009
Cobalt	mg/L	—	—	0.0009	18	-	-	0	0.000027	0.000099	0.00004739	0.00005	0.00001622	0.00006330	44	-	-	2	0.00002	0.0198	0.0005556	0.0000545	0.002973	0.0005874	16	-	-	0	0.00002	0.000183	0.00006275	0.00005	0.00003804	0.0001208
Copper	mg/L	1	0.002-0.004	0.001-0.005	18	0	0	0	0.0005	0.00078	0.0006606	0.0007	0.00008761	0.000746	44	0	1	1	0.0005	0.0143	0.0009925	0.0007	0.002056	0.0008065	16	0	2	2	0.0005	0.0475	0.004308	0.0007	0.01190	0.02133
Iron (total)	mg/L	0.3	0.3	0.3	18	1	1	1	0.0639	0.32	0.1412	0.108	0.07757	0.2894	44	20	20	20	0.0064	1.48	0.3672	0.276	0.3422	1.094	16	2	2	2	0.0102	0.589	0.1462	0.09095	0.1483	0.3948
Lead	mg/L	0.01	0.001-0.007	0.001-0.005	18	0	0	0	0.00005	0.0001	0.00007939	0.0000815	0.00002063	0.0001	44	0	1	1	0.000051	0.00486	0.0002015	0.0001	0.0007203	0.0001485	16	0	0	0	0.00005	0.000393	0.0001544	0.0001225	0.00009049	0.0003053
Lithium	mg/L	—	—	—	18	-	-	-	0.00055	0.0011	0.0008717	0.000975	0.0001696	0.001015	44	-	-	-	0.00039	0.0237	0.001419	0.001	0.003450	0.001294	16	-	-	-	0.00071	0.00225	0.001349	0.00119	0.0005347	0.002228
Manganese	mg/L	0.05	—	—	18	1	-	-	0.0109	0.062	0.02139	0.01875	0.01160	0.03506	44	14	-	-	0.00586	1.04	0.09737	0.03945	0.1959	0.4543	16	0	-	-	0.0055	0.0458	0.01991	0.0179	0.01129	0.03688
Mercury	mg/L	0.001	0.000026	0.0002	18	0	0	0	0.0000007	0.000002901	0.000001241	0.00000112	5.15064E-07	0.000001889	44	0	0	0	6.863E-07	0.00001	0.000002191	1.658E-06	1.904E-06	4.358E-06	16	0	0	0	0.0000001	6.2363E-06	0.000001591	1.036E-06	1.782E-06	5.804E-06
Methyl mercury	mg/L	—	0.000004	—	18	-	0	-	5.4E-09	0.000000077	3.300E-08	3.32304E-08	1.57174E-08	5.20715E-08	42	-	0	-	5.4E-09	0.000000237	5.623E-08	4.350E-08	4.360E-08	1.099E-07	15	-	0	-	5.4E-09	4.51926E-07	6.004E-08	2.900E-08	1.107E-07	1.951E-07
Molybdenum	mg/L	—	0.073	0.04	18	-	0	0	0.00009	0.0002	0.0001433	0.0001105	0.00005253	0.0002	44	-	0	0	0.00005	0.0145	0.0004667	0.000152	0.002166	0.0002	16	-	0	0	0.000069	0.0002	0.0001255	0.000093	0.00005285	0.0002
Nickel	mg/L	—	0.025-0.15	0.025	18	-	0	0	0.0002	0.001	0.0007867	0.001	0.0003547	0.001	44	-	0	0	0.0002	0.0052	0.0009727	0.001	0.0007117	0.001	16	-	0	0	0.0002	0.001	0.0007706	0.001	0.0003595	0.001
^{226}Radium[c]	Beq/L	—	—	1	10	-	-	0	0.01	0.01	0.01	0.01	0	0.01	25	-	-	0	0.01	0.02	0.01040	0.01	0	0.01	5	-	-	0	0.01	0.01	0.01	0.01	0	0.01
Selenium	mg/L	0.01	0.001	0.1	18	0	5	0	0.0002	0.002	0.0008333	0.0005	0.0007554	0.002	44	0	18	0	0.0002	0.0034	0.001098	0.0005	0.0008568	0.002	16	0	6	0	0.0002	0.002	0.0009688	0.0005	0.0008340	0.002
Silicon	mg/L	—	—	—	2	-	-	-	1.75	2.64	2.195	2.195	0.6293	2.596	5	-	-	-	2.11	3.31	2.668	2.35	0.5835	3.306	1	-	-	-	0.394	0.394	0.394	0.394	0	0.3940
Silver	mg/L	—	0.0001	0.0001	18	-	0	0	0.000005	0.00005	0.00002556	0.000007	0.00002251	0.00005	44	-	0	0	0.000005	0.00005	0.00002525	0.000007	0.00002184	0.00005	16	-	0	0	0.000005	0.00005	0.00002003	0.000007	0.00002091	0.00005
Strontium	mg/L	—	—	—	18	-	-	-	0.0107	0.026	0.01831	0.01725	0.004117	0.02592	44	-	-	-	0.0127	0.587	0.03599	0.0185	0.08555	0.04429	16	-	-	-	0.0233	0.0296	0.02563	0.0251	0.001991	0.02908
Tellurium	mg/L	—	—	—	18	-	-	-	0.00001	0.00007	0.00005056	0.00006	0.00002623	0.00007	44	-	-	-	0.00001	0.00007	0.00005636	0.00006	0.00002092	0.00007	16	-	-	-	0.00001	0.00007	0.00004750	0.00006	0.00002646	0.00007
Thallium	mg/L	—	0.0008	0.0003	18	-	0	0	0.000002	0.00003	0.00001503	0.000004	0.00001379	0.00003	44	-	0	0	0.000002	0.00003	0.00001512	0.000004	0.00001320	0.00003	16	-	0	0	0.000002	0.00003	0.00001171	0.000004	0.00001275	0.00003
Tin	mg/L	—	—	—	18	-	-	-	0.00004	0.0002	0.0001184	0.0001	0.00006264	0.0002	44	-	-	-	0.00004	0.000633	0.0001230	0.0001	0.0001204	0.0002085	16	-	-	-	0.00004	0.000413	0.0001340	0.0001	0.00009822	0.0002533
Titanium	mg/L	—	—	—	18	-	-	-	0.00071	0.00346	0.001606	0.001545	0.0006351	0.002381	44	-	-	-	0.0005	0.00843	0.001935	0.001295	0.001776	0.006013	16	-	-	-	0.0002	0.0106	0.003306	0.00182	0.003431	0.009693
Tungsten	mg/L	—	—	0.03	18	-	-	0	0.00001	0.0001	0.00005911	0.00004	0.00003911	0.0001	44	-	-	0	0.00001	0.00718	0.0002254	0.00004	0.001073	0.0001	16	-	-	0	0.000011	0.0001	0.00005206	0.00004	0.00003491	0.0001
Uranium	mg/L	0.02	0.015	0.005	18	0	0	0	0.000016	0.000198	0.00005889	0.00004815	0.00004620	0.0001547	44	0	0	0	0.0000045	0.00134	0.00005915	0.00001485	0.0002013	0.0001367	16	0	0	0	0.0000678	0.000144	0.00009358	0.00008325	0.00002476	0.0001425
Vanadium	mg/L	—	—	0.006	18	-	-	0	0.000186	0.00033	0.0002793	0.000286	0.00004120	0.00033	44	-	-	0	0.000089	0.000518	0.0002516	0.000233	0.00009018	0.0004299	16	-	-	0	0.00003	0.000763	0.0002793	0.000213	0.0001849	0.0005658
Zinc	mg/L	5	0.03	0.02	18	0	0	0	0.002	0.0082	0.003133	0.003	0.001465	0.00565	44	0	0	1	0.002	0.0238	0.003864	0.003	0.003492	0.007640	16	0	0	0	0.002	0.0085	0.003313	0.003	0.001546	0.005875
Zirconium	mg/L	—	—	0.004	18	-	-	0	0.000067	0.0002	0.0001209	0.0001	0.00005227	0.0002	44	-	-	0	0.00005	0.00201	0.0001974	0.000125	0.0002929	0.0002685	16	-	-	0	0.00005	0.00232	0.0002676	0.0001	0.0005499	0.00073
Dissolved Metals																																	
Aluminum	mg/L	—	—	—	18	-	-	-	0.0057	0.0257	0.01361	0.0139	0.006472	0.02383	44	-	-	-	0.0036	0.0653	0.01939	0.01915	0.01276	0.03921	16	-	-	-	0.0032	0.0234	0.00813	0.00605	0.005625	0.01635
Antimony	mg/L	—	—	—	18	-	-	-	0.000025	0.0002	0.0001077	0.0001	0.00006643	0.0002	44	-	-	-	0.000018	0.0002	0.0001306	0.0001	0.00006308	0.0002	16	-	-	-	0.000024	0.0002	0.0001165	0.0001	0.00007233	0.0002
Arsenic	mg/L	—	—	—	18	-	-	-	0.00035	0.00091	0.00062	0.0005735	0.0001796	0.0008845	44	-	-	-	0.00039	0.00235	0.0008171	0.0007005	0.0004216	0.001547	16	-	-	-	0.000346	0.00105	0.0006287	0.000595	0.0002216	0.0009338
Barium	mg/L	—	—	—	18	-	-	-	0.00314	0.00799	0.005816	0.005995	0.001594	0.007931	44	-	-	-	0.00248	0.0146	0.006464	0.006045	0.002619	0.01130	16	-	-	-	0.00577	0.00997	0.007194	0.00695	0.001047	0.008838
Beryllium	mg/L	—	—	—	18	-	-	-	0.000005	0.00006	0.00004472	0.00006	0.00002535	0.00006	44	-	-	-	0.000005	0.00006	0.00005130	0.00006	0.00002024	0.00006	16	-	-	-	0.000005	0.00006	0.00004281	0.00006	0.00002633	0.00006
Bismuth	mg/L	—	—	—	18	-	-	-	0.00005	0.0002	0.0001306	0.0001	0.00006673	0.0002	44	-	-	-	0.00005	0.0002	0.0001352	0.0001	0.00005963	0.0002	16	-	-	-	0.00005	0.0002	0.0001156	0.0001	0.00006250	0.0002
Boron	mg/L	—	—	—	18	-	-	-	0.001	0.005	0.0034	0.0035	0.001258	0.005	44	-	-	-	0.0012	0.005	0.003139	0.0029	0.001178	0.005	16	-	-	-	0.002	0.005	0.003644	0.00355	0.001140	0.005
Cadmium	mg/L	—	—	—	18	-	-	-	0.000005	0.000047	0.00001729	0.00001	0.00001369	0.0000436	44	-	-	-	0.0000064	0.000061	0.00002195	0.000011	0.00001469	0.00004385	16	-	-	-	0.000005	0.000045	0.00001818	0.00001	0.00001411	0.00004425
Chromium (total)	mg/L	—	—	—	18	-	-	-	0.0002	0.0005	0.0004306	0.0005	0.0001273	0.0005	44	-	-	-	0.0002	0.00083	0.0004018	0.0005	0.0001581	0.0005	16	-	-	-	0.0002	0.00071	0.0004213	0.0005	0.0001587	0.0005525
Cobalt	mg/L	—	—	—	18	-	-	-	0.00003	0.000108	0.000057	0.00005	0.00002304	0.00009865	44	-	-	-	0.00003	0.000948	0.0001116	0.0000745	0.0001563	0.0004123	16	-	-	-	0.00003	0.000149	0.0000646	0.00005	0.00003294	0.0001153
Copper	mg/L	—	—	—	18	-	-	-	0.0004	0.00186	0.0008606	0.0007	0.0004355	0.001537	44	-	-	-	0.0004	0.00465	0.0009430	0.0007	0.0006655	0.001471	16	-	-	-	0.0004	0.00165	0.0008713	0.00074	0.0004172	0.001553
Iron (total)	mg/L	—	—	—	18	-	-	-	0.005	0.187	0.05294	0.037	0.05166	0.1709	44	-	-	-	0.005	0.818	0.1896	0.1335	0.1957	0.6442	16	-	-	-	0.005	0.209	0.0295	0.01545	0.04875	0.07625
Lead	mg/L	—	—	—	18	-	-	-	0.00005	0.0001	0.00008611	0.0001	0.00002304	0.0001	44	-	-	-	0.00005	0.00031	0.00009693	0.0001	0.00003757	0.0001	16	-	-	-	0.00005	0.0001	0.00008600	0.0001	0.00002227	0.0001
Lithium	mg/L	—	—	—	18	-	-	-	0.00057	0.0011	0.0008906	0.0009	0.0001485	0.001015	44	-	-	-	0.0004	0.0016	0.0009350	0.00093	0.0001809	0.001170	16	-	-	-	0.00073	0.00154	0.0009806	0.00095	0.0002081	0.001390
Manganese	mg/L	—	—	—	18	-	-	-	0.00169	0.0234	0.008662	0.00484	0.007781	0.02272	44	-	-	-	0.00134	0.932	0.08213	0.02555	0.1821	0.4233	16	-	-	-	0.0005	0.0309	0.00846	0.005055	0.008837	0.02768
Mercury	mg/L	—	—	—	18	-	-	-	4.200E-07	1.264E-06	7.754E-07	7.347E-07	2.675E-07	1.234E-06	44	-	-	-	0.00000022	0.00002	2.060E-06	1.085E-06	4.010E-06	2.694E-06	16	-	-	-	0.0000001	0.00000111	5.275E-07	4.917E-07	2.622E-07	1.043E-06
Methyl mercury	mg/L	—	—	—	18	-	-	-	5.4E-09	0.000000075	2.896E-08	2.668E-08	1.918E-08	6.174E-08	42	-	-	-	5.4E-09	0.000000118	3.428E-08	2.930E-08	2.209E-08	6.771E-08	16	-	-	-	5.4E-09	1.03369E-07	3.356E-08	3.141E-08	2.981E-08	8.154E-08
Molybdenum	mg/L	—	—	—	18	-	-	-	0.00008	0.0002	0.0001381	0.0000915	0.00005707	0.0002	44	-	-	-	0.00005	0.0002	0.0001380	0.000122	0.00005886	0.0002	16	-	-	-	0.000067	0.0002	0.0001198	0.00009	0.00005633	0.0002
Nickel	mg/L	—	—	—	18	-	-	-	0.0002	0.001	0.0006422	0.00075	0.0003696	0.001	44	-	-	-	0.0002	0.001	0.0006973	0.00081	0.0003225	0.001	16	-	-	-	0.0002	0.001	0.0006300	0.00071	0.0003517	0.001
Selenium	mg/L	—	—	—	18	-	-	-	0.0002	0.001	0.0005556	0.0005	0.0003110	0.001	44	-	-	-	0.0002	0.001	0.0006568	0.0005	0.0003068	0.001	16	-	-	-	0.0002	0.001	0.0005938	0.0005	0.0003473	0.001
Silver	mg/L	—	—	—	18	-	-	-	0.000005	0.00005	0.00002639	0.00001	0.00002182	0.00005	44	-	-	-	0.000005	0.00005	0.00002648	0.00001	0.00002081	0.00005	16	-	-	-	0.000005	0.00005	0.00002094	0.00001	0.00002035	0.00005
Strontium	mg/L	—	—	—	18	-	-	-	0.0105	0.0262	0.01835	0.0172	0.004205	0.02595	44	-	-	-	0.0133	0.0485	0.02298	0.0187	0.009252	0.04217	16	-	-	-	0.0238	0.0279	0.02595	0.02575	0.001252	0.02753
Tellurium	mg/L	—	—	—	18	-	-	-	0.00001	0.00007	0.00005333	0.00007	0.00002765	0.00007	44	-	-	-	0.00001	0.000081	0.00006070	0.00007	0.00002237	0.00007	16	-	-	-	0.00001	0.00007	0.00005125	0.00007	0.00002872	0.00007
Thallium	mg/L	—	—	—	18	-	-	-	0.000002	0.00003	0.00001669	0.00001	0.00001262	0.00003	44	-	-	-	0.000002	0.00003	0.00001736	0.00001	0.00001148	0.00003	16	-	-	-	0.000002	0.00003	0.00001379	0.00001	0.00001178	0.00003
Tin	mg/L	—	—	—	18	-	-	-	0.0001	0.0002	0.0001278	0.0001	0.00004609	0.0002	44	-	-	-	0.0001	0.00227	0.0001664	0.0001	0.0003266	0.0002	16	-	-	-	0.0001	0.0002	0.0001325	0.0001	0.00004726	0.0002
Titanium	mg/L	—	—	—	18	-	-	-	0.0002	0.00055	0.0004322	0.0005	0.0001232	0.0005075	44	-	-	-	0.0002	0.00119	0.0005398	0.0005	0.0001513	0.000730	16	-	-	-	0.0002	0.0005	0.0004181	0.0005	0.0001329	0.000500
Tungsten	mg/L	—	—	—	18	-	-	-	0.00001	0.0001	0.00005094	0.000018	0.00004522	0.0001	44	-	-	-	0.00001	0.000112	0.00005491	0.0000405	0.00004345	0.0001	16	-	-	-	0.00001	0.0001	0.00005025	0.0000255	0.00004156	0.0001
Uranium	mg/L	—	—	—	18	-	-	-	0.000012	0.000168	0.00005313	0.0000433	0.00004238	0.0001536	44	-	-	-	0.0000029	0.000204	0.00002741	0.000012	0.00003819	0.00009464	16	-	-	-	0.0000536	0.000134	0.00008551	0.0000852	0.00002784	0.0001280
Vanadium	mg/L	—	—	—	18	-	-	-	0.00015	0.00031	0.0002272	0.000222	0.00004372	0.000293	44	-	-	-	0.00005	0.00035	0.0001876	0.0002	0.00005476	0.0002685	16	-	-	-	0.00005	0.0004	0.0002125	0.000205	0.00008747	0.0003468
Zinc	mg/L	—	—	—	18	-	-	-	0.002	0.0111	0.004228	0.0037	0.002764	0.009655	44	-	-	-	0.002	0.023	0.004905	0.00415	0.003805	0.009485	16	-	-	-	0.002	0.0234	0.005588	0.0038	0.005442	0.01290
Zirconium	mg/L	—	—	—	18	-	-	-	0.00005	0.000236	0.00009017	0.0000985	0.00004177	0.0001204	44	-	-	-	0.000025	0.000199	0.00009045	0.0001	0.00003472	0.0001496	16	-	-	-	0.00002	0.0001	0.00006744	0.000061	0.00002764	0.0001

Notes:

0.1 - Values in blue font are below the analytical detection limit.

(a) Refer to Attachment 2.II.1 for details and notes on criteria.

Table 3.3.1-1: Characterization of the Water Crossings along the All-weather Access Road

Water Crossing ID	NAD 83 UTM Zone 15N[a]		Drainage Area (km^2)	Mean Annual Flow (L/s)	Field Flow Measurement (L/s)	Average Bankfull Width (m)	Average Bankfull Depth (m)	Mean Channel Slope (%)	Channel Sinuosity	Watercourse Classification	Minor Navigable Water
	East	North									
AWC1	496929	5571667	3.6	38	—[d]	—[d]	—[d]	—[e]	1	Perennial	—[d]
AWC2	494900	5575472	84.1	883	233	5	0.7	—[e]	1.6	Perennial	No
AWC3[b]	490533	5584619	< 1	8	—[b]	—[b]	—[b]	—[b]	—[b]	Interm/Ephem	—[b]
AWC4	490280	5586187	4.9	51	—[g]	—[g]	—[g]	—[e]	1	Perennial	—[g]
AWC5[c]	490044	5586912	240	2,520	—[i]	25.0	2	—[e]	1.5	Perennial	No
AWC6	491003	5589952	< 1	7	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
AWC7	491847	5591625	7	74	6	1.2	0.2	—[e]	1.1	Interm/Ephem	Yes
AWC8	494535	5594720	1.3	14	—[i]	2.1	0.3	—[e]	1	Interm/Ephem	Yes
AWC9	495442	5595327	3.8	40	7	0.8	0.3	—[e]	1	Interm/Ephem	Yes
AWC10	500446	5601071	20.4	214	7	1.1	0.1	—[e]	2.6	Interm/Ephem	Yes
AWC11	502477	5603836	7.9	83	—[d]	—[d]	—[d]	—[d]	—[d]	Perennial	—[d]
AWC12	508087	5610650	7.3	77	0[j]	1.1	0.3	—[e]	1	Interm/Ephem	Yes
AWC13	512137	5612200	2.4	25	0[j]	1.1	0.2	—[e]	1.2	Interm/Ephem	Yes
AWC14	514110	5614099	1,572.5	16,511	—[i]	20.0	0.5	—[e]	1	Perennial	No
AWC15	514678	5614878	14.4	151	0[j]	1.6	0.7	—[e]	1	Perennial	No
AWC16	519082	5615181	6.4	67	16	2	0.1	—[e]	1.1	Interm/Ephem	Yes
WC1	524133	5620004	5	53	0[j]	2.3	0.8	0.33	1.6	Perennial	Yes
WC2	521688	5624045	107.8	1,131	174	13	1.4	0.2	1.8	Perennial	No
WC3	519761	5628183	80	840	238	14.5	1.8	0.13	1.1	Perennial	No
WC4	518011	5632278	2.4	25	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC5	518541	5633311	1.3	14	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC6	518546	5635528	8.3	87	4	4.4	1	—[e]	1	Perennial	No
WC7	517334	5636948	< 1	3	0[j]	2.2	1.3	—[e]	1.3	Interm/Ephem	No
WC8	517415	5637506	11.8	124	0[j]	7	0.9	—[e]	1.2	Perennial	No
WC9	517579	5638042	15,771	40,913[h]	—[i]	>100	>3	0.1	1.1	Perennial	No
WC10	522068	5646003	16.4	172	0[j]	9.1	1.3	0.31	1.1	Perennial	No
WC11	521815	5647338	89.3	938	0[j]	10.9	1.3	0.24	1.3	Perennial	No
WC12	521841	5649760	16.5	173	0[j]	4.5	1	—[e]	1.2	Perennial	No
WC13	521109	5654467	6.5	68	—[g]	—[g]	—[g]	0.31	1	Perennial	—[g]
WC14	521025	5656076	11.7	123	0[j]	5	0.9	0.4	1.5	Perennial	No

Table 3.3.1-1: Characterization of the Water Crossings along the All-weather Access Road (Continued)

Water Crossing ID	NAD 83 UTM Zone 15N[a]		Drainage Area (km^2)	Mean Annual Flow (L/s)	Field Flow Measurement (L/s)	Average Bankfull Width (m)	Average Bankfull Depth (m)	Mean Channel Slope (%)	Channel Sinuosity	Watercourse Classification	Minor Navigable Water
	East	North									
WC15	520839	5657302	71.9	755	0[j]	11	1.2	—[e]	1.1	Perennial	No
WC16	520322	5658334	1.1	12	0[j]	2.1	0.7	—[e]	1.1	Interm/Ephem	No
WC17	519938	5659791	2.6	27	0[j]	1.6	1	—[e]	1	Perennial	Yes
WC18	520060	5662108	16.5	173	0[j]	4.6	0.8	0.16	1.1	Perennial	No
WC19	519935	5663158	28	294	0[j]	6.9	0.6	—[e]	1.4	Perennial	No
WC20	519604	5666837	5.3	56	0[j]	2.3	0.8	—[e]	1.1	Perennial	Yes
WC21	519898	5669205	< 1	8	0[j]	0.9	0.6	—[e]	1	Interm/Ephem	Yes
WC22	520051	5676958	421.7	4,428	1,778	42.9	1.9	0.32	1.3	Perennial	No
WC23	519752	5678174	< 1	7	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC24	519628	5680125	< 1	6	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC25	519059	5682468	19.1	201	0[j]	9.9	1.1	0.36	1.2	Perennial	No
WC26	519837	5684281	1.6	17	0[j]	1.4	0.4	—[e]	1	Interm/Ephem	Yes
WC27	521688	5691500	335.9	3,527	—[i]	10	1.5	0.14	1.5	Perennial	No
WC28	519687	5699406	2	21	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC29	519242	5702193	30,210	200,705[h]	—[i]	>50	>3	0.08	1.2	Perennial	No
WC30	518602	5706436	< 1	6	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC31	517756	5708096	< 1	9	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC32	517020	5709101	90	945	0[j]	10	1.4	—[e]	1.2	Perennial	No
WC33	515442	5714732	3.7	39	0[j]	12.1	0.7	—[e]	1	Interm/Ephem	No
WC34	514943	5716821	579.2	6,081	758	36.3	1.7	0.2	1.2	Perennial	No
WC35	513677	5722560	14	147	0[j]	3.9	0.9	—[e]	1.2	Perennial	No
WC36	512354	5725169	56.3	591	0[j]	5.6	1.4	—[e]	1	Perennial	No
WC37	511150	5728301	1.2	13	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC38	511271	5732949	1,036.1	10,879	—[i]	>20	>3	0.09	1.4	Perennial	No
WC39	511637	5734487	26.2	275	0[j]	4.8	1	—[e]	1.4	Perennial	Yes
WC40	512897	5749140	50.7	532	0[j]	9.5	1.8	—[e]	1.1	Perennial	No
WC41	524965	5777011	3.8	40	0[j]	2.9	0.5	—[e]	1	Perennial	Yes
WC42	525924	5777778	26,490	278,145	—[i]	>50	>3	0.07	1.2	Perennial	No
WC43	527288	5778338	4.4	46	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC44	532315	5783452	6.4	67	29	0.7	0.3	—[e]	1.2	Interm/Ephem	Yes
WC45	532685	5785342	4.7	49	20	3	0.4	0.32	1.2	Interm/Ephem	Yes

Table 3.3.1-1: Characterization of the Water Crossings along the All-weather Access Road (Continued)

Water Crossing ID	NAD 83 UTM Zone 15N[a]		Drainage Area (km^2)	Mean Annual Flow (L/s)	Field Flow Measurement (L/s)	Average Bankfull Width (m)	Average Bankfull Depth (m)	Mean Channel Slope (%)	Channel Sinuosity	Watercourse Classification	Minor Navigable Water
	East	North									
WC46	539874	5794153	19.3	203	564	11.7	0.4	0.21	1.1	Interm/Ephem	No
WC47[b]	538893	5798187	2	21	—[b]	—[b]	—[b]	—[b]	—[b]	Perennial	—[b]
WC48	542434	5822086	79.7	837	1,102	12.1	1.5	—[e]	1.1	Perennial	No
WC49	544958	5831655	82.6	867	781	11.5	1.1	0.2	1.1	Perennial	No
WC50	547093	5835119	2.9	30	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC51	547620	5836111	1	11	—[f]	—[f]	—[f]	—[e]	1	Interm/Ephem	—[f]
WC52	547969	5836842	193.3	2,030	2,206	15.2	1.9	0.13	1.2	Perennial	No
WC53[b]	547718	5844154	< 1	5	—[b]	—[b]	—[b]	—[b]	—[b]	Interm/Ephem	—[b]

Note:

The identifiers "AWC" and "WC" indicate water crossings along the existing Painter Lake Road/Anaconda Road section and the new All-weather Access Road section, respectively.

"Interm" = intermittent; "Ephem" = ephemeral.

(a) UTM coordinates at All-weather Access Road crossing location.

(b) Not visited during field surveys due to scheduling constraints.

(c) Stream visited 700 m upstream, at existing Anaconda Road crossing (site ID AWA6).

(d) Lake with no defined channel.

(e) Very flat area, channel slope could not be determined from topographic data.

(f) Site could not be assessed in the field; no defined channel found.

(g) Site could not be assessed due to extensive flooding.

(h) Mean annual flow at crossings WC29 and WC9 was estimated as the product of an annual yield of 10.5 L/s/km^2 and its tributary drainage area, less the estimate of diverted flow (Appendix 2.II).

(i) Flow measurement not taken; dry area or unable to safely take measurement (mainly in large rivers).

(j) Trace flow, could not be measured with the available equipment.

Attachment F – Surface Water Quality Within and Surrounding the Regional Study Area

Table F-1: Provincial Water Quality Monitoring Network Data Within and Surrounding the Regional Study Area

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Parameter	Units	Water Management, Policies, Guidelines (1)	Ontario Drinking Water Standards, Objectives and Guidelines	Canadian Council of Ministers of the Environment	Albany River at Nottick Island	Little Current River	Ogoki River	Albany River at Comb Island	Albany River at Hill Island	Kenogami River at Coltman Island
		(mg/L)	Standards, Objectives and Guidelines (mg/L)	Water Quality Guidelines for the Protection of Aquatic Life (mg/L)	Station ID 19005300102	Station ID 19005300202	Station ID 19005300402	Station ID 19005300702	Station ID 19005300802	Station ID 19005300902
			MAC		Value	Mean Value	Mean Value	Value	Value	Value
ALKALINITY, TOTAL	mg/L	Should not be decreased by more than 25% of the natural concentration	30-500 (2)	-	-	66	16	41	40	46.8
ALUMINIUM, UNFILTERED TOTAL	mg/L	0.075	0.1 (2)	0.005 if pH < 6.5; 0.1 if pH ≥ 6.5	0.06	0.058	0.03	0.0705	0.0678	0.104
AMMONIUM, TOTAL FILTER.REAC	mg/L	-	-	-	-	0.03	0.01	-	-	-
AMMONIUM, TOTAL UNFIL.REAC	mg/L	-	-	-	-	-	-	0.017	0.011	0.009
ARSENIC, UNFILTERED TOTAL	mg/L	0.005	0.025 (14)	0.005	0.001	0.001	0.001	-	-	-
BARIUM, UNFILTERED TOTAL	mg/L	-	1 (5)	-	-	-	-	0.00568	0.00579	0.00478
BERYLIUM,UNFILTERED TOTAL	mg/L	0.011-1.1 (17)	-	-	-	-	-	0.0000149	0.0000137	0.0000216
CADMIUM, UNFILTERED TOTAL	mg/L	0.0001-0.0005mg/L (18)	0.005 (5)	0.00004mg/L to 0.00012mg/L *see equation in Guidelines to correct value for hardness	0.0005	0.0005	0.0006	0.000989	0.000115	-0.000144
CALCIUM, UNFILTERED TOTAL	mg/L	-	-	-	-	-	-	13.2	13.2	16.8
CARBON, DISSOLVED INORGANIC	mg/L	-	-	-	-	-	-	9.2	9.7	11.6
CARBON, DISSOLVED ORGANIC	mg/L	-	-	-	-	-	-	13.6	13.5	20
CHLORIDE, UNFIL.REAC	mg/L		250 (3)	120	-	0.2	0.3	0.4	0.4	0.7
CHROMIUM, UNFILTERED TOTAL	mg/L	CR(VI) 0.001, CR(III) 0.0089	0.05 (5)	CR(VI) 0.001 CR(III) 0.0089	0.004	0.0055	0.003	0.000476	-0.0000828	0.0000848
COBALT, UNFILTERED TOTAL	mg/L	0.0009mg/L	-	-	0.002	0.002	0.002	0.000348	-0.0000973	0.000555
CONDUCTIVITY, 25C	µS/cm	-	-	-	-	132	40	78	78	94
CONDUCTIVITY, AMBIENT	umho/cm	-	-	-	-	-	-	71	72	87
COPPER, UNFILTERED TOTAL	mg/L	0.001-0.005 (19)	1 (3)	0.002 *see equation in Guidelines to correct value for hardness	0.001	0.0015	0.002	0.000459	0.00077	0.00077
DISSOLVED OXYGEN	mg/L	4-8 should not be less than 47-63% of saturation value	-	5.5-9.5 *variable, for more info refer to Guidelines	-	-	-	9.26	9.5	9.47
HARDNESS, TOTAL	mg/L	-	80-100 (2)	-	-	75	16	43.2	43	53.6
IRON, UNFILTERED TOTAL	mg/L	0.3	0.3 (3)	0.3	0.31	0.155	0.0935	0.187	0.191	0.244
LEAD, UNFILTERED TOTAL	mg/L	0.001-0.005	0.01 (5)(15)	0.001-0.007 *see equation in Guidelines to correct value for hardness	0.003	0.0035	0.005	-0.00443	-0.00341	0.000998
MAGNESIUM,UNFILTERED TOTAL	mg/L	-	-	-	-	-	-	2.48	2.46	2.85
MANGANESE,UNFILTERED TOTAL	mg/L	-	≤0.05 (3)	-	0.037	0.018	0.0125	0.017	0.0176	0.0226
MERCURY, UNFILTERED TOTAL	µg/L	0.0002mg/L	0.001 (5)	0.000026mg/L	0.016	0.04	0.0275	-	-	-
MOLYBDENUM,UNFILTERED TOTAL	mg/L	0.04	-	0.073	-	-	-	0.0011	0.00089	0.000265
NICKEL, UNFILTERED TOTAL	mg/L	0.025	-	0.025-0.15 *see equation in Guidelines to correct value for hardness	0.002	0.002	0.002	0.000768	0.00105	0.00027
NITRATE, FILTERED REACTIVE	mg/L	-	10 (5)(6)	13	-	0.01	0.01	-	-	-
NITRATES TOTAL, UNFIL.REAC	mg/L	-	10 (5)(6)	13	-	-	-	0.01	0.01	0.01
NITRITE, FILTERED REACTIVE	mg/L	-	1 (5)(6)	60 NO2-N µg/L	-	0.003	0.002	-	-	-
NITRITE, UNFILTERED REACTIVE	mg/L	-	1 (5)(6)	60 NO2-N µg/L	-	-	-	0.003	0.003	0.005
NITROGEN,TOT,KJELDAHL/UNF.REA	mg/L	-	-	-	-	0.48	0.325	-	-	-
PH (-LOG H+ CONCN)	-	6.5-8.5	6.5-8.5 (2)	6.5-9.0	-	7.8	7.1	7.8	7.78	7.77
PH FIELD	-	6.5-8.5	6.5-8.5 (2)	6.5-9.0	-	-	-	7.5	7.6	7.4
PHOSPHATE,FILTERED REACTIVE	mg/L	-	-	-	-	0.003	0.0015	0.0022	0.0022	0.0021
PHOSPHORUS,UNFILTERED TOTAL	mg/L	0.01-0.03	-	-	-	0.019	0.0085	-	-	-
RESIDUE,PARTICULATE	mg/L	-	-	-	-	4	2	5.8	6.5	6.8
RESIDUE,TOTAL	mg/L	-	-	-	-	150	45	-	-	-
SILICATES,UNFILTERED REACTIVE	mg/L	-	-	-	-	2.2	1.3	0.92	0.92	0.92
STREAM CONDITION	-	-	-	-	-	-	-	8	-	-
STRONTIUM, UNFILTERED TOTAL	mg/L	-	-	-	-	-	-	0.015	0.0174	0.0432
SULPHATE, UNFILTERED REACTIVE	mg/L	-	≤500 (3)(16)		-	1.8	2.5	-	-	-
TEMPERATURE, WATER	°C	-	-	-	-	-	-	19.2	20	20
TITANIUM, UNFILTERED TOTAL	mg/L	-	-	-	-	-	-	0.003	0.00302	0.00365
TURBIDITY	FNU	-	5 NTU (25)	- (20)	-	1.4	0.45	-	-	-
VANADIUM, UNFILTERED TOTAL	mg/L	0.006	-	-	-	-	-	0.00107	0.000623	0.000284
ZINC, UNFILTERED TOTAL	mg/L	0.02	≤5.0 (3)	0.03	0.01	0.0045	0.002	0.000233	0.000338	0.000729

1) Ontario Ministry of the Environment, 1994. Water Management, Policies, Guidelines. Provincial Water Quality Objectives of the Ministry of Environment and Energy. ISBN 0-7778-8473-9 rev. Queen's Printer for Ontario, 1994.
2) Operational Guideline detailed in the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (MOE 2003).
3) Aesthetic objective detailed in the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (MOE 2003).
4) Interim PWQO to avoid nuisance concentrations of algae in lakes.
5) Maximum Acceptable Concentration (MAC) detailed in the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (MOE 2003)
6) Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen).
7) Canadian Water Quality Guideline, Water Quality (Freshwater) for the Protection of Aquatic Life (CCME 1999).
8) Applicable for all waters at the point of consumption.
9) The Criterion for dissolved oxygen is based on minimum values presented in the standard.
10) Values reported for unfiltered samples.
11) The values of the samples with detection limits higher that the guidelines were set at the detection limits.
12) The PWQO criterion for total lead is dependent on the alkalinity. Alkalinity at the Ogoki River was 16 mg/L as CaCO3 and therefore the lead criterion was set at 0.005 mg/L. Average alkalinity at the remaining stations is between 40 and 80 mg/L as CaCO3 and therefore the lead criterion was set at 0.02 mg/L for these stations.
13) The interim PWQO criterion for total lead is dependent on the hardness. Hardness at the Ogoki River was 16 mg/L as CaCO3 and therefore the lead criterion was set at 0.001 mg/L. Hardness at the remaining stations is between 30 and 80 mg/L as CaCO3 and therefore the lead criterion was set at 0.003 mg/L for these stations.
14) TECH Interim Maximum Acceptable Concentration (IMAC)
15) This standard applies to water at the point of consumption. Since lead is a component in some plumbing systems, first flush water may contain higher concentrations of lead than water that has been flushed for five minutes.
16) When sulphate levels exceed 500 mg/L, water may have a laxative effect on some people
17) The PWQO criterion for total beryllium is dependent on the hardness. Hardness at the stations were either below or at 75 mg/L as CaCO3 and therefore the beryllium criterion was set at 0.011 mg/L.
18) The PWQO criterion for total cadmium is dependent on the hardness. Hardness at the stations were either below 100 mg/L as CaCO3 and therefore the cadmium criterion was set at 0.0001 mg/L.
19) The PWQO criterion for total copper is dependent on the hardness. Hardness at the Ogoki River was 16 mg/L as CaCO3 and therefore the copper criterion was set at 0.001 mg/L. Average hardness at the remaining stations is between 43 and 75 mg/L as CaCO3 and therefore the copper criterion was set at 0.005 mg/L for these stations.
20)Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).

Bolded values indicated exceedances of guidelines.

°C = degrees Celsius; mg/L = milligrams per litre; mg(as CaCO3)/L = milligrams as calcium carbonate per litre; n/a = not applicable; NTU = Nephelometric Turbidity Units; µg/L = micrograms per litre; and µS/cm = microsiemens per centimetre

Table F-2: 2020 Field Investigation Water Quality Results - Marten Falls Community Access Road Project

21455151

Sample Location			RA1-4 WC33	RA1-4 WC35	RA1-4 WC 37	RA1-WC-14	RA1- WC 26	RA1-WC-27	RA1-WC-28	RA1-WC 57	RA1-WC-66	RA4-WC-15	RA4-WC 18	RA4-WC-22	RA4-WC-31	RA4-WC-34	RA4-WC 42	RA4-WC-45	RA4-WC-55	RA4-WC 58	RA-4B WC01
Sample Date			19-Oct-20	14-Oct-20	14-Oct-20	19-Oct-20	20-Oct-20	24-Oct-20	24-Oct-20	20-Oct-20	20-Oct-20	25-Oct-20	15-Oct-20	25-Oct-20	18-Oct-20	26-Oct-20	19-Oct-20	18-Oct-20	22-Oct-20	19-Oct-20	15-Oct-20
Mapbook Figure Location			F-8	F-8	F-8	F-3	F-4	F-4	F-5	F-6	F-6	F-3	F-3	F-3	F-4	F-5	F-5	F-5	F-7	F-7	F-3
Parameter	**MDL** [1]	**Units**																			
Inorganics																					
Total Ammonia-N	0.05	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.1	0.13	<0.050	<0.050	<0.050	<0.050	0.078	<0.050	<0.050	<0.050	<0.050	0.12	<0.050	<0.050
Conductivity	1	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (F-)	0.1	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen (TKN)	0.1	mg/L	0.27	0.32	0.24	0.37	0.65	0.34	0.54	0.29	0.26	0.34	0.38	0.4	0.52	0.27	0.35	0.32	0.39	0.3	0.25
Dissolved Organic Carbon (DOC)	0.4	mg/L	21	23	9.3	16	42	11	38	20	15	14	19	18	41	13	29	26	20	21	13
Orthophosphate (P)	0.01	mg/L	0.011	0.005	0.033	0.01	0.008	0.017	0.007	0.005	0.005	0.007	0.009	0.007	0.007	0.008	0.01	0.01	0.012	0.004	0.013
pH		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus	0.004	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	1	mg/L																			
Dissolved Sulphate (SO4)	1	mg/L	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Turbidity	0.1	NTU																			
Alkalinity (as CaCO3)	1	mg/L	4.2	7.8	130	42	15	54	13	21	9.3	60	41	48	6.6	54	15	12	29	10	56
Dissolved Chloride (Cl-)	1	mg/L	1.6	1.3	<1.0	1	1.8	2	2.6	1.9	1.6	1.8	1.4	1.5	2.7	1.7	1.9	1.9	1.5	1.3	1.2
Nitrate (NO3)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite (NO2)	0.01	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Ammonia Nitrogen (NH3 + NH4)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ammoinia - Un-ionized (NH3+)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids (TDS)	10	mg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Aluminum (Al)	4.9	ug/L	62	46	9.9	19	140	120	140	41	29	33	33	26	140	25	83	77	52	47	39
Total Antimony (Sb)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Barium (Ba)	2	ug/L	2.8	<2.0	4.9	3.7	2.5	6.7	3.1	2.5	2.4	6.5	4.1	3.2	2.9	6.2	2.6	2.9	3.1	2.2	6.6
Total Beryllium (Be)	0.4	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Bismuth (Bi)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Boron (B)	10	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	0.09	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Calcium (Ca)	200	µg/L	3700	5300	43000	14000	11000	17000	9000	8400	4900	21000	15000	16000	7100	18000	8500	6900	11000	5700	18000
Total Chromium (Cr)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cobalt (Co)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Copper (Cu)	0.9	ug/L	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
Total Iron (Fe)	100	ug/L	180	260	160	<100	220	220	360	210	170	<100	100	110	280	<100	230	250	200	170	100
Total Lead (Pb)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Lithium (Li)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Magnesium (Mg)	50	µg/L	560	910	7100	2900	2200	3400	1700	1500	810	4200	2600	3200	1300	3600	1500	1100	2000	1100	3800
Total Manganese (Mn)	2	ug/L	5.3	14	21	18	4.1	19	2.5	9.7	4.4	11	4.5	7.8	8.9	8.5	5	6.2	11	2.6	12
Total Molybdenum (Mo)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Nickel (Ni)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Potassium (K)	200	µg/L	<200	<200	310	350	<200	420	<200	<200	<200	450	220	210	<200	400	<200	<200	<200	<200	410
Total Selenium (Se)	2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Silicon (Si)	50	µg/L	430	1000	2300	2200	1700	1700	1800	1400	1100	2100	1400	1700	1300	1600	1300	700	1300	1200	1900
Total Silver (Ag)	0.09	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Sodium (Na)	100	µg/L	320	400	970	580	680	570	550	480	340	660	390	470	420	610	480	410	440	490	580
Total Strontium (Sr)	1	ug/L	8	8.4	35	16	11	16	12	12	8.2	18	12	12	9.7	17	12	8.8	12	10	16
Total Tellurium (Te)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Thallium (Tl)	0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Tin (Sn)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Titanium (Ti)	5	ug/L	<5.0	<5.0	<5.0	<5.0	6.3	8.9	6.9	<5.0	<5.0	5.9	<5.0	<5.0	5.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Tungsten (W)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Uranium (U)	0.1	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	0.52	0.62	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Zinc (Zn)	5	ug/L	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Zirconium (Zr)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Table F-3: 2021 Field Investigation Water Quality Results - Marten Falls Community Access Road Project

Sample Location			RA1-4-WC-01	RA1-4-WC-07	RA4-WC-37	RA4-WC-26	RA1-WC-02	RA1-WC-23	RA4-WC-27	RA4-WC-34	RA4-WC-57	RA1-WC-67	RA4-WC-21	RA1-WC-02	RA4-WC-55	RA1-WC-09
Sample Date			11-Sep-21	11-Sep-21	12-Sep-21	13-Sep-21	14-Sep-21	15-Sep-21	15-Sep-21	15-Sep-21	16-Sep-21	18-Sep-21	18-Sep-21	17-Sep-21	16-Sep-21	17-Sep-21
Mapbook Figure Location			F-3	F-4	F-5	F-3	F-2	F-4	F-4	F-5	F-7	F-6	F-3	F-2	F-7	F-3
Parameter	**MDL [1]**	**Units**														
Calculated Parameters																
Total Animal/Vegetable Oil and Grease	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bicarb. Alkalinity (calc. as CaCO3)	1	mg/L	26	26	14	54	47	40	39	55	16	17	40	47	33	38
Carb. Alkalinity (calc. as CaCO3)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (CaCO3)	1	mg/L	37	39	27	61	56	51	51	61	24	25	48	52	39	46
Petroleum Hydrocarbons																
Total Oil & Grease	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Oil & Grease Mineral/Synthetic	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Inorganics																
Total Ammonia-N	0.05	mg/L	0.053	<0.050	0.051	<0.050	0.063	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Conductivity	1	umho/cm	57	58	42	110	94	82	80	110	40	47	81	92	67	79
Fluoride (F-)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen (TKN)	0.1	mg/L	0.63	0.61	0.69	0.45	0.69	0.64	0.59	0.4	0.42	0.41	0.45	0.54	0.48	0.53
Dissolved Organic Carbon	0.4	mg/L	33	36	37	16	21	30	29	13	23	25	26	23	24	24
Total Organic Carbon (TOC)	0.4	mg/L	32	34	35	15	20	29	28	12	22	23	24	21	22	22
Orthophosphate (P)	0.01	mg/L	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH		pH	6.82	6.92	6.84	7.63	7.56	7.22	7.34	7.68	6.94	7.11	7.34	7.54	7.43	7.52
Total Phosphorus	0.004	mg/L	0.009	0.011	0.023	0.01	0.016	0.011	0.012	0.012	0.006	0.008	0.008	0.009	0.01	0.007
Total Suspended Solids	1	mg/L	<1	1	8	1	5	**27**	4	2	2	1	2	2	4	2
Dissolved Sulphate (SO4)	1	mg/L	<5.0 (1)	<5.0 (1)	<1.0	<1.0	<1.0	<5.0 (1)	<5.0 (1)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	0.1	NTU	0.5	0.7	1.6	1.5	2.8	0.8	0.5	1	0.6	0.6	0.1	0.7	0.7	<0.1
Alkalinity (Total as CaCO3)	1	mg/L	26	26	14	54	47	40	39	55	16	17	40	47	33	39
Dissolved Chloride (Cl-)	1	mg/L	1.3	1.3	1.2	<1.0	1.5	1.5	2.1	<1.0	1.2	1.4	<1.0	1.6	1.4	1.7
Nitrate (N)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Metals[5]																
Total Aluminum (Al)	4.9	ug/L	59	97	**130**	20	**110**	61	72	44	62	62	43	38	75	15
Total Antimony (Sb)	0.50	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	1.0	ug/L	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Barium (Ba)	2.0	ug/L	3.6	5.5	6.2	3.5	5.1	5.2	5.1	7.3	3.5	3.7	5.1	5.6	4.2	3.4
Total Beryllium (Be)	0.40	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Bismuth (Bi)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Boron (B)	10	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	0.090	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Calcium (Ca)	200	ug/L	11000	11000	8600	17000	15000	14000	15000	17000	7600	7900	15000	16000	13000	14000
Total Chromium (Cr)	5.0	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cobalt (Co)	0.50	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Copper (Cu)	0.90	ug/L	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
Total Iron (Fe)	100	ug/L	300	**450**	**900**	110	270	**320**	**370**	<100	260	**410**	170	130	**310**	<100
Total Lead (Pb)	0.50	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Lithium (Li)	5.0	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Magnesium (Mg)	50	ug/L	2200	2100	1300	3300	3200	2900	3000	3600	1400	1300	3100	3500	2300	3100
Total Manganese (Mn)	2.0	ug/L	7.3	24	49	13	18	12	18	14	14	44	5.9	10	35	4.1
Total Molybdenum (Mo)	0.50	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Nickel (Ni)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Potassium (K)	200	ug/L	240	<200	<200	<200	240	250	260	470	<200	<200	<200	350	<200	250
Total Selenium (Se)	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Silicon (Si)	50	ug/L	1800	2100	2400	1900	2200	2100	2200	1700	1600	1500	1800	2000	1700	1500
Total Silver (Ag)	0.090	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Sodium (Na)	100	ug/L	610	640	510	520	570	660	690	590	520	540	580	560	530	760
Total Strontium (Sr)	1.0	ug/L	10	16	15	20	17	18	19	18	14	12	17	15	16	15
Total Tellurium (Te)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Thallium (Tl)	0.050	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Tin (Sn)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Sample Location			RA1-4-WC-01	RA1-4-WC-07	RA4-WC-37	RA4-WC-26	RA1-WC-02	RA1-WC-23	RA4-WC-27	RA4-WC-34	RA4-WC-57	RA1-WC-67	RA4-WC-21	RA1-WC-02	RA4-WC-55	RA1-WC-09
Sample Date			11-Sep-21	11-Sep-21	12-Sep-21	13-Sep-21	14-Sep-21	15-Sep-21	15-Sep-21	15-Sep-21	16-Sep-21	18-Sep-21	18-Sep-21	17-Sep-21	16-Sep-21	17-Sep-21
Mapbook Figure Location			F-3	F-4	F-5	F-3	F-2	F-4	F-4	F-5	F-7	F-6	F-3	F-2	F-7	F-3
Parameter	**MDL [1]**	**Units**														
Total Titanium (Ti)	5.0	ug/L	<5.0	<5.0	<5.0	<5.0	7.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.6	<5.0
Total Tungsten (W)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Uranium (U)	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	0.50	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Zinc (Zn)	5.0	ug/L	<5.0	<5.0	<5.0	5.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Zirconium (Zr)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Elements																
Total Methyl Mercury	0.05	ng/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radionuclide																
Polonium-210	0.01	Bq/L	-	-	-	-	-	-	-	0.036	-	-	-	-	-	-
Lead-210	1	Bq/L	-	-	-	-	-	-	-	<1.0	-	-	-	-	-	-
Radium-226	1	Bq/L	-	-	-	-	-	-	-	<1.0	-	-	-	-	-	-
Thornium-230	5	Bq/L	-	-	-	-	-	-	-	<5.0	-	-	-	-	-	-
Polyaromatic Hydrocarbons																
Biphenyl	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Acenaphthene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Acenaphthylene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Anthracene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Benzo(a)anthracene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Benzo(a)pyrene	0.009	ug/L	-	-	-	-	-	-	-	<0.0090	-	-	-	-	-	-
Benzo(b/j)fluoranthene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Benzo(g,h,i)perylene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Benzo(k)fluoranthene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Chrysene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Fluoranthene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Fluorene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
1-Methylnaphthalene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
2-Methylnaphthalene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Naphthalene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Phenanthrene	0.03	ug/L	-	-	-	-	-	-	-	<0.030	-	-	-	-	-	-
Pyrene	0.05	ug/L	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-
Volatile Organics																
Acetone (2-Propanone)	10	ug/L	-	-	-	-	-	-	-	<10	-	-	-	-	-	-
Benzene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Bromodichloromethane	0.5	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Bromoform	1	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Bromomethane	0.5	ug/L	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-
Carbon Tetrachloride	0.19	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Chlorobenzene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Chloroform	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Dibromochloromethane	0.5	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
1,2-Dichlorobenzene	0.4	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
1,3-Dichlorobenzene	0.4	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
1,4-Dichlorobenzene	0.4	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Dichlorodifluoromethane (FREON 12)	1	ug/L	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-
1,1-Dichloroethane	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
1,2-Dichloroethane	0.49	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
1,1-Dichloroethylene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
cis-1,2-Dichloroethylene	0.5	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
trans-1,2-Dichloroethylene	0.5	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-

Table F-3: 2021 Field Investigation Water Quality Results - Marten Falls Community Access Road Project

Sample Location			RA1-4-WC-01	RA1-4-WC-07	RA4-WC-37	RA4-WC-26	RA1-WC-02	RA1-WC-23	RA4-WC-27	RA4-WC-34	RA4-WC-57	RA1-WC-67	RA4-WC-21	RA1-WC-02	RA4-WC-55	RA1-WC-09
Sample Date			11-Sep-21	11-Sep-21	12-Sep-21	13-Sep-21	14-Sep-21	15-Sep-21	15-Sep-21	15-Sep-21	16-Sep-21	18-Sep-21	18-Sep-21	17-Sep-21	16-Sep-21	17-Sep-21
Mapbook Figure Location			F-3	F-4	F-5	F-3	F-2	F-4	F-4	F-5	F-7	F-6	F-3	F-2	F-7	F-3
Parameter	MDL [1]	Units														
1,2-Dichloropropane	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
cis-1,3-Dichloropropene	0.3	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
trans-1,3-Dichloropropene	0.4	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Ethylbenzene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Ethylene Dibromide	0.19	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Hexane	1	ug/L	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-
Methylene Chloride(Dichloromethane)	2	ug/L	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-
Methyl Ethyl Ketone (2-Butanone)	10	ug/L	-	-	-	-	-	-	-	<5.0	-	-	-	-	-	-
Methyl Isobutyl Ketone	5	ug/L	-	-	-	-	-	-	-	<5.0	-	-	-	-	-	-
Methyl t-butyl ether (MTBE)	0.5	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Styrene	0.4	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	0.5	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	0.4	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Tetrachloroethylene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Toluene	0.2	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
1,1,1-Trichloroethane	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
1,1,2-Trichloroethane	0.4	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Trichloroethylene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Trichlorofluoromethane (FREON 11)	0.5	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Vinyl Chloride	0.2	ug/L	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
p+m-Xylene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
o-Xylene	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-
Total Xylenes	0.2	ug/L	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-

Table F-4: June 2022 Field Investigation Water Quality Results - Marten Falls Community Access Road Project

21455151

Sample Location			RA4-WC-41	RA4-WC-55	RA1-4-WC-33	RA1-4-WC-37	RA4-WC-45	RA4-WC-21	RA4-WC-05	RA1-WC-32	RA4-WC-24	RA4-WC-00	RA1-WC-14	RA1-WC-09	RA1-WC-28	RA4-WC-22	RA1-WC-16	RA4-WC-02	RA4-WC-17	RA1-4-WC-36	RA1-4-WC-35	RA1-4-WC-19	RA1-WC-11	RA1-WC-66	RA1-WC-67	RA1-4-WC-21
Sample Date			25-Jun-22	27-Jun-22	24-Jun-22	26-Jun-22	27-Jun-22	27-Jun-22	26-Jun-22	25-Jun-22	27-Jun-22	24-Jun-22	23-Jun-22	23-Jun-22	24-Jun-22	22-Jun-22	22-Jun-22	11-Jun-22	28-Jun-22	28-Jun-22	28-Jun-22	28-Jun-22	29-Jun-22	30-Jun-22	30-Jun-22	01-Jul-22
Mapbook Figure Location			F-5	F-7	F-8	F-8	F-5	F-3	F-3	F-5	F-3	F-1	F-3	F-3	F-5	F-3	F-3	F-2	F-3	F-8	F-8	F-7	F-3	F-6	F-6	F-7
Parameter	**MDL [1]**	**Units**																								
Calculated Parameters																										
Total Animal/Vegetable Oil and Grease	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bicarb. Alkalinity (calc. as CaCO3)	1	mg/L	24	24	5.1	120	11	30	26	10	24	30	31	34	13	41	26	36	30	13	7.8	16	31	12	12	9.6
Carb. Alkalinity (calc. as CaCO3)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (CaCO3)	1	mg/L	29	28	8.2	**120**	16	35	30	19	27	37	33	40	24	45	30	38	38	23	16	24	34	17	21	15
Petroleum Hydrocarbons																										
Total Oil & Grease	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Oil & Grease Mineral/Synthetic	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Inorganics																										
Total Ammonia-N	0.05	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Conductivity	1	umho/cm	51	51	16	230	29	61	55	32	50	63	64	70	38	84	54	72	61	36	27	39	64	30	34	26
Fluoride (F-)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen (TKN)	0.1	mg/L	0.41	0.37	0.3	0.35	0.28	0.44	0.44	0.34	0.43	0.56	0.46	0.5	0.44	0.43	0.43	0.52	0.48	0.33	0.36	0.32	0.35	0.32	0.37	0.25
Dissolved Organic Carbon	0.4	mg/L	23	20	17	13	22	22	23	24	17	28	18	21	30	19	23	18	24	27	25	21	14	18	23	27
Total Organic Carbon (TOC)	0.4	mg/L	21	18	16	11	20	21	21	23	17	27	17	20	30	17	22	17	24	24	23	20	14	16	21	17
Orthophosphate (P)	0.01	mg/L	<0.010	<0.010	<0.010	0.014	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH		pH	7.25	7.29	6.72	7.9	6.82	7.07	7.21	6.68	7.03	7.07	7.25	7.3	6.79	7.46	7.12	7.44	7.24	6.86	**6.45**	6.98	7.43	6.65	6.85	6.77
Total Phosphorus	0.004	mg/L	0.023	0.01	0.014	0.068	0.013	0.018	0.009	0.009	0.009	0.008	0.013	0.005	0.009	0.01	0.009	0.014	0.007	0.014	0.006	0.006	0.016	0.008	0.008	0.031
Total Suspended Solids	1	mg/L	4	3	<1	20	<1	2	2	1	<1	<1	3	2	3	2	<1	4	<1	2	17	1	3	<1	3	9
Dissolved Sulphate (SO4)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	0.1	NTU	2.6	2.4	0.9	1.1	0.5	1.3	1.1	0.6	<0.1	<0.1	1.1	<0.1	0.6	0.4	0.3	1.6	<0.1	1.2	2.8	0.5	2.4	<0.1	1.3	**5.9**
Alkalinity (Total as CaCO3)	1	mg/L	24	24	5.1	120	11	30	26	10	24	30	31	34	13	42	26	36	30	13	7.8	16	31	12	12	9.6
Dissolved Chloride (Cl-)	1	mg/L	<1.0	<1.0	1	<1.0	<1.0	<1.0	1.2	1.1	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrate (N)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Metals[5]																										
Total Aluminum (Al)	4.9	ug/L	**250**	82	58	10	62	51	49	79	11	50	29	15	**150**	46	51	59	45	**160**	63	49	51	39	91	70
Total Antimony (Sb)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Barium (Ba)	2	ug/L	5.6	3.7	2.7	9.9	3.2	4.6	4.4	4	4.6	4.3	4.4	3.3	3.8	4.9	4.2	5.4	4.2	3	2.1	4.2	5.4	3.8	3.1	3.2
Total Beryllium (Be)	0.4	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Bismuth (Bi)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Boron (B)	10	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	0.09	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Calcium (Ca)	200	ug/L	9400	8900	2700	37000	5500	11000	9300	6200	8200	12000	10000	11000	7600	14000	9500	11000	11000	7000	5100	7900	10000	5600	6500	4700
Total Chromium (Cr)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cobalt (Co)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Copper (Cu)	0.9	ug/L	<0.90	2.4	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	0.98	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
Total Iron (Fe)	100	ug/L	**570**	250	160	240	260	170	180	**310**	130	110	120	<100	**310**	140	150	120	110	**390**	210	210	130	150	280	210
Total Lead (Pb)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Lithium (Li)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Magnesium (Mg)	50	ug/L	1700	1500	370	6200	850	2200	2000	970	1600	2400	2200	2600	1400	2600	2000	2600	2300	1300	840	1200	2100	870	1000	920
Total Manganese (Mn)	2	ug/L	**92**	31	4.4	**65**	12	10	18	19	5.4	7.8	14	<2.0	4.8	16	6.6	20	5.2	34	17	5.7	22	12	35	14
Total Molybdenum (Mo)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Nickel (Ni)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Potassium (K)	200	ug/L	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	290	<200	<200	<200	<200	390	<200	<200	<200	<200	410	<200	<200	<200
Total Selenium (Se)	2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Silicon (Si)	50	ug/L	970	680	180	1300	490	1000	710	550	260	1100	960	1500	480	1100	860	860	600	930	470	510	1600	610	640	720
Total Silver (Ag)	0.09	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Sodium (Na)	100	ug/L	380	350	240	820	290	450	380	330	330	470	420	520	490	370	420	490	360	460	370	430	530	320	360	430
Total Strontium (Sr)	1	ug/L	11	11	6	34	7.8	12	9.5	10	11	11	13	12	12	13	12	11	11	12	8.2	14	11	10	11	10
Total Tellurium (Te)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Thallium (Tl)	0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Tin (Sn)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Titanium (Ti)	5	ug/L	12	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.1	<5.0	<5.0	<5.0	<5.0	7.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Tungsten (W)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Uranium (U)	0.1	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	0.5	ug/L	0.7	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.51	<0.50	0.54	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Zinc (Zn)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Zirconium (Zr)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Elements																										
Total Methyl Mercury	0.05	ng/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radionuclide																										
Polonium-210	0.01	Bq/L	<0.010	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-	0.026	-	-	-	-	-	-	-	-
Lead-210	1	Bq/L	<1.0	<1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0	-	-	-	-	-	-	-	-
Radium-226	1	Bq/L	<1.0	<1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0	-	-	-	-	-	-	-	-
Thornium-230	5	Bq/L	<5.0	<5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<5.0	-	-	-	-	-	-	-	-
Polyaromatic Hydrocarbons																										
Biphenyl	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Acenaphthene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Acenaphthylene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Anthracene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Benzo(a)anthracene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Benzo(a)pyrene	0.009	ug/L	<0.0090	<0.0090	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0090	-	-	-	-	-	-	-	-
Benzo(b/j)fluoranthene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Chrysene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Fluoranthene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Fluorene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
1-Methylnaphthalene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Naphthalene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-
Phenanthrene	0.03	ug/L	<0.030	<0.030	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.030	-	-	-	-	-	-	-	-
Pyrene	0.05	ug/L	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-

Table F-4: June 2022 Field Investigation Water Quality Results - Marten Falls Community Access Road Project

Sample Location			RA4-WC-41	RA4-WC-55	RA1-4-WC-33	RA1-4-WC-37	RA4-WC-45	RA4-WC-21	RA4-WC-05	RA1-WC-32	RA4-WC-24	RA4-WC-00	RA1-WC-14	RA1-WC-09	RA1-WC-28	RA4-WC-22	RA1-WC-16	RA4-WC-02	RA4-WC-17	RA1-4-WC-36	RA1-4-WC-35	RA1-4-WC-19	RA1-WC-11	RA1-WC-66	RA1-WC-67	RA1-4-WC-21
Sample Date			25-Jun-22	27-Jun-22	24-Jun-22	26-Jun-22	27-Jun-22	27-Jun-22	26-Jun-22	25-Jun-22	27-Jun-22	24-Jun-22	23-Jun-22	23-Jun-22	24-Jun-22	22-Jun-22	22-Jun-22	11-Jun-22	28-Jun-22	28-Jun-22	28-Jun-22	28-Jun-22	29-Jun-22	30-Jun-22	30-Jun-22	01-Jul-22
Mapbook Figure Location			F-5	F-7	F-8	F-8	F-5	F-3	F-3	F-5	F-3	F-1	F-3	F-3	F-5	F-3	F-3	F-2	F-3	F-8	F-8	F-7	E-3	F-6	F-6	F-7
Parameter	MDL [1]	Units																								
Volatile Organics																										
Acetone (2-Propanone)	10	ug/L	<10	<10	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-	-	-	-	-	-
Benzene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Bromodichloromethane	0.5	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Bromoform	1	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Bromomethane	0.5	ug/L	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-	-	-
Carbon Tetrachloride	0.19	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Chlorobenzene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Chloroform	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Dibromochloromethane	0.5	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	0.4	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	0.4	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	0.4	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Dichlorodifluoromethane (FREON 12)	1	ug/L	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-	-	-
1,1-Dichloroethane	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
1,2-Dichloroethane	0.49	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
1,1-Dichloroethylene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethylene	0.5	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
trans-1,2-Dichloroethylene	0.5	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
1,2-Dichloropropane	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	0.3	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
trans-1,3-Dichloropropene	0.4	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Ethylbenzene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.19	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Hexane	1	ug/L	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-	-	-
Methylene Chloride(Dichloromethane)	2	ug/L	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone (2-Butanone)	10	ug/L	<5.0	<5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<5.0	-	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	5	ug/L	<5.0	<5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<5.0	-	-	-	-	-	-	-	-
Methyl t-butyl ether (MTBE)	0.5	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Styrene	0.4	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	0.5	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	0.4	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Toluene	0.2	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	0.33	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	0.4	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Trichloroethylene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Trichlorofluoromethane (FREON 11)	0.5	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
Vinyl Chloride	0.2	ug/L	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-
p+m-Xylene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
o-Xylene	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-
Total Xylenes	0.2	ug/L	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	-	-	-	-	-	-	-

Table F-5: August 2022 Field Investigation Water Quality Results - Marten Falls Community Access Road Project

21455151

Sample Location			RA1-4-WC-21	RA1-4-WC-37	RA1-WC-09	RA1-4-WC-10	RA1-4-WC-19	RA1-WC-30	RA1-WC-32	RA1-WC-28	RA1-WC-01	RA1-4-WC-33	RA1-4-WC-35	RA1-WC-14	RA4-WC-19	RA1-WC-11	RA1-WC-22	RA1-WC-17	RA1-WC-16	RA1-4-WC-36	RA1-WC-41	RA4-WC-00	RA4-WC-22	RA4-WC-21	RA4B-WC-02	RA1-WC-51	RA4-WC-45
Sample Date			16-Aug-22	16-Aug-22	17-Aug-22	18-Aug-22	18-Aug-22	22-Aug-22	21-Aug-22	21-Aug-22	20-Aug-22	19-Aug-22	19-Aug-22	22-Aug-22	22-Aug-22	21-Aug-22	20-Aug-22	20-Aug-22	19-Aug-22	25-Aug-22	23-Aug-22	25-Aug-22	24-Aug-22	24-Aug-22	23-Aug-22	26-Aug-22	26-Aug-22
Mapbook Figure Location			F-7	F-8	F-3	F-7	F-7	F-5	F-5	F-5	F-2	F-8	F-8	F-3	F-3	F-3	F-3	F-3	F-3	F-8	F-5	F-2	F-3	F-3	F-3	F-5	F-5
Parameter	**MDL** [1]	**Units**																									
Calculated Parameters																											
Total Animal/Vegetable Oil and Grease	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	1.1	0.8	<0.50	<0.50	<0.50	<0.50	1.1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.8	<0.50	<0.50	<0.50	0.9	<0.50	<0.50
Bicarb. Alkalinity (calc. as CaCO3)	1	mg/L	9.7	140	39	25	25	13	14	21	39	4.4	13	40	25	41	58	51	33	23	20	50	55	38	15	36	20
Carb. Alkalinity (calc. as CaCO3)	1	mg/L	<1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (CaCO3)	1	mg/L	17	150	46	32	32	22	26	36	46	12	25	50	32	46	69	61	45	28	25	58	59	45	24	37	23
Petroleum Hydrocarbons																											
Total Oil & Grease	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	1.1	0.8	<0.50	<0.50	<0.50	0.9	1.1	<0.50	<0.50	<0.50	<0.50	<0.50	0.8	0.8	<0.50	<0.50	1	0.9	<0.50	<0.50
Total Oil & Grease Mineral/Synthetic	0.5	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.5	<0.50	<0.50	<0.50	0.8	<0.50	<0.50	<0.50
Inorganics																											
Total Ammonia-N	0.05	mg/L	<0.050	0.097	<0.050	<0.050	<0.050	0.16	0.15	0.2	0.19	0.16	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Conductivity	1	umho/cm	29	270	79	52	54	35	38	49	77	19	38	83	52	84	120	100	68	50	45	110	110	83	41	72	44
Fluoride (F-)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen (TKN)	0.1	mg/L	0.38	0.33	0.32	0.38	0.34	0.4	0.41	0.59	0.43	0.39	0.52	0.44	0.42	0.35	0.47	0.37	0.48	0.47	0.41	0.56	0.41	0.5	0.51	0.4	0.5
Dissolved Organic Carbon	0.4	mg/L	19	14	22	26	26	30	30	42	21	21	29	19	21	15	21	21	25	29	21	29	19	25	27	21	25
Total Organic Carbon (TOC)	0.4	mg/L	19	12	21	25	24	26	29	45	20	19	30	19	21	13	20	20	26	27	19	27	19	25	27	19	23
Orthophosphate (P)	0.01	mg/L	<0.010	0.049	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH		pH	6.78	7.88	7.29	7.09	7.21	6.78	6.8	6.88	7.33	**6.35**	6.66	7.29	7.05	7.65	7.45	7.54	7.12	7.1	7.06	7.39	7.52	7.14	6.95	7.53	6.79
Total Phosphorus	0.004	mg/L	0.004	0.078	<0.004	0.007	0.006	0.005	0.005	0.006	0.011	0.017	0.011	0.006	0.008	0.008	0.012	0.01	<0.004	0.022	0.013	0.008	0.01	0.009	0.007	0.012	0.023
Total Suspended Solids	1	mg/L	4	3	<1	<1	2	1	1	<1	2	2	1	1	1	1	1	<1	<1	3	1	<1	2	1	1	3	4
Dissolved Sulphate (SO4)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0 (1)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	0.1	NTU	1.2	2	0.2	0.9	0.8	0.4	0.8	0.7	0.8	1	0.8	0.6	0.7	0.8	0.8	1.2	0.4	3	0.7	0.4	1.5	0.5	0.4	0.9	1.3
Alkalinity (Total as CaCO3)	1	mg/L	9.7	140	39	25	25	13	14	21	39	4.4	13	40	25	41	58	52	33	23	20	50	56	39	15	36	20
Dissolved Chloride (Cl-)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	1.9	1.2	<1.0	1.3	<1.0	1.3	<1.0	1.5	1.4	1.2	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	1
Nitrate (N)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Metals [5]																											
Total Aluminum (Al)	4.9	ug/L	58	12	13	65	60	56	81	**180**	52	72	99	18	42	29	36	51	38	**150**	33	36	39	34	44	40	59
Total Antimony (Sb)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	1	ug/L	<1.0	<1.0	<1.0	1.3	1.5	<1.0	1	1.3	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.7
Total Barium (Ba)	2	ug/L	3.4	8.3	3.3	5.5	5.8	3.8	4.7	4.9	5.1	3.4	4	6.2	5.1	5.6	5.5	6.3	5	3.7	3.1	5.8	4.9	6.5	2.2	3.1	5.9
Total Beryllium (Be)	0.4	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Bismuth (Bi)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Boron (B)	10	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	29	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	0.09	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Calcium (Ca)	200	ug/L	5500	48000	13000	10000	11000	6700	8000	11000	13000	3700	8000	14000	9300	14000	20000	19000	13000	8800	7300	18000	19000	14000	7100	12000	7900
Total Chromium (Cr)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cobalt (Co)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Copper (Cu)	0.9	ug/L	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
Total Iron (Fe)	100	ug/L	190	**510**	<100	**530**	**580**	290	**520**	**580**	290	200	**630**	200	**320**	120	230	290	180	**820**	150	220	**330**	260	170	300	**1200**
Total Lead (Pb)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Lithium (Li)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Magnesium (Mg)	50	ug/L	1100	8200	2900	1700	1700	1100	1200	1800	2700	490	1200	3000	1800	2700	3700	3400	2500	1500	1400	3800	3500	2800	1300	2100	1100
Total Manganese (Mn)	2	ug/L	13	**100**	5	**56**	30	17	36	12	**59**	17	**170**	42	**68**	20	36	15	15	49	6.9	32	25	10	7.8	38	**270**
Total Molybdenum (Mo)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Nickel (Ni)	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0
Total Potassium (K)	200	ug/L	<200	<200	<200	<200	<200	<200	<200	<200	250	<200	<200	<200	<200	370	230	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Total Selenium (Se)	2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Silicon (Si)	50	ug/L	910	3700	1900	1500	1400	900	1100	2300	1300	500	1200	1900	1100	1200	1900	2000	2000	1500	1100	3500	1900	2100	1300	1200	1100
Total Silver (Ag)	0.09	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Total Sodium (Na)	100	ug/L	500	830	560	450	450	420	390	610	580	390	540	570	390	590	620	670	470	440	460	650	470	490	270	360	380
Total Strontium (Sr)	1	ug/L	12	44	16	20	22	11	13	17	16	8.3	12	21	11	14	22	19	17	17	13	19	19	16	7.2	14	13
Total Tellurium (Te)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Thallium (Tl)	0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Tin (Sn)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Titanium (Ti)	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	9.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Tungsten (W)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Uranium (U)	0.1	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.72	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Zinc (Zn)	5	ug/L	<5.0	<5.0	<5.0	<5.0	5.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Zirconium (Zr)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Elements																											
Total Methyl Mercury	0.05	ng/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	0.07	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Radionuclide																											
Polonium-210	0.01	Bq/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.071	-	
Lead-210	1	Bq/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0	-	
Radium-226	1	Bq/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0	-	
Thornium-230	5	Bq/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5.0	-	
Polyaromatic Hydrocarbons																											
Biphenyl	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Acenaphthene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Acenaphthylene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Anthracene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Benzo(a)anthracene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Benzo(a)pyrene	0.009	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0090	-	
Benzo(b/j)fluoranthene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Benzo(g,h,i)perylene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Benzo(k)fluoranthene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Chrysene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Dibenzo(a,h)anthracene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Fluoranthene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Fluorene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Indeno(1,2,3-cd)pyrene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
1-Methylnaphthalene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
2-Methylnaphthalene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Naphthalene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Phenanthrene	0.03	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.030	-	
Pyrene	0.05	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	-	
Volatile Organics																											
Acetone (2-Propanone)	10	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	
Benzene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-	

Table F-5: August 2022 Field Investigation Water Quality Results - Marten Falls Community Access Road Project

Sample Location			RA1-4-WC-21	RA1-4-WC-37	RA1-WC-09	RA1-4-WC-10	RA1-4-WC-19	RA1-WC-30	RA1-WC-32	RA1-WC-28	RA1-WC-01	RA1-4-WC-33	RA1-4-WC-35	RA1-WC-14	RA4-WC-19	RA1-WC-11	RA1-WC-22	RA1-WC-17	RA1-WC-16	RA1-4-WC-36	RA1-WC-41	RA4-WC-00	RA4-WC-22	RA4-WC-21	RA4B-WC-02	RA1-WC-51	RA4-WC-45
Sample Date			16-Aug-22	16-Aug-22	17-Aug-22	18-Aug-22	18-Aug-22	22-Aug-22	21-Aug-22	21-Aug-22	20-Aug-22	19-Aug-22	19-Aug-22	22-Aug-22	22-Aug-22	21-Aug-22	20-Aug-22	20-Aug-22	19-Aug-22	25-Aug-22	23-Aug-22	25-Aug-22	24-Aug-22	24-Aug-22	23-Aug-22	26-Aug-22	26-Aug-22
Mapbook Figure Location			F-7	F-8	F-3	F-7	F-7	F-5	F-5	F-5	F-2	F-8	F-8	F-3	F-3	F-3	F-3	F-3	F-3	F-8	F-5	F-2	F-3	F-3	F-3	F-5	F-5
Parameter	MDL [1]	Units																									
Bromodichloromethane	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Bromoform	1	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Bromomethane	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-
Carbon Tetrachloride	0.19	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Chlorobenzene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Chloroform	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Dibromochloromethane	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
1,2-Dichlorobenzene	0.4	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
1,3-Dichlorobenzene	0.4	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
1,4-Dichlorobenzene	0.4	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Dichlorodifluoromethane (FREON 12)	1	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-
1,1-Dichloroethane	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
1,2-Dichloroethane	0.49	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
1,1-Dichloroethylene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
cis-1,2-Dichloroethylene	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
trans-1,2-Dichloroethylene	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
1,2-Dichloropropane	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
cis-1,3-Dichloropropene	0.3	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
trans-1,3-Dichloropropene	0.4	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Ethylbenzene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Ethylene Dibromide	0.19	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Hexane	1	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-
Methylene Chloride(Dichloromethane)	2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50	-
Methyl Ethyl Ketone (2-Butanone)	10	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5.0	-
Methyl Isobutyl Ketone	5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5.0	-
Methyl t-butyl ether (MTBE)	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Styrene	0.4	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
1,1,1,2-Tetrachloroethane	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
1,1,2,2-Tetrachloroethane	0.4	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Tetrachloroethylene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Toluene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
1,1,1-Trichloroethane	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
1,1,2-Trichloroethane	0.4	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Trichloroethylene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Trichlorofluoromethane (FREON 11)	0.5	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
Vinyl Chloride	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-
p+m-Xylene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
o-Xylene	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-
Total Xylenes	0.2	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10	-

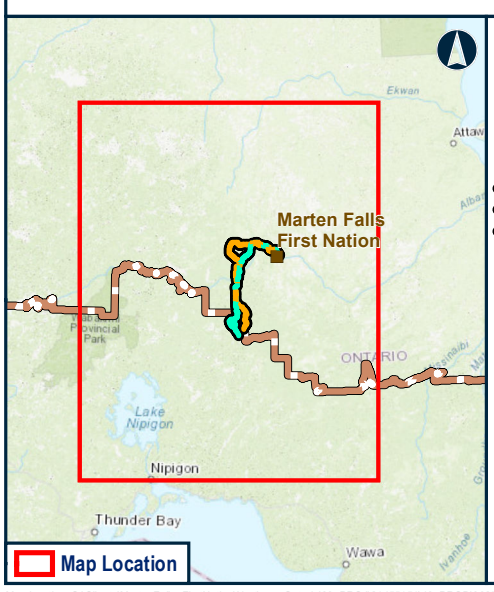
Watershed Size			Small		Medium		Large	
Flows			Moderate	Low	Moderate	Low	Moderate	Low
Parameter	Units	Condition						
Alkalinity	mg/L as CaCO3	Min	5	4	8	10	24	36
	mg/L as CaCO3	Max	120	140	54	58	55	41
	mg/L as CaCO3	Avg.	34	44	26	29	36	39
Aluminum	µg/L	Min	10	12	20	33	25	29
	µg/L	Max	150	180	250	150	120	40
	µg/L	Avg.	61	54	68	60	58	35
Iron	µg/L	Min	110	170	100	150	100	120
	µg/L	Max	360	580	900	1200	310	300
	µg/L	Avg.	218	313	253	426	202	210
Manganese	µg/L	Min	3	5	3	7	9	20
	µg/L	Max	65	100	92	270	35	38
	µg/L	Avg.	12	31	18	55	18	29
Phosphorus	µg/L	Min	0.005	0.006	0.006	0.004	0.010	0.008
	µg/L	Max	0.068	0.078	0.031	0.023	0.016	0.012
	µg/L	Avg.	0.015	0.020	0.012	0.010	0.012	0.010
Cadmium	µg/L	Min	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
	µg/L	Max	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
	µg/L	Avg.	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Chromium	µg/L	Min	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	µg/L	Max	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	µg/L	Avg.	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt	µg/L	Min	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	µg/L	Max	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	µg/L	Avg.	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Copper	µg/L	Min	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
	µg/L	Max	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
	µg/L	Avg.	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
Lead	µg/L	Min	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	µg/L	Max	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	µg/L	Avg.	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nickel	µg/L	Min	<1.0	<1.0	<1.0	1.3	<1.0	<1.0
	µg/L	Max	<1.0	<1.0	<1.0	1.3	<1.0	<1.0
	µg/L	Avg.	<1.0	<1.0	<1.0	1.3	<1.0	<1.0
Zinc	µg/L	Min	5.0	<5.0	5.3	5.4	<5.0	<5.0
	µg/L	Max	5.0	<5.0	5.3	5.4	<5.0	<5.0
	µg/L	Avg.	5.0	<5.0	5.3	5.4	<5.0	<5.0
Calcium	µg/L	Min	2700	3700	4700	5500	8900	12000
	µg/L	Max	43000	48000	17000	20000	21000	14000
	µg/L	Avg.	13056	16400	9809	11281	14878	13000
Magnesium	µg/L	Min	370	490	810	1100	1500	2100
	µg/L	Max	7100	8200	3500	3700	4200	2700
	µg/L	Avg.	2452	3070	1868	2025	2944	2400
Lead-210	Bq/L	Min	- (a)	- (a)	<1.0	- (a)	<1.0	<1.0
	Bq/L	Max	- (a)	- (a)	<1.0	- (a)	<1.0	<1.0
	Bq/L	Avg.	- (a)	- (a)	<1.0	- (a)	<1.0	<1.0
Radium-226	Bq/L	Min	- (a)	- (a)	<1.0	- (a)	<1.0	<1.0
	Bq/L	Max	- (a)	- (a)	<1.0	- (a)	<1.0	<1.0
	Bq/L	Avg.	- (a)	- (a)	<1.0	- (a)	<1.0	<1.0
Polonium-210	Bq/L	Min	- (a)	- (a)	0.026	- (a)	0.011	0.071
	Bq/L	Max	- (a)	- (a)	0.026	- (a)	0.036	0.071
	Bq/L	Avg.	- (a)	- (a)	0.026	- (a)	0.024	0.071
Thornium-230	Bq/L	Min	- (a)	- (a)	<5.0	- (a)	<5.0	<5.0
	Bq/L	Max	- (a)	- (a)	<5.0	- (a)	<5.0	<5.0
	Bq/L	Avg.	- (a)	- (a)	<5.0	- (a)	<5.0	<5.0
Potassium	µg/L	Min	240	<200	210	230	400	370
	µg/L	Max	350	<200	390	250	470	370
	µg/L	Avg.	288	<200	274	240	427	370
Methyl Mercury	ng/L	Min	- (a)	<0.05	- (a)	<0.05	- (a)	<0.05
	ng/L	Max	- (a)	<0.05	- (a)	0.08	- (a)	<0.05
	ng/L	Avg.	- (a)	<0.05	- (a)	0.08	- (a)	<0.05
Dissolved Organic Carbon	mg/L	Min	13	14	16	19	13	15
	mg/L	Max	33	42	37	30	24	21
	mg/L	Avg.	22	25	24	24	18	18

Note(s):

a) Results not available for parameter under specific conditions. Only select crossing locations were assessed for specific parameters (i.e., Lead-210, Radium-226, Polonium-210, Thornium-230 and Methyl Mercury).

Avg. = average value; Bq/L = becquerel per litre; Max = maximum value; mg/L = milligrams per litre; ng/L = nanograms per litre; mg(as CaCO3)/L = milligrams as calcium carbonate per litre; Min = minimum value; and µg/L = micrograms per litre

WINISK RIVER PROVINCIAL PARK
PIPESTONE RIVER PROVINCIAL PARK
OTOSKWIN-ATTAWAPISKAT RIVER PROVINCIAL PARK
04GF-UPPER ALBANY - MUSWABIK WATERSHED
19005300102
04GC-UPPER ALBANY - MISEHKOW WATERSHED
04GD-UPPER ALBANY - MAKOKIBATAN WATERSHED
ALBANY RIVER PROVINCIAL PARK
04GE-LOWER OGOKI WATERSHED
19005300702
19005300802
19005300902
19005300402
WABAKIMI PROVINCIAL PARK
OGOKI RIVER PROVINCIAL PARK (WATERWAY CLASS)
LITTLE CURRENT RIVER PROVINCIAL PARK
19005300202
SEDGMAN LAKE PROVINCIAL PARK (NATURE RESERVE CLASS)
WHITESAND PROVINCIAL PARK (WATERWAY CLASS)
WINDIGO BAY PROVINCIAL PARK (NATURE RESERVE CLASS)
NAKINA MORAINE PROVINCIAL PARK (NATURAL ENVIRONMENT CLASS)
KOPKA RIVER PROVINCIAL PARK (WATERWAY CLASS)
OBONGA-OTTERTOOTH PROVINCIAL PARK (WATERWAY CLASS)
WEST BAY PROVINCIAL PARK (NATURE RESERVE CLASS)
LIVINGSTONE POINT PROVINCIAL PARK (NATURE RESERVE CLASS)
Greenstone
Longlac
Geraldton
MACLEOD PROVINCIAL PARK (RECREATIONAL CLASS)
GULL RIVER PROVINCIAL PARK (WATERWAY CLASS)
KAIASHK PROVINCIAL PARK (NATURE RESERVE CLASS)
NAGAGAMISIS PROVINCIAL PARK (NATURAL ENVIRONMENT CLASS)
NAGAGAMI LAKE PROVINCIAL PARK (NATURE RESERVE CLASS)
LAKE NIPIGON PROVINCIAL PARK (NATURAL ENVIRONMENT CLASS)
BLACK STURGEON RIVER PROVINCIAL PARK (WATERWAY CLASS)
ALBERT LAKE MESA PROVINCIAL PARK (NATURE RESERVE CLASS)
STEEL RIVER PROVINCIAL PARK (WATERWAY CLASS)



Legend

- PROVINCIAL (STREAM) WATER QUALITY MONITORING NETWORK (PWQMN) SITE
- TOWN/COMMUNITY
- ROAD
- WATERBODY
- WATERCOURSE

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4

- FAR NORTH BOUNDARY
- LOWER OGOKI WATERSHED
- UPPER ALBANY - MAKOKIBATAN WATERSHED
- UPPER ALBANY - MUSWABIK WATERSHED
- FIRST NATION COMMUNITY
- PROVINCIAL PARK
- PROPOSED DEVELOPMENT AREA
- SURFACE WATER REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Location of PWQMN Stations

0 5 10 20 30 40
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-1

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HARROGATE LAKE
ESSER LAKE
OGOKI RIVER
MCCAW LAKE
RA4B-WC-02
RA1-WC-02
RA1-WC-01
RA4-WC-05
PAINTER LAKE
DEBAERE LAKE
RA4-WC-02
ORVISS LAKE
COLPITTS LAKE
BURY LAKE
RA4-WC-00
PIGMENT LAKE
CRONY LAKE
RENWICK LAKE
ZURBRIGG LAKE
BURNABY LAKE
SAGA LAKE
KAPIKOTONGWA RIVER
PERCY LAKE
LITTLE CURRENT RIVER
JUNGFRAU LAKE
LITTLE JUNGFRAU LAKE
FARRELL LAKE
MURIEL RIVER
RUNWAY LAKE

Ekwan
Attawapiskat
Winisk Provincial Park
ONTARIO
Lake Nipigon
Nipigon
Thunder Bay
Wawa
Map Location

Legend

FIELD INVESTIGATED WATER QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

50 PERSONS

200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

ALTERNATIVE 1

ALTERNATIVE 4

ALTERNATIVE 1 AND ALTERNATIVE 4

APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE

APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

BEDROCK

SAND AND GRAVEL

ROAD

WATERCOURSE

WATERBODY

FAR NORTH BOUNDARY

PROVINCIAL PARK

AQUATIC LOCAL STUDY AREA

AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Water Quality Crossing Locations

0 2.25 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-2

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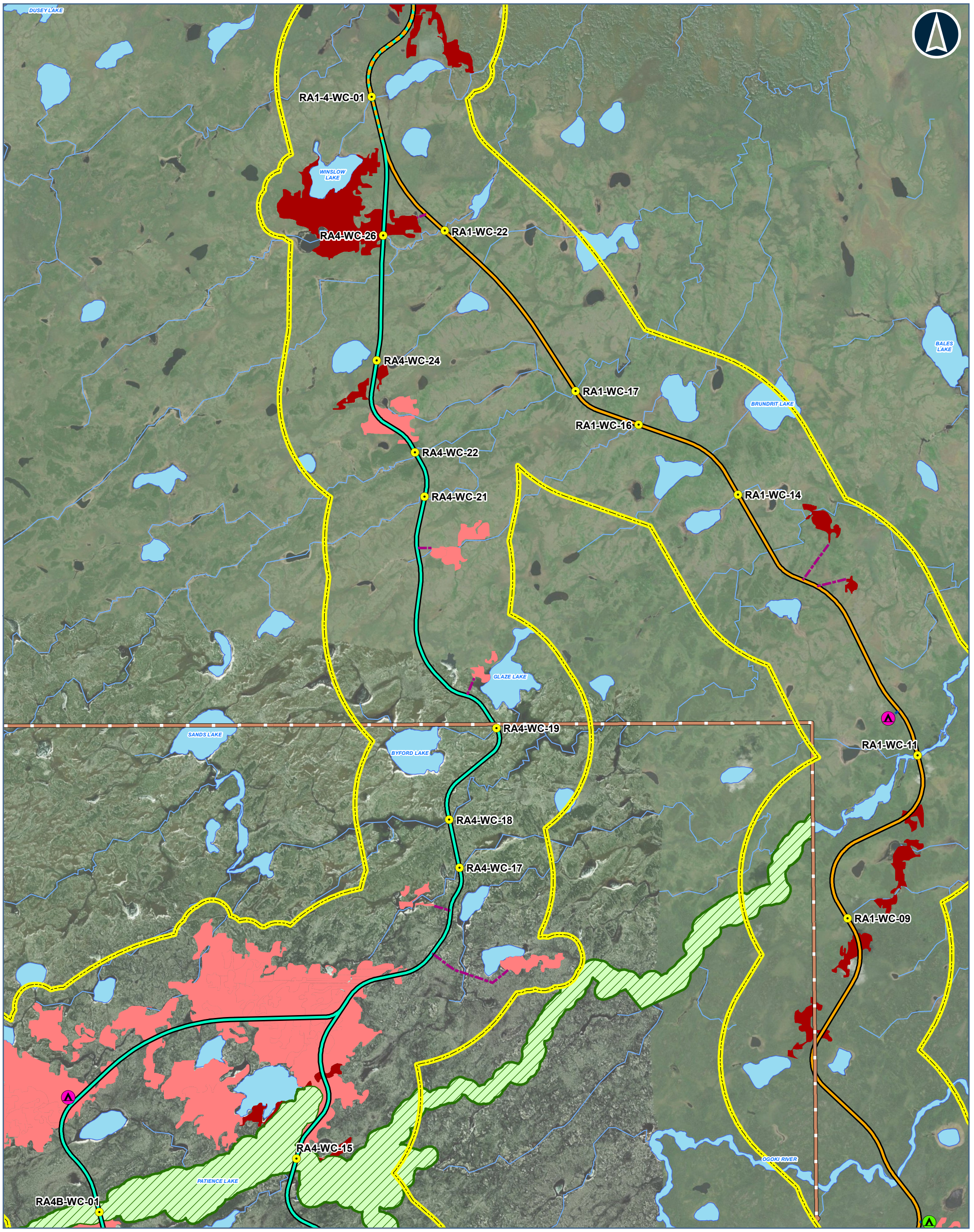

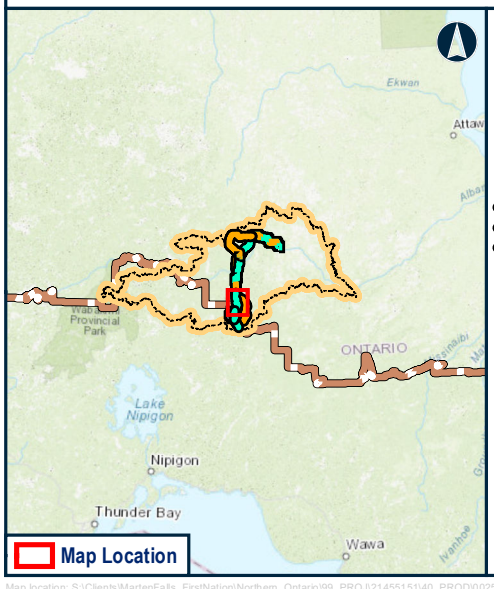

Legend

- FIELD INVESTIGATED WATER QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Water Quality Crossing Locations

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-3

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RA1-WC-27
RA1-WC-26
RA4-WC-31
TEABEAU LAKE
ALBANY RIVER
TOLFREE LAKE
RA1-WC-23
RA4-WC-27
RA1-4-WC-07
SUWALA LAKE
DUSEY RIVER
DUSEY LAKE
TANASE LAKE

Map Location

Legend

- FIELD INVESTIGATED WATER QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Water Quality Crossing Locations

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-4

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RA1-WC-51
WABASSI RIVER
VENTON LAKE
MAXEY LAKE
RA4-WC-45
RA1-WC-41
TREBELL LAKE
RA4-WC-42
RA4-WC-41
RA1-WC-32
RA1-WC-30
SAARIMAKI LAKE
ALBANY RIVER
RA4-WC-37
RA4-WC-34
RA1-WC-28

Map Location

Legend

FIELD INVESTIGATED WATER QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

50 PERSONS

200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

ALTERNATIVE 1

ALTERNATIVE 4

ALTERNATIVE 1 AND ALTERNATIVE 4

APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE

APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

BEDROCK

SAND AND GRAVEL

WATERCOURSE

WATERBODY

FAR NORTH BOUNDARY

PROVINCIAL PARK

AQUATIC LOCAL STUDY AREA

AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Water Quality Crossing Locations

0 2.25 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-5

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Date Saved: 2/11/2026 12:09:02 PM User Name: INRR172702

GARVEY LAKE

SLADE LAKE

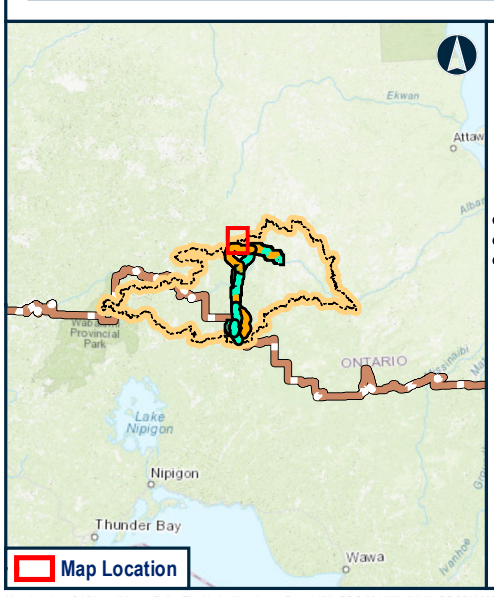
MABIE LAKE

OXTOBY LAKE

RA1-WC-57

RA1-WC-66

RA1-WC-67



Legend

- FIELD INVESTIGATED WATER QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Water Quality Crossing Locations

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-6

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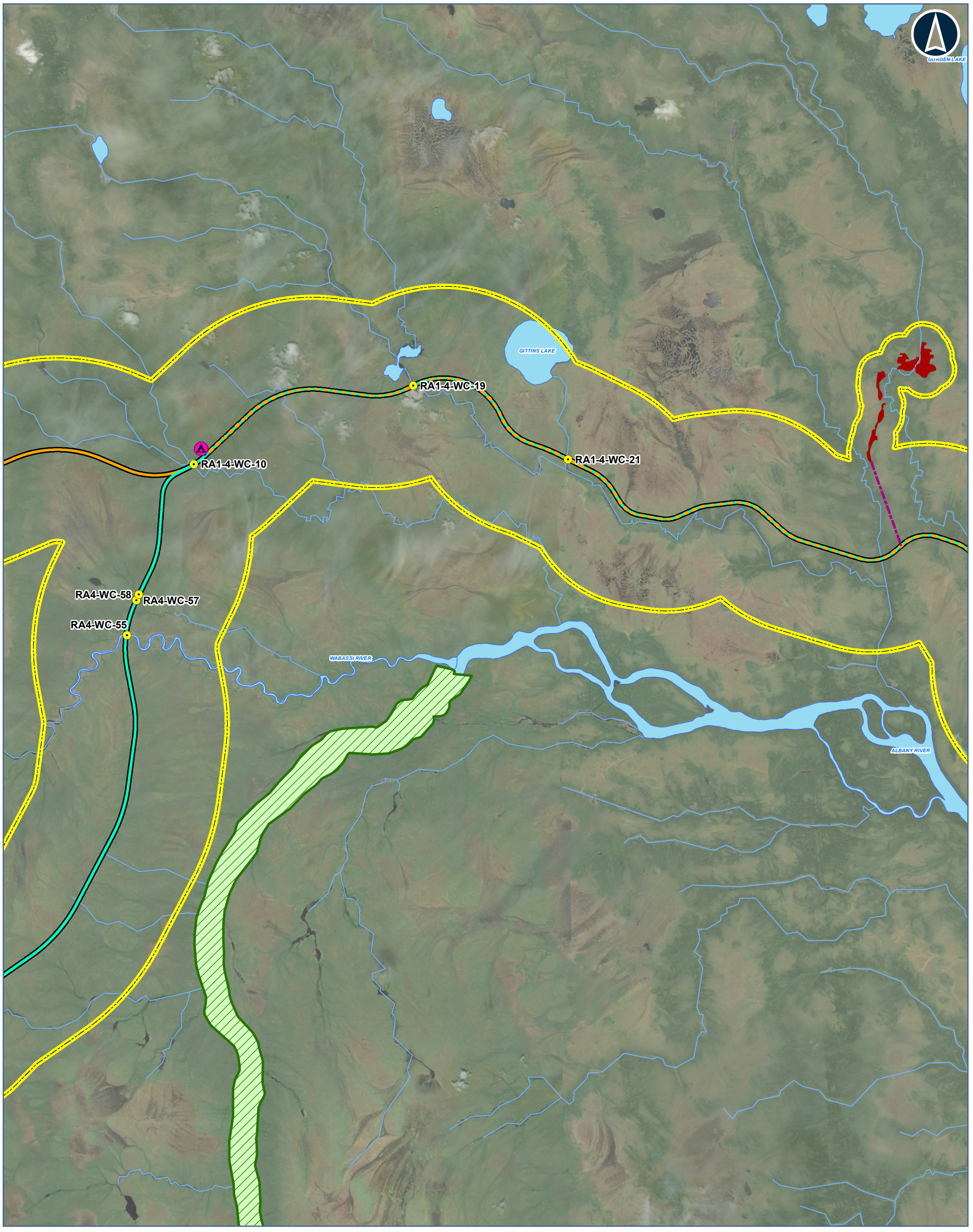

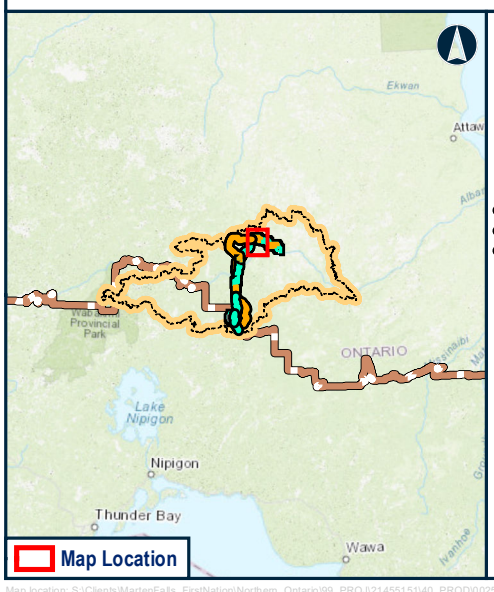

Legend

- FIELD INVESTIGATED WATER QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Water Quality Crossing Locations

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-7

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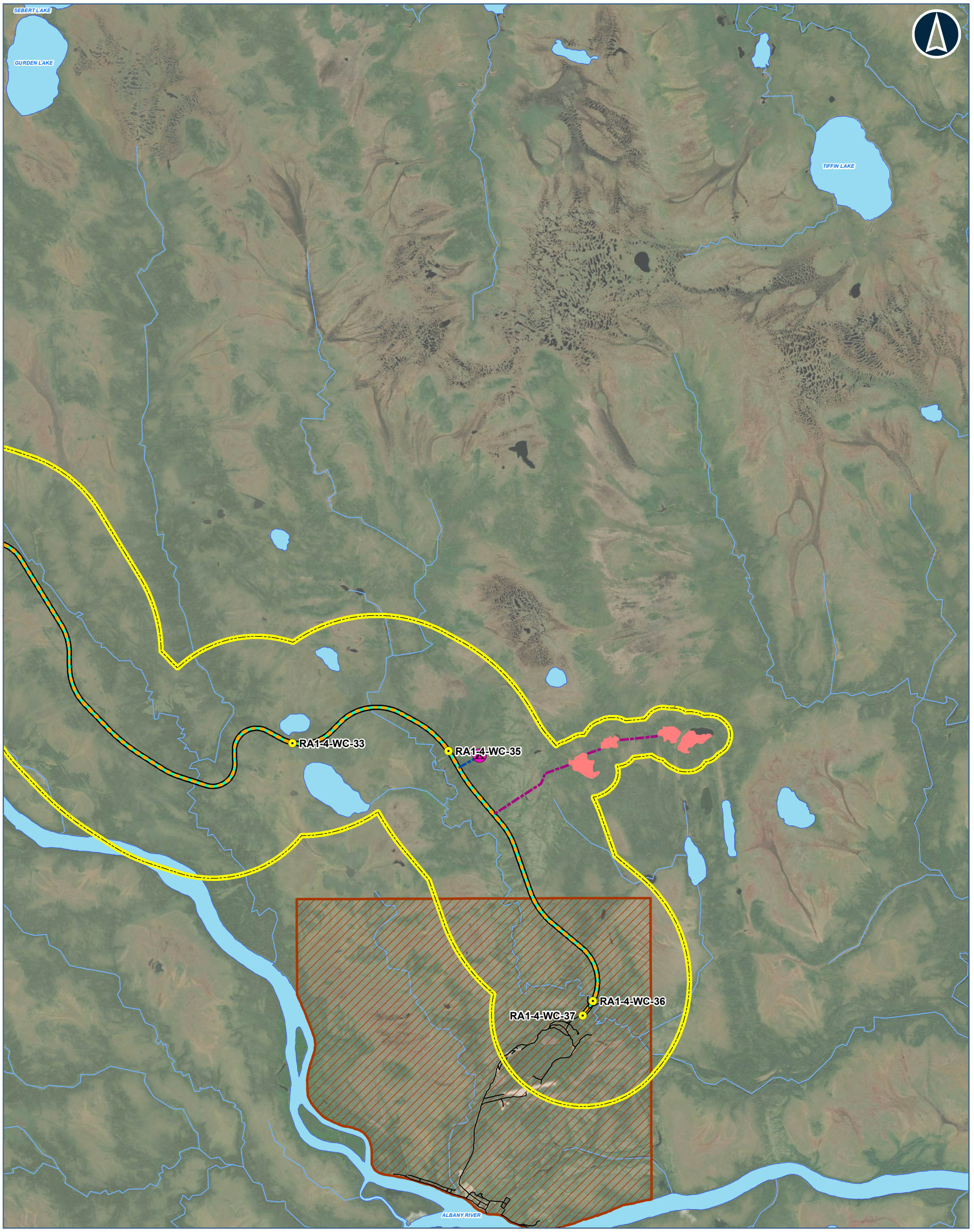

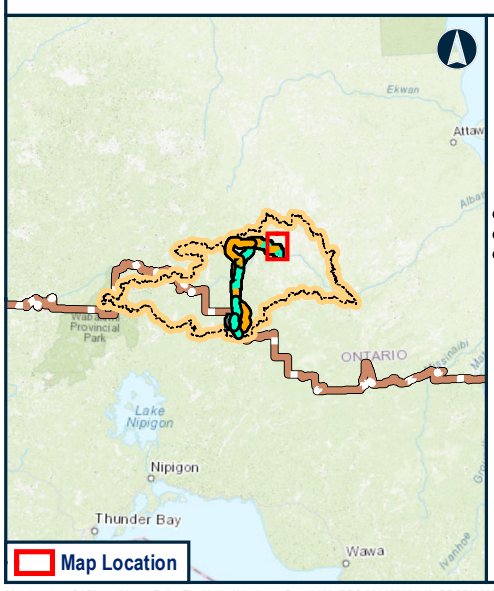

Legend

- FIELD INVESTIGATED WATER QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (SIZE)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Water Quality Crossing Locations

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure F-8

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Attachment G – Sediment Quality Data

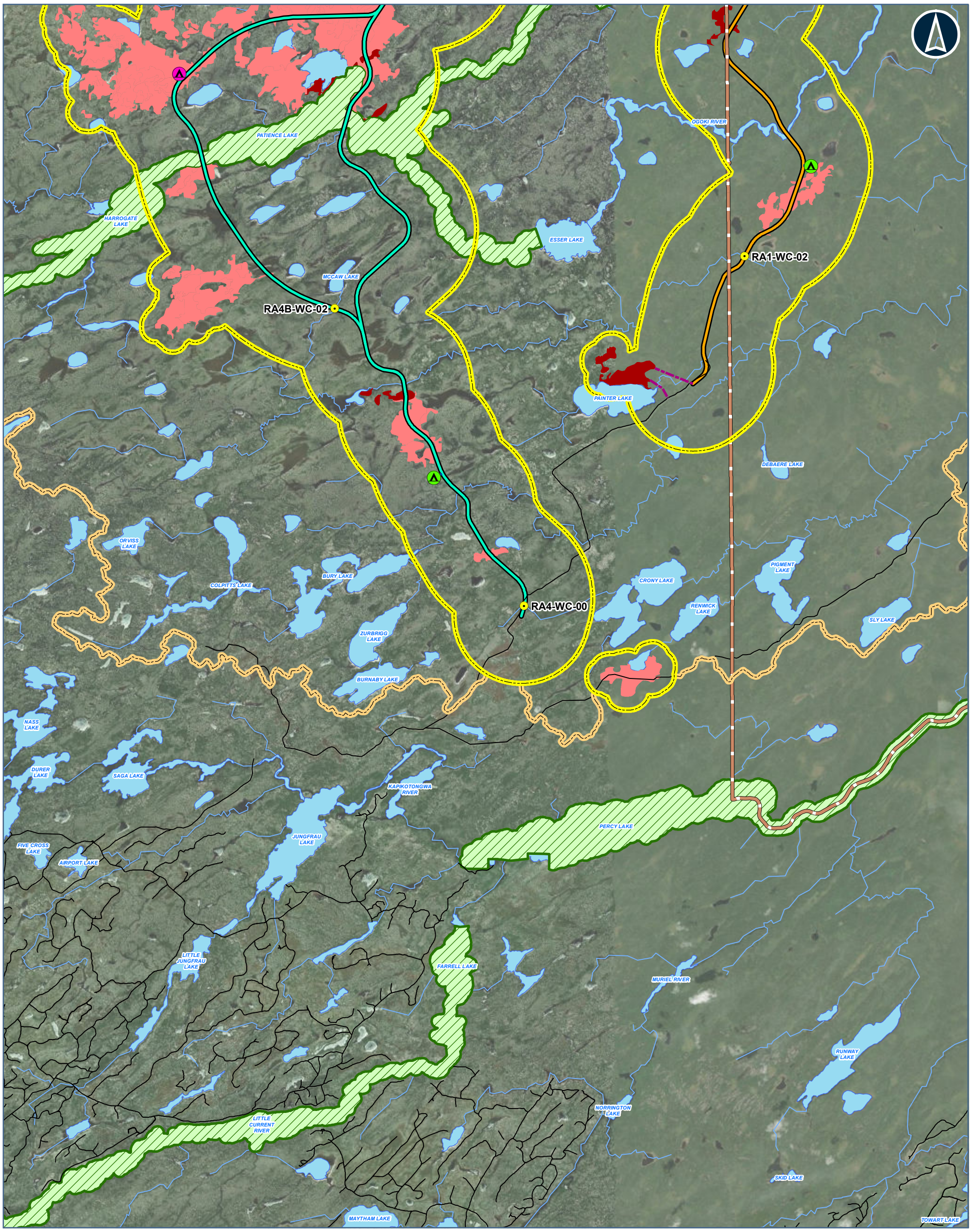
Sample Location			RA1-4-WC-37	RA1-4-WC-35	RA4-WC-58	RA4-WC-45	RA1-WC-57	RA4-WC-42	RA1-WC-66	RA1-WC-26	RA4-WC-31	RA1-WC-14	Sediment Quality Guidelines			
Sample Date			14-Oct-20	14-Oct-20	18-Oct-20	18-Oct-20	20-Oct-20	19-Oct-20	20-Oct-20	20-Oct-20	18-Oct-20	19-Oct-20	CCME		PSQG	
Mapbook Figure Location			G-7	G-7	G-6	G-4	G-5	G-4	G-5	G-3	G-3	G-2				
Parameter	MDL [1]	Units											ISQG	PEL	LEL	SEL
Inorganics																
Moisture	1	%	79	68	85	50	62	76	70	82	23	44	-	-	-	-
Total Organic Carbon	500	mg/kg	94000	84000	170000	51000	58000	87000	72000	310000	4300	37000	-	-	-	-
Calculated Total Kjeldahl Nitrogen	100	ug/g	**9430**	**6540**	**11000**	3960	**5170**	**6940**	**6960**	**16200**	479	1880	-	-	550	4800
Metals																
Acid Extractable Antimony (Sb)	0.2	ug/g	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	-
Acid Extractable Arsenic (As)	1	ug/g	3.8	4.3	4.3	2.7	3.3	3.9	5.2	4.5	<1.0	1.3	5.9	17	6	33
Acid Extractable Barium (Ba)	0.5	ug/g	48	91	100	97	55	71	83	68	7.7	42	-	-	-	-
Acid Extractable Beryllium (Be)	0.2	ug/g	<0.20	0.3	0.23	0.34	0.21	0.23	0.21	0.27	<0.20	0.29	-	-	-	-
Acid Extractable Boron (B)	5	ug/g	5.5	5.3	5	<5.0	<5.0	<5.0	<5.0	6.7	<5.0	6.7	-	-	-	-
Acid Extractable Cadmium (Cd)	0.1	ug/g	0.13	0.31	1.1	0.43	0.26	0.4	0.38	0.7	<0.10	0.12	0.6	3.5	0.6	10
Acid Extractable Chromium (Cr)	1	ug/g	11	28	24	32	19	22	19	21	12	21	37.3	90	26	110
Acid Extractable Cobalt (Co)	0.1	ug/g	3.8	8.2	8.4	6.6	5.8	7.3	6.5	8	2.4	5.2	-	-	-	-
Acid Extractable Copper (Cu)	0.5	ug/g	4.5	5.2	5.7	5.7	4.5	5.2	3.9	8.5	0.99	7	35.7	197	16	110
Acid Extractable Lead (Pb)	1	ug/g	3.5	9.3	11	8.8	5.2	11	6.6	10	3.3	5.1	35	91.3	31	250
Acid Extractable Molybdenum (Mo)	0.5	ug/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	-	-	-
Acid Extractable Nickel (Ni)	0.5	ug/g	6.7	13	11	20	10	11	9	11	6.4	12	-	-	16	75
Acid Extractable Selenium (Se)	0.5	ug/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.84	<0.50	<0.50	-	-	-	-
Acid Extractable Silver (Ag)	0.2	ug/g	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	-
Acid Extractable Thallium (Tl)	0.05	ug/g	<0.050	0.17	0.21	0.2	0.1	0.15	0.16	0.13	<0.050	0.077	-	-	-	-
Mapbook Figure Location	0.05	ug/g	0.31	2.2	0.86	0.88	0.55	0.56	0.76	0.75	0.24	0.46	-	-	-	-
Acid Extractable Vanadium (V)	5	ug/g	12	27	22	33	19	23	21	17	15	20	-	-	-	-
Acid Extractable Zinc (Zn)	5	ug/g	47	77	100	67	63	73	75	67	18	29	123	315	120	820
Physical Testing																
Silt or Clay (<0.075mm)		%	82	88	93	97	77	75	76	98	8	48	-	-	-	-
Sand (>0.075mm)		%	18	12	7	3	23	25	24	2	92	52	-	-	-	-
Texture		N/A	FINE	FINE	FINE	FINE	FINE	FINE	FINE	FINE	COARSE	COARSE	-	-	-	-

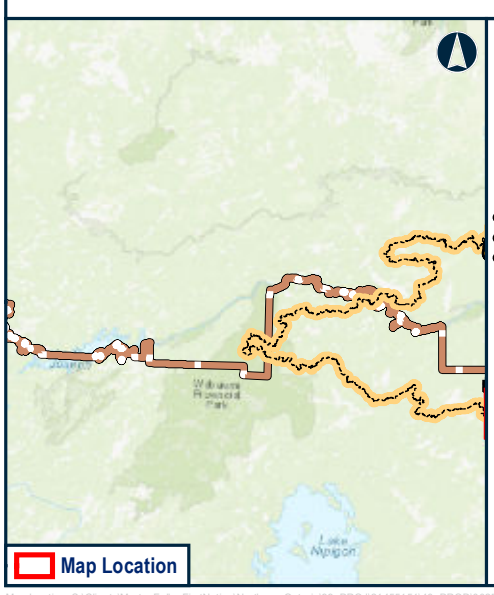
Table G-2: 2021 Field Investigation Sediment Quality Results - Marten Falls Community Acess Road Project

21455151

Sample Location			RA1-4-WC-01	RA1-4-WC-07	RA4-WC-37	RA4-WC-26	RA1-WC-02	RA1-WC-23	RA4-WC-34	RA4-WC-57	RA1-WC-67	RA4-WC-21	RA1-WC-02	RA4-WC-55	RA1-WC-09	Sediment Quality Guidelines			
Sample Date			11-Sep-21	11-Sep-21	12-Sep-21	13-Sep-21	14-Sep-21	15-Sep-21	15-Sep-21	16-Sep-21	18-Sep-21	18-Sep-21	17-Sep-21	16-Sep-21	17-Sep-21	CCME		PSQG	
Mapbook Figure Location			G-2	G-3	G-4	G-2	G-1	G-3	G-4	G-6	G-5	G-2	G-1	G-6	G-2				
Parameter	MDL [1]	Units														ISQG	PEL	LEL	SEL
Inorganics																			
Moisture	1	%	66	86	88	26	77	84	13	73	32	83	64	28	89	-	-	-	-
Nitrogen (N)	0.01	%	0.44	1.4	1.5	0.034	0.83	1.7	0.014	0.89	0.11	1.6	0.44	0.028	2	-	-	-	-
Total Organic Carbon	500	mg/kg	75000	230000	220000	28000	120000	290000	3400	85000	14000	230000	22000	3900	420000	-	-	-	-
Calculated Total Kjeldahl Nitrogen	100	ug/g	4420	**14200**	**15500**	344	**8310**	**17000**	139	**8910**	1110	**15500**	4350	281	**19900**	-	-	550	4800
Nitrite (N)	0.5	ug/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
Nitrate (N)	2	ug/g	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Nitrate + Nitrite (N)	3	ug/g	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	-	-	-	-
Metals																			
Acid Extractable Aluminum (Al)	50	ug/L	4400	15000	19000	10000	11000	9100	3700	8700	5500	16000	5400	3900	3100	-	-	-	-
Acid Extractable Antimony (Sb)	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	-
Acid Extractable Arsenic (As)	1	ug/L	1.1	4	5.8	1.5	2	3	<1.0	2.6	2.8	1.9	<1.0	<1.0	2.6	5.9	17	6	33
Acid Extractable Barium (Ba)	0.5	ug/L	20	110	120	23	66	91	13	50	35	80	21	11	51	-	-	-	-
Acid Extractable Beryllium (Be)	0.2	ug/L	<0.20	0.35	0.42	0.24	0.36	0.37	<0.20	<0.20	<0.20	0.35	<0.20	<0.20	<0.20	-	-	-	-
Acid Extractable Bismuth (Bi)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Acid Extractable Boron (B)	5	ug/L	<5.0	6.8	9.7	<5.0	5.1	12	<5.0	<5.0	<5.0	5.6	<5.0	<5.0	7	-	-	-	-
Acid Extractable Cadmium (Cd)	0.1	ug/L	0.16	0.8	0.56	<0.10	0.3	0.29	<0.10	0.34	0.13	0.38	<0.10	<0.10	0.35	0.6	3.5	0.6	10
Acid Extractable Calcium (Ca)	50	ug/L	5000	13000	11000	4900	8800	28000	48000	5800	3900	14000	3300	7800	34000	-	-	-	-
Acid Extractable Chromium (Cr)	1	ug/L	13	33	41	36	27	21	16	21	15	34	19	13	7.3	37.3	90	26	110
Acid Extractable Cobalt (Co)	0.1	ug/L	2.6	8	8.3	7.4	6.3	4.9	3.4	5.3	6.1	4.9	3.9	3.2	2.9	-	-	-	-
Acid Extractable Copper (Cu)	0.5	ug/L	2.4	9.1	8.8	4.7	9.5	17	4.4	4.2	3	9.4	2.7	3	8.1	35.7	197	16	110
Acid Extractable Iron (Fe)	50	ug/L	8100	18000	23000	20000	14000	17000	11000	13000	13000	14000	8600	8100	13000	-	-	-	-
Acid Extractable Lead (Pb)	1	ug/L	5.9	13	13	3.9	8.4	6.1	2.7	7.5	3.2	8.3	3.1	2	5.1	35	91.3	31	250
Acid Extractable Magnesium (Mg)	50	ug/L	2500	5100	4800	6300	4200	5000	12000	3200	3100	4200	2700	4400	3100	-	-	-	-
Acid Extractable Manganese (Mn)	1	ug/L	130	640	**1100**	290	410	250	170	430	780	320	150	89	610	-	-	460	1100
Acid Extractable Molybdenum (Mo)	0.5	ug/L	<0.50	<0.50	0.51	<0.50	<0.50	0.96	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	-	-	-
Acid Extractable Nickel (Ni)	0.5	ug/L	7.3	17	17	20	15	14	7.9	10	8.1	16	8.6	7.5	6.1	-	-	16	75
Acid Extractable Phosphorus (P)	50	mg/L	460	810	900	630	520	590	650	530	430	830	270	340	710	-	-	600	2000
Acid Extractable Potassium (K)	200	ug/L	330	1300	1800	490	1000	830	390	900	400	1200	360	270	460	-	-	-	-
Acid Extractable Selenium (Se)	0.5	ug/L	<0.50	0.57	0.64	<0.50	<0.50	0.86	<0.50	<0.50	<0.50	0.61	<0.50	<0.50	1	-	-	-	-
Acid Extractable Silver (Ag)	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	-
Acid Extractable Sodium (Na)	50	ug/L	<50	100	130	<50	77	86	58	77	56	85	<50	51	54	-	-	-	-
Acid Extractable Strontium (Sr)	1	ug/L	10	33	30	11	16	31	31	18	10	30	6.9	9.1	51	-	-	-	-
Acid Extractable Thallium (Tl)	0.05	ug/L	<0.050	0.16	0.24	<0.050	0.13	0.093	<0.050	0.11	0.066	0.16	0.052	<0.050	0.06	-	-	-	-
Acid Extractable Tin (Sn)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Acid Extractable Uranium (U)	0.05	ug/L	0.32	0.7	1	0.54	1.5	2.2	0.58	0.77	0.45	0.84	0.99	0.46	0.74	-	-	-	-
Acid Extractable Vanadium (V)	5	ug/L	13	27	35	29	24	22	21	20	19	23	15	16	6.6	-	-	-	-
Acid Extractable Zinc (Zn)	5	ug/L	33	140	77	58	66	52	16	64	50	56	32	22	47	123	315	120	820
Acid Extractable Mercury (Hg)	0.05	ug/L	<0.050	0.18	0.15	<0.050	0.08	0.08	<0.050	0.062	<0.050	0.093	<0.050	<0.050	0.11	0.17	0.486	0.2	2
Physical Testing																			
Clay		%	3	12	12	3	10	6	8	5	3	8	3	3	-	-	-	-	-
Sand		%	92	60	42	96	47	56	76	59	77	41	82	92	-	-	-	-	-
Silt		%	5	28	45	<2	43	37	16	36	19	51	15	6	-	-	-	-	-
Texture		N/A	SAND	SANDY LOAM	LOAM	SAND	LOAM	SANDY LOAM	SANDY LOAM	SANDY LOAM	LOAMY SAND	SILT LOAM	LOAMY SAND	SAND	-	-	-	-	-

Sample Location			RA1-WC-14	RA1-WC-22	RA4-WC-21	RA4B-WC-02	RA4-WC-00	RA1-WC-28	RA1-WC-41	RA1-WC-30	RA1-WC-51	RA1-WC-32	RA1-4-WC-36	Sediment Quality Guidelines			
Sample Date			22-Aug-22	21-Aug-22	24-Aug-22	23-Aug-22	25-Aug-22	21-Aug-22	23-Aug-22	22-Aug-22	26-Aug-22	21-Aug-22	25-Aug-22	CCME		PSQG	
Mapbook Figure Location			G-2	G-2	G-2	G-1	G-1	G-4	G-4	G-4	G-4	G-4	G-7				
Parameter	MDL [1]	Units												ISQG	PEL	LEL	SEL
Inorganics																	
Moisture	1	%	45	79	64	86	84	48	67	55	56	74	20	-	-	-	-
Nitrogen (N)	0.01	%	0.23	1.1	1.1	1.6	1	0.41	0.84	0.27	0.33	0.65	0.039	-	-	-	-
Total Organic Carbon	500	mg/kg	21000	130000	150000	200000	150000	91000	85000	23000	31000	60000	7000	-	-	-	-
Calculated Total Kjeldahl Nitrogen	100	ug/g	2250	**11400**	**11200**	**15600**	**10100**	4100	**8370**	2720	3310	**6540**	386	-	-	550	4800
Nitrite (N)	0.5	ug/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
Nitrate (N)	2	ug/g	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	-
Nitrate + Nitrite (N)	3	ug/g	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	-	-	-	-
Metals																	
Acid Extractable Aluminum (Al)	50	ug/L	7100	16000	22000	3000	7500	22000	10000	3800	5900	7500	4800	-	-	-	-
Acid Extractable Antimony (Sb)	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	-
Acid Extractable Arsenic (As)	1	ug/L	<1.0	2.9	1.3	1.3	1.7	3.9	2.1	<1.0	1.3	1.7	<1.0	5.9	17	6	33
Acid Extractable Barium (Ba)	0.5	ug/L	40	90	93	29	66	140	49	15	28	46	18	-	-	-	-
Acid Extractable Beryllium (Be)	0.2	ug/L	0.27	0.55	0.65	<0.20	<0.20	0.83	0.33	<0.20	<0.20	0.2	<0.20	-	-	-	-
Acid Extractable Bismuth (Bi)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Acid Extractable Boron (B)	5	ug/L	5.8	9	7.6	<5.0	<5.0	16	6.3	<5.0	<5.0	<5.0	<5.0	-	-	-	-
Acid Extractable Cadmium (Cd)	0.1	ug/L	<0.10	0.29	0.44	0.4	0.34	0.24	0.21	0.11	0.15	0.24	<0.10	0.6	3.5	0.6	10
Acid Extractable Calcium (Ca)	50	ug/L	13000	10000	12000	9100	8800	16000	5700	2900	4300	5200	5700	-	-	-	-
Acid Extractable Chromium (Cr)	1	ug/L	19	40	48	8	20	58	26	12	17	18	15	37.3	90	26	110
Acid Extractable Cobalt (Co)	0.1	ug/L	4.4	10	7.4	1.5	6.6	14	6.1	2.6	4.1	4.5	4.2	-	-	-	-
Acid Extractable Copper (Cu)	0.5	ug/L	6.3	13	15	3.5	4.4	19	7.9	1.4	4	4.1	2.2	35.7	197	16	110
Acid Extractable Iron (Fe)	50	ug/L	12000	26000	19000	4400	13000	34000	14000	7200	11000	10000	10000	-	-	-	-
Acid Extractable Lead (Pb)	1	ug/L	4.4	8.8	8.6	9.7	5.2	13	4.8	3.9	4.4	7.1	2.6	35	91.3	31	250
Acid Extractable Magnesium (Mg)	50	ug/L	7900	7000	6200	1400	2900	11000	4700	2200	2900	2900	3300	-	-	-	-
Acid Extractable Manganese (Mn)	1	ug/L	140	790	180	66	**1300**	390	150	220	150	500	250	-	-	460	1100
Acid Extractable Molybdenum (Mo)	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	-	-	-
Acid Extractable Nickel (Ni)	0.5	ug/L	12	23	25	4.2	9.5	35	15	6.5	9.3	9.4	8.6	-	-	16	75
Acid Extractable Phosphorus (P)	50	mg/L	380	660	830	380	600	490	380	390	470	540	270	-	-	600	2000
Acid Extractable Potassium (K)	200	ug/L	1000	2000	1700	250	670	3500	1200	240	500	670	330	-	-	-	-
Acid Extractable Selenium (Se)	0.5	ug/L	<0.50	<0.50	0.76	0.57	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	-	-	-
Acid Extractable Silver (Ag)	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	-
Acid Extractable Sodium (Na)	50	ug/L	120	130	93	<50	51	200	78	<50	<50	<50	<50	-	-	-	-
Acid Extractable Strontium (Sr)	1	ug/L	18	21	33	23	16	41	18	8.7	11	15	9.7	-	-	-	-
Acid Extractable Thallium (Tl)	0.05	ug/L	0.06	0.16	0.16	<0.050	0.086	0.19	0.097	<0.050	0.065	0.095	<0.050	-	-	-	-
Acid Extractable Tin (Sn)	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Acid Extractable Uranium (U)	0.05	ug/L	0.41	0.8	1.3	0.38	0.88	1.2	0.54	0.27	0.57	0.63	0.36	-	-	-	-
Acid Extractable Vanadium (V)	5	ug/L	20	34	36	7.8	15	54	25	12	18	17	17	-	-	-	-
Acid Extractable Zinc (Zn)	5	ug/L	31	92	75	44	86	120	60	25	51	47	30	123	315	120	820
Acid Extractable Mercury (Hg)	0.05	ug/L	<0.050	0.078	0.07	0.052	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.17	0.486	0.2	2
Physical Testing																	
Clay		%	16	15	15	8	6	59	8	2	7	7	4	-	-	-	-
Sand		%	76	52	29	79	55	22	67	95	61	75	93	-	-	-	-
Silt		%	8	33	57	13	39	20	25	2	33	18	2	-	-	-	-
Texture		N/A	SANDY LOAM	LOAM	SILT LOAM	LOAMY SAND	SANDY LOAM	CLAY	SANDY LOAM	SAND	SANDY LOAM	SANDY LOAM	SAND	-	-	-	-





Legend

- FIELD INVESTIGATED SEDIMENT QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

Data Source:
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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Sediment Quality Crossing Locations

0 — 3.25 — 6.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:136,220 * when printed 11"x17"
Rev:0	

Figure G-1

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Map location: S:\Clients\MartenFalls_FirstNation\Northern_Ontario\99_PROJ\21455151\40_PROD\0025_SW_ExistingConditonsReport\21455151-0025-CS-0006.mxd
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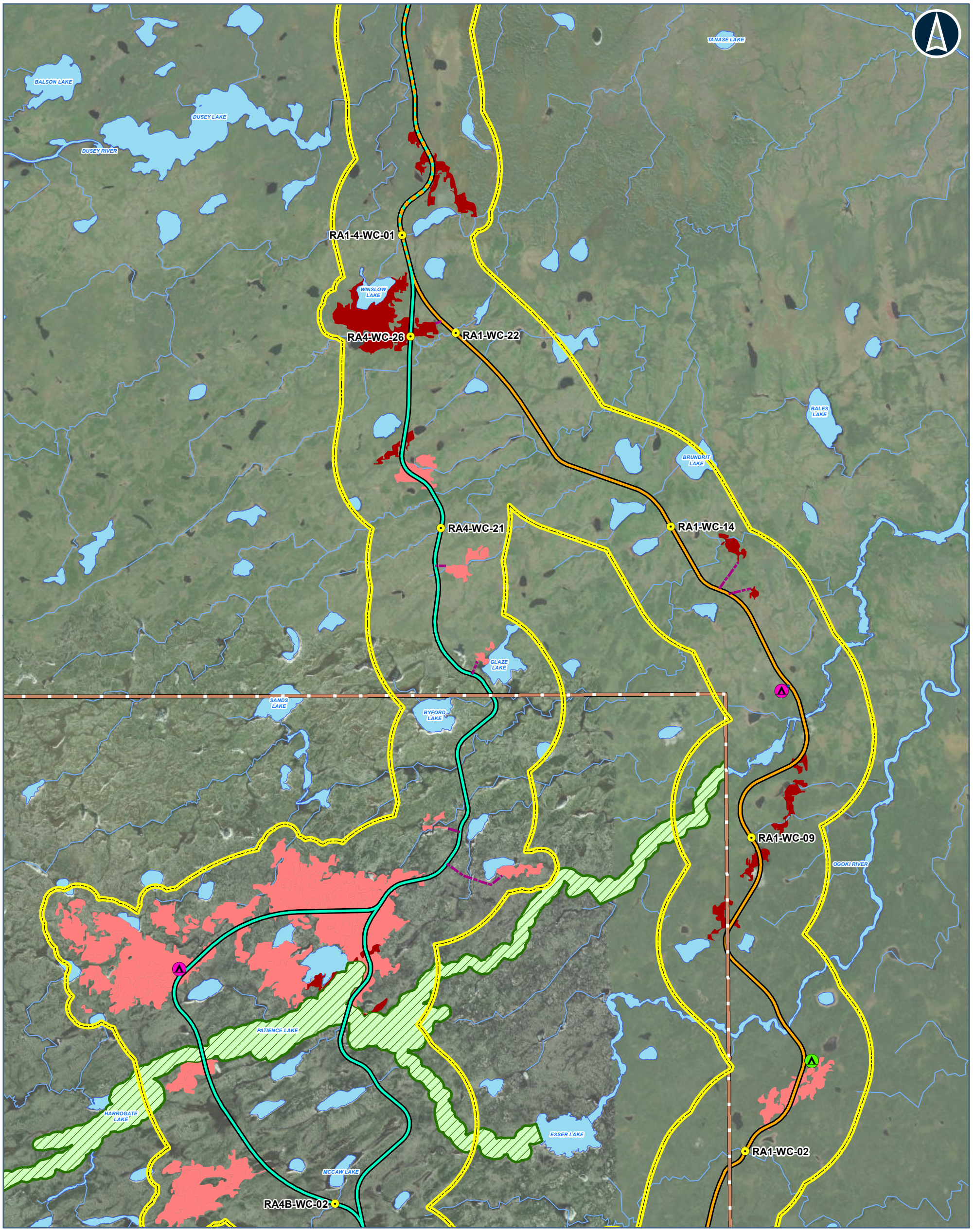

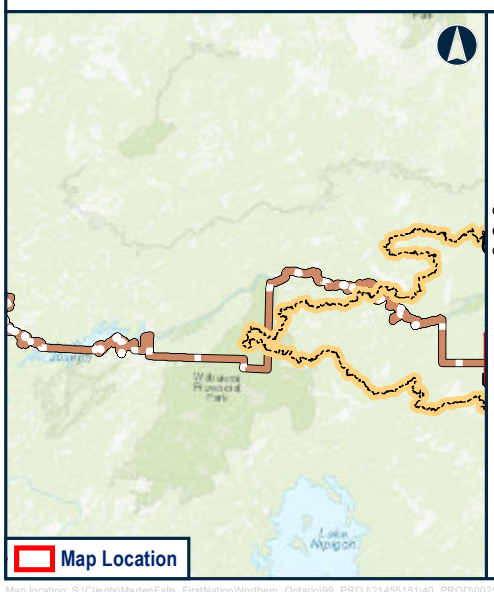

Legend

- FIELD INVESTIGATED SEDIMENT QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

Data Source:

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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Sediment Quality Crossing Locations

0 — 3.25 — 6.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:136,220 * when printed 11"x17"
Rev:0	

Figure G-2

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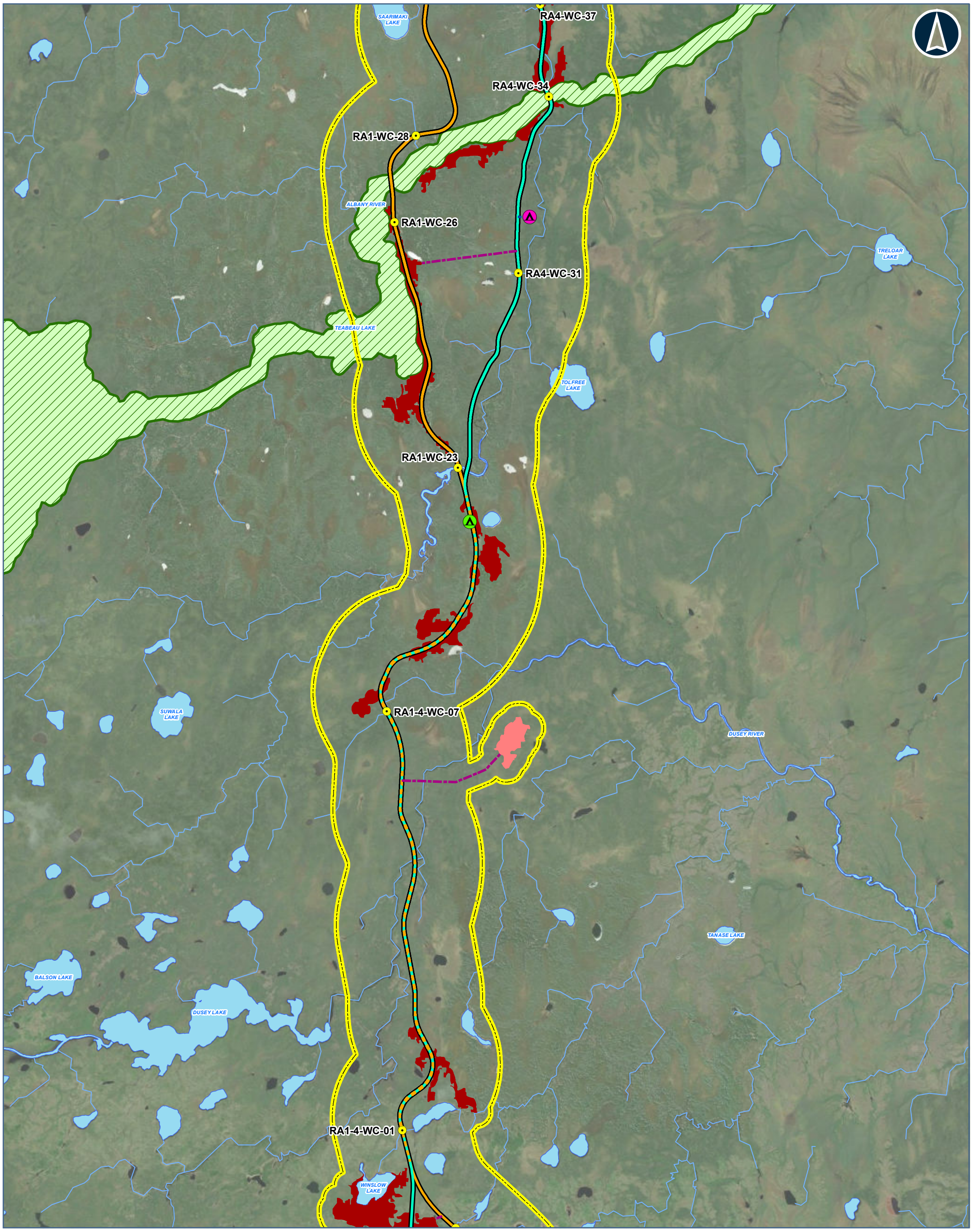
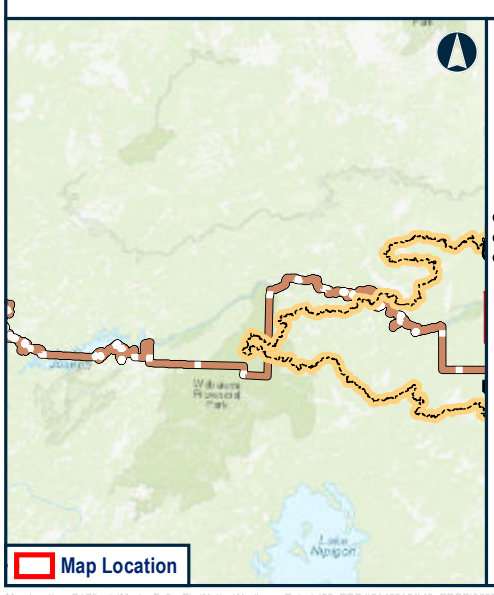
Date Saved: 2/13/2026 5:02:00 PM User Name: gld_rduval





Legend

- FIELD INVESTIGATED SEDIMENT QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Sediment Quality Crossing Locations

0 — 3.25 — 6.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure G-3

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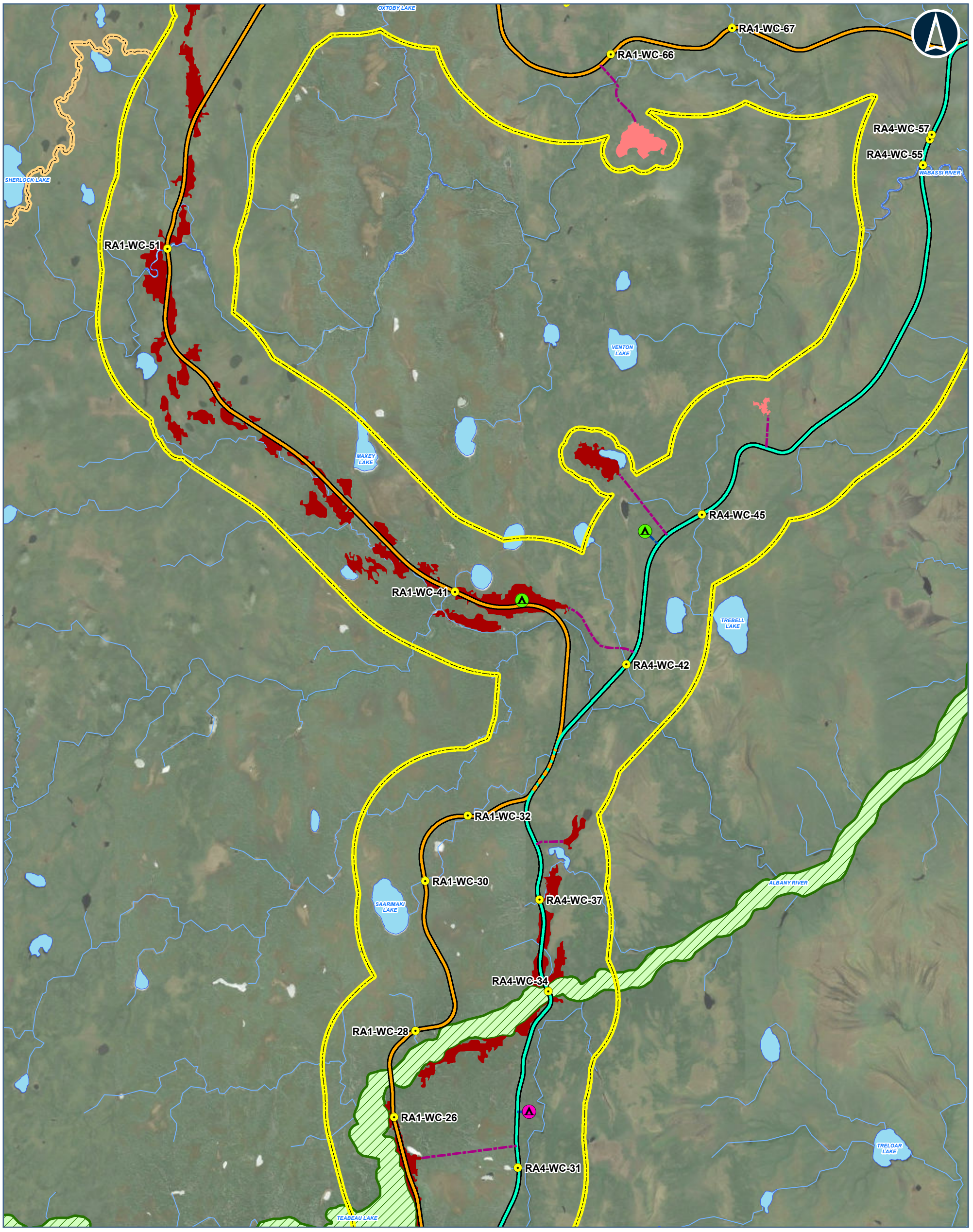

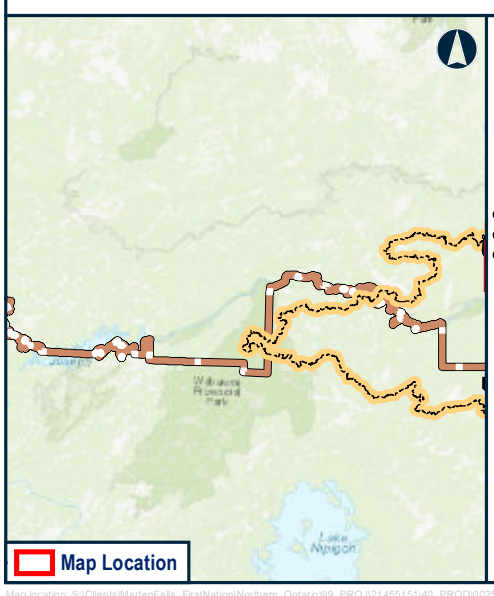

Legend

- FIELD INVESTIGATED SEDIMENT QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Sediment Quality Crossing Locations

0 — 3.25 — 6.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Rev:0	

Figure G-4

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Date Saved: 2/11/2026 12:27:49 PM User Name: gld_rduval

ATTAWAPISKAT RIVER
SEABROOK LAKE
GARVEY LAKE
SLADE LAKE
DAINTY LAKE
TILLETT LAKE
MABIE LAKE
RA1-WC-57
OXTOBY LAKE
RA1-WC-67
RA1-WC-66
RA4-WC-57
RA4-WC-55
WABASSI RIVER
SHERLOCK LAKE
RA1-WC-51
VENTON LAKE

Map Location

Legend

- FIELD INVESTIGATED SEDIMENT QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Sediment Quality Crossing Locations

0 3.25 6.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure G-5

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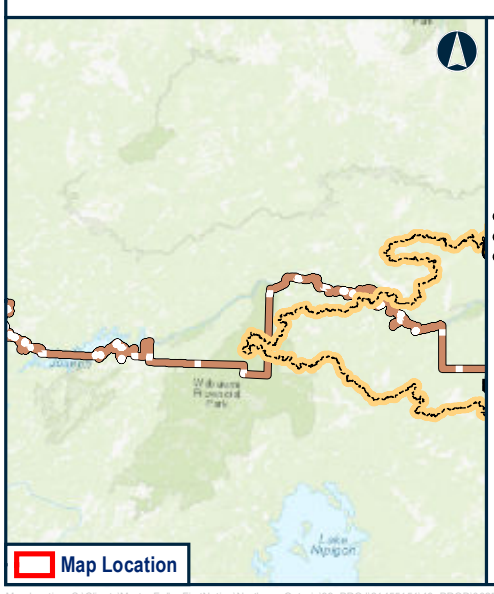
Date Saved: 2/11/2026 12:27:49 PM User Name: gld_rduval

DAINTY LAKE
PALLISTER LAKE
ACTON LAKE
SEBERT LAKE
GURDEN LAKE
GITTINS LAKE
RA1-WC-67
RA4-WC-58
RA4-WC-57
RA4-WC-55
WABASSI RIVER
ALBANY RIVER
TREBELL LAKE



Legend

- FIELD INVESTIGATED SEDIMENT QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Sediment Quality Crossing Locations

0 — 3.25 — 6.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure G-6

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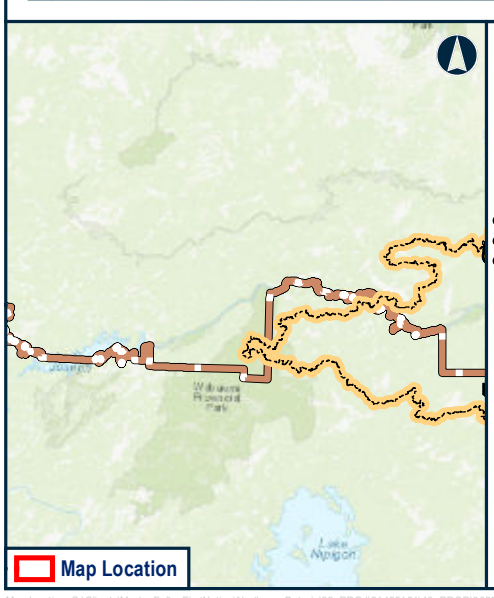
ACTON LAKE
SEBERT LAKE
GURDEN LAKE
TIFFIN LAKE
RA1-4-WC-35
RA1-4-WC-36
RA1-4-WC-37
ALBANY RIVER
DARK RIVER
OGOKI RIVER



Legend

- FIELD INVESTIGATED SEDIMENT QUALITY CROSSING LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL

- ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

Data Source:
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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Field Investigated Sediment Quality Crossing Locations

0 — 3.25 — 6.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

Feb, 2026	1:136,220 * when printed 11"x17"
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Figure G-7

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Attachment H – Field Data Sheets

2019
Water Crossing Surveys

RA1-4-WC-07

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-07

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

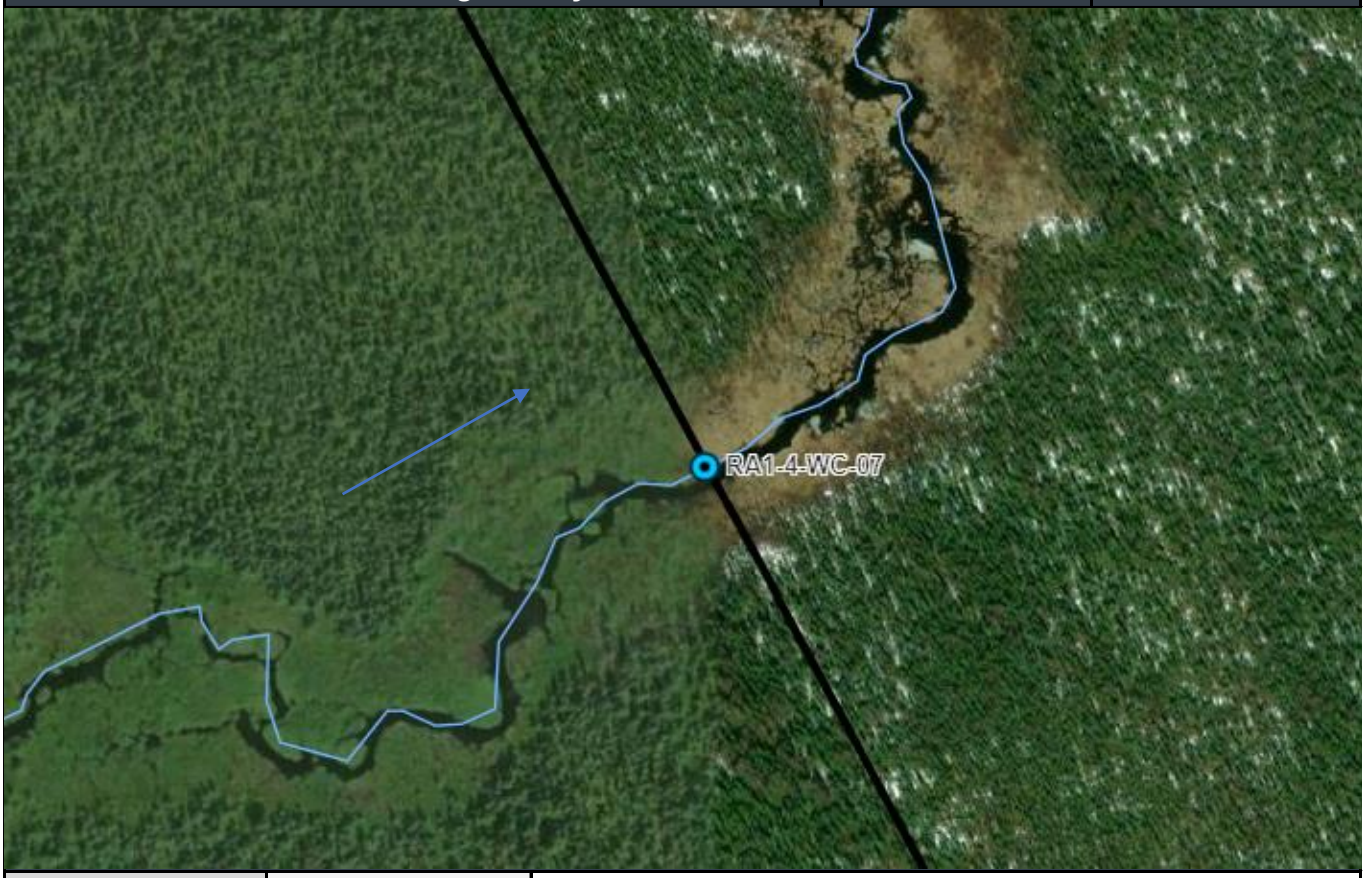
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 25 m upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-06				
Location Description:	Small unnamed watercourse flowing through a sedge dominated wetland.				
Coordinates of Crossing:	Zone 16	Easting:	519091	Northing:	5682476
Coordinates of Cross Section:	Zone 16	Easting:	519088	Northing:	5682480
Personnel Present:	KE, MR				
Weather Conditions:	Overcast, 11°C				
Project:	21455151		Date Surveyed:		2019-09-06

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-07



Current Metering Section:	Surface Geology:	Organics and Silt	
	General Description:	Sedge dominated wetland with deeply incised banks, flat topography, and a large floodplain. Braided and irregularly meandering.	
	Hydraulic Control:	None observed/	
	Sinuosity:	Moderate sinuosity	
	Bed Slope:	Relatively flat	
	Relative Entrenchment:	Un-Confined	
	Fluvial Geomorphology:	In Regime Stability Index: 0.11	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.5	
	Wetted Width (m):	6.0	
	Bankfull Depth (m):	0.5	
	Bankfull Width (m):	60.0	
	Floodplain Observations:	Flat topography likely causing floodplain to extend past bankfull width	
Substrate:	Left Downstream Bank:	Organics	
	Bed:	Organics and Silt	
	Right Downstream Bank:	Organics	
Water Chemistry:	Time measured:	11:17	Additional Comments:
	Temperature	11.18 °C	
	Conductivity:	49.5 mS/cm	
	pH:	6.58	
	Turbidity:	0.39 NTU	
	DO:	3.78 mg/L	
		35.8 %	

Project:	21455151	Date Surveyed:	2019-09-06

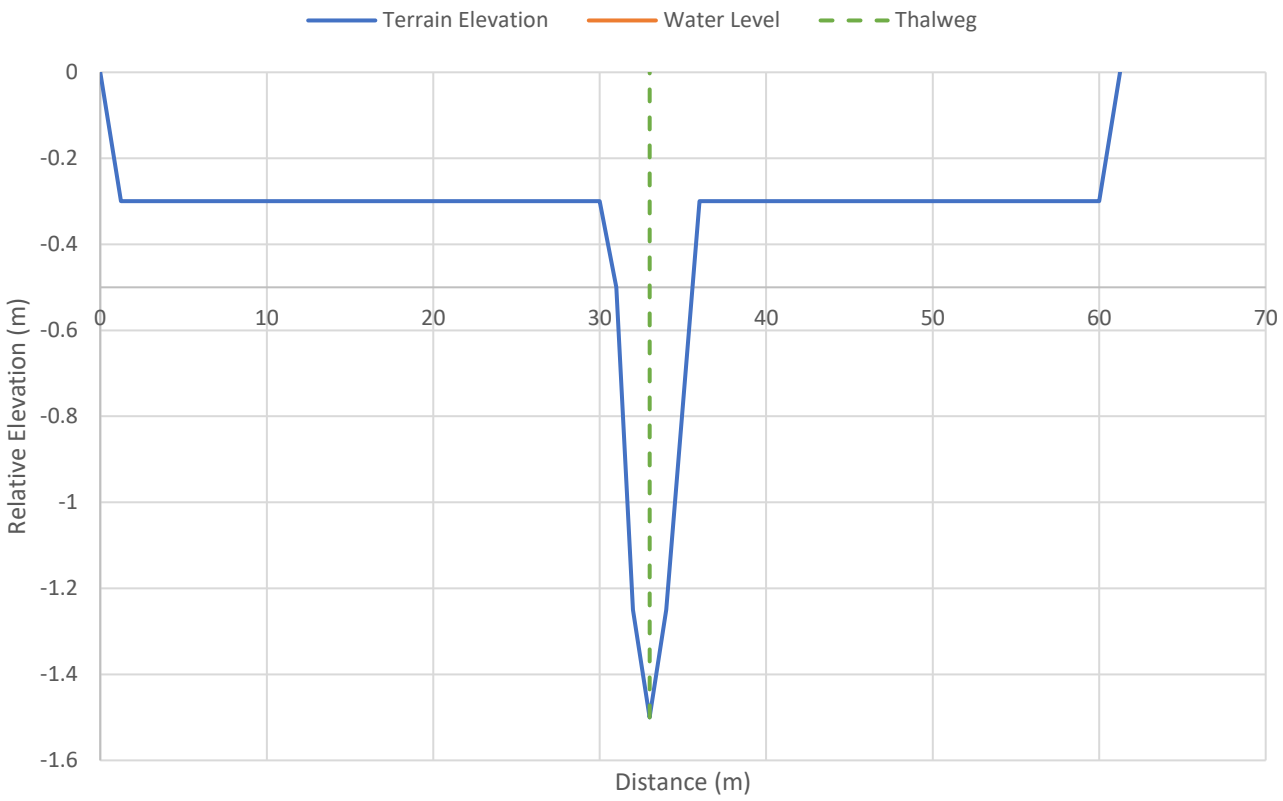
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-07

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0	0	LDB
1.25	0.3	-0.3	LDB EOW
15	0.3	-0.3	
30	0.3	-0.3	
31	0.5	-0.5	
32	1.25	-1.25	
33	1.5	-1.5	
34	1.25	-1.25	
36	0.3	-0.3	
46	0.3	-0.3	
60	0.3	-0.3	RDB EOW
61.25	0	0	RDB

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-4-WC-07 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade

Flow Rate (m^3/s):	-
Notes:	Water depth over 1.2 m at the edge of water, flow transect not completed due to safety precautions

Project:	21455151	Date Surveyed:	2019-09-06

2019
Water Crossing Surveys

RA1-4-WC-21

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-21

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 50m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-08				
Location Description:	Small unnamed watercourse that intersects wetland terrain.				
Coordinates of Crossing:	Zone 16	Easting:	551024	Northing:	5740733
Coordinates of Cross Section:	Zone 16	Easting:	551034	Northing:	5740732
Personnel Present:	KE, MR				
Weather Conditions:	Sunny, 12°C				
Project:	21455151		Date Surveyed:		2019-09-08

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-21

Current Metering Section:	Surface Geology:	Sedge dominated wetland.		
	General Description:	Inundated and incised banks, mostly sedges and muskeg.		
	Hydraulic Control:	None observed.		
	Sinuosity:	High sinuosity		
	Bed Slope:	Relatively flat.		
	Relative Entrenchment:	Slightly entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0.075		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5		
	Wetted Width (m):	8		
	Bankfull Depth (m):	>1.5		
	Bankfull Width (m):	150		
	Floodplain Observations:	Flat topography, floodplain probably extends beyond bankfull width of 150m		
Substrate:	Left Downstream Bank:	Organics		
	Bed:	Organics and silt		
	Right Downstream Bank:	Organics		
Water Chemistry:	Time measured:	12:30		Additional Comments:
	Temperature	10.8	°C	
	Conductivity:	35	mS/cm	
	pH:	6.6		
	Turbidity:	0.149	NTU	
	DO:	9.07	mg/L	
		84.7	%	

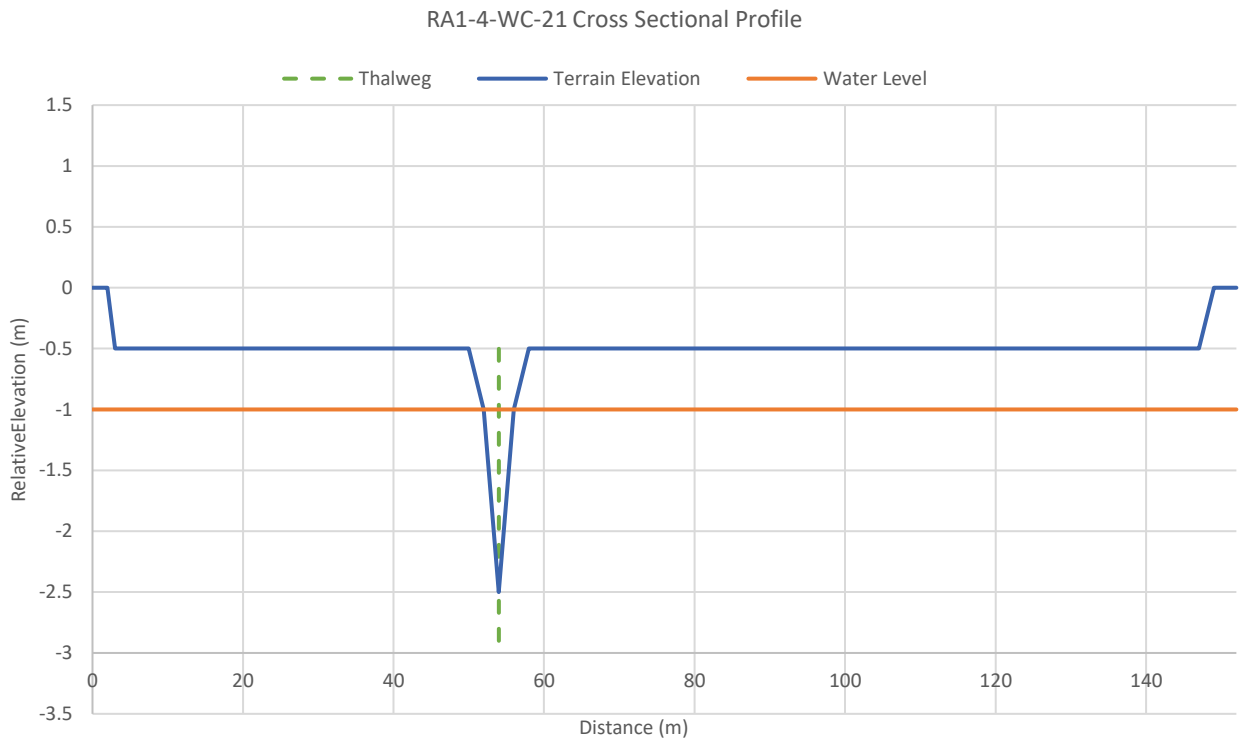
Project:	21455151	Date Surveyed:	2019-09-08

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-21

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0		0	
1		0	
2		0	
3		-0.5	
25		-0.5	
50		-0.5	LDB
52		-1	LDB EOW
54		-2.5	
56		-1	RDB EOW
58		-0.5	RDB
75		-0.5	
125		-0.5	
147		-0.5	
149		0	
152		0	
Based on field estimates, channel not surveyed due to water depth. Water level represents level of saturation across width of floodplain.			
Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank			

Water Crossing RA1-4-WC-21 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Channel too deep to safely wade, flow measurements not taken and cross-sectional survey based on observations from the ground and from the helicopter.

Project:	21455151	Date Surveyed:	2019-09-08

2019
Water Crossing Surveys
RA1-WC-05

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-05

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-09				
Location Description:	Ogoki River				
Coordinates of Crossing:	Zone 16	Easting:	534175	Northing:	5637960
Coordinates of Cross Section:	Zone 16	Easting:	534175	Northing:	5637960
Personnel Present:	KE, MR				
Weather Conditions:	Overcast, 14°C				
Project:	21455151		Date Surveyed:		2019-09-09

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-05

Current Metering Section:	Surface Geology:	Predominantly boulders and cobble.		
	General Description:	Moderate current, 1.2 to >1.5m deep. Boulder/cobble substrate.		
	Hydraulic Control:	Riffles		
	Sinuosity:	Low sinuosity		
	Fluvial	1.91		
	Relative Entrenchment:	Slightly entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0.04		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5		
	Wetted Width (m):	39.5		
	Floodplain	2.0		
	Bankfull Width (m):	Primary bench 50m | Secondary bench 70m		
	Floodplain Observations:	Grasses and shrubs with mature mixed forest.		
Substrate:	Left Downstream Bank:	Cobbles, boulders, come coarse and medium gravel		
	Bed:	Cobbles, boulders, coarse gravel		
	Right Downstream Bank:	Cobbles, boulders, some corase and medium gravel		
Water Chemistry:	Time measured:	14:49		Additional Comments:
	Temperature	16.26	°C	
	Conductivity:	97.05	mS/cm	
	pH:	8.47		
	Turbidity:	0.131	NTU	
	DO:	11	mg/L	
		116.81	%	

Project:	21455151	Date Surveyed:	2019-09-09

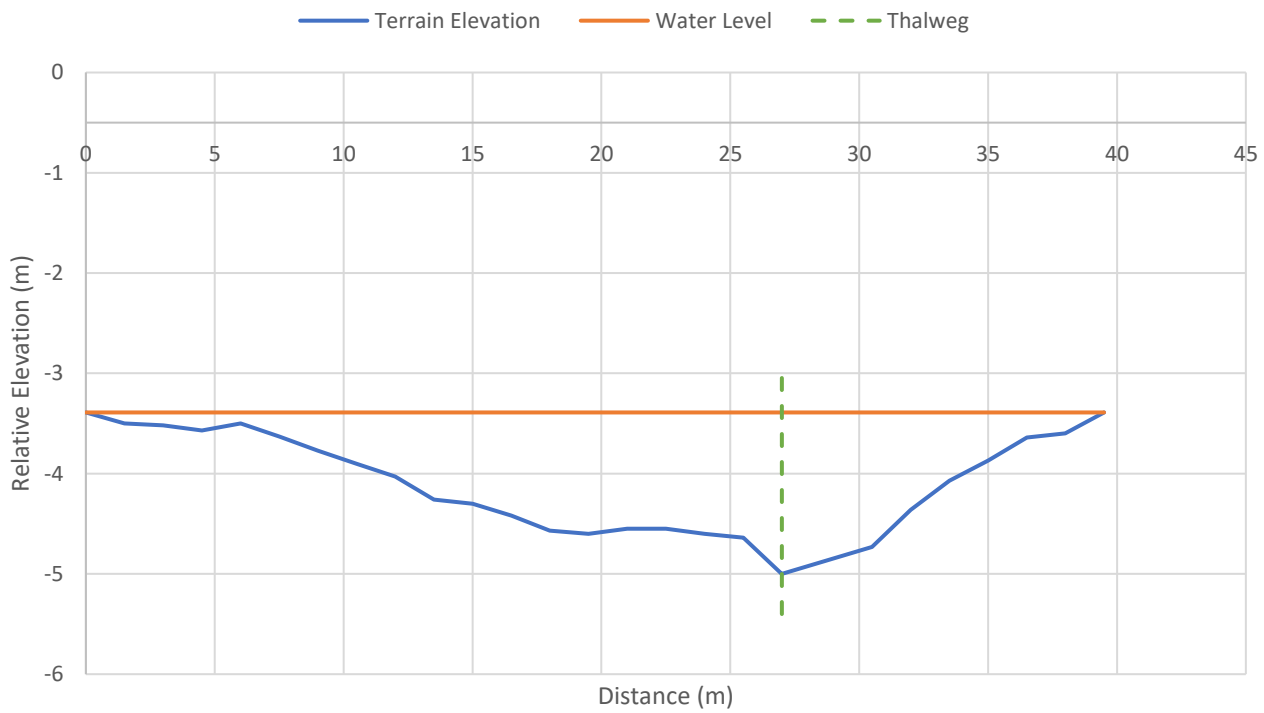
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-05

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	3.39	-3.39	LDB EOW
1.5	3.5	-3.5	
3	3.52	-3.52	
4.5	3.57	-3.57	
6	3.5	-3.5	
7.5	3.63	-3.63	
9	3.77	-3.77	
10.5	3.9	-3.9	
12	4.03	-4.03	
13.5	4.26	-4.26	
15	4.3	-4.3	
16.5	4.42	-4.42	
18	4.57	-4.57	
19.5	4.6	-4.6	CL
21	4.55	-4.55	
22.5	4.55	-4.55	
24	4.6	-4.6	
25.5	4.64	-4.64	
27	5	-5	
30.5	4.73	-4.73	
32	4.36	-4.36	
33.5	4.07	-4.07	
35	3.87	-3.87	
36.5	3.64	-3.64	
38	3.6	-3.6	
39.5	3.39	-3.39	RDB EOW

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-05 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2019-09-09

Marten Falls CAR Water Crossing Survey			Crossing Location:		RA1-WC-05
Manual Flow Measurements					
Distance (m)	Depth (m)	Velocity (m/s)			Comments
		60% Depth	80% / 20% Depth		
2.00	0.14	0.081			LDB
3.00	0.24	0.0133			
4.00	0.42	0.108			
5.00	0.44	0.215			
6.00	0.51	0.183			
7.00	0.54	0.172			
8.00	0.60	0.081			
9.00	0.60	0.241			
10.00	0.42	0.273			
11.00	0.74		0.331	0.132	
12.00	0.72		0.319	0.266	
13.00	0.71		0.225	0.18	
14.00	0.66		0.389	0.289	
15.00	0.78		0.305	0.254	
16.00	0.82		0.373	0.243	
17.00	0.75		0.351	0.214	
18.00	0.95		0.331	0.239	
19.00	1.00		0.361	0.178	
20.00	1.00		0.407	0.291	
21.00	0.63	0.361			Boulder
22.00	1.00		0.452		
23.00	0.99		0.521		
24.00	0.82		0.526		Boulder
25.00	0.99		0.482		
26.00	1.00		0.5		
27.00	0.98		0.526		
28.00	0.54	0.456			Boulder
29.00	0.40		0.503		
30.00	0.58	0.433			Boulder
31.00	0.84		0.467		
32.00	0.81		0.515		
33.00	0.52	0.261			
34.00	0.28	0.27			
35.00	0.37	0.16			
36.00	0.19	0.09			
36.50	0.16	0.00			RDB

Flow Rate (m^3/s):	**7.867**
Notes:	Transect recorded ~75m downstream of crossing RoW.

Project:	21455151	Date Surveyed:	2019-09-09

2019
Water Crossing Surveys
RA1-WC-09

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

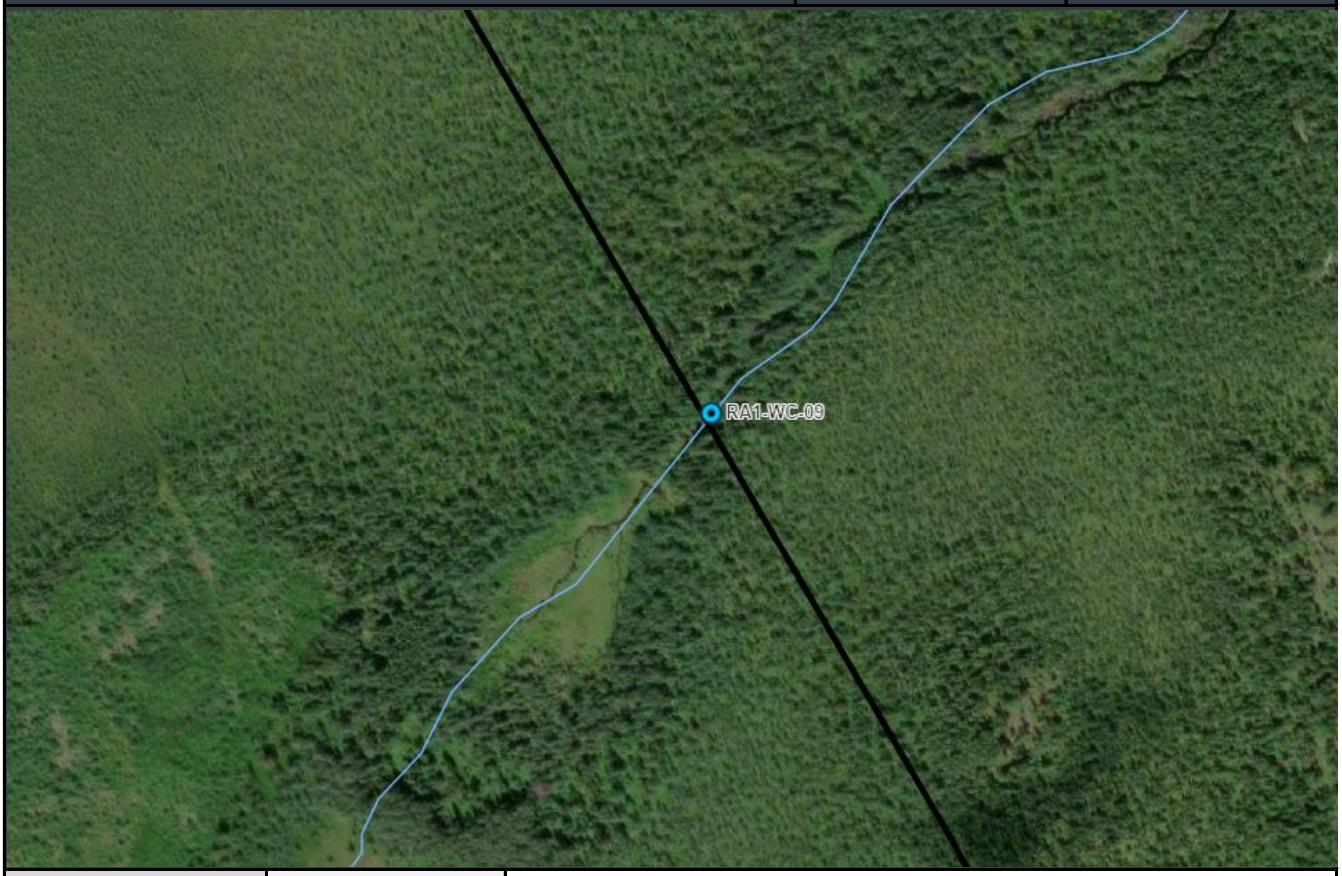
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-09				
Location Description:	Small unnamed watercourse that intersects forested and wetland terrain.				
Coordinates of Crossing:	Zone 16	Easting:	532606	Northing:	5644605
Coordinates of Cross Section:	Zone 16	Easting:	532603	Northing:	5644610
Personnel Present:	KE, MR				
Weather Conditions:	Overcast, 13°C				
Project:	21455151		Date Surveyed:		2019-09-09

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09



Current Metering Section:	Surface Geology:	Organics	
	General Description:	Small permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentationsuch as slumping and undercut banks).	
	Hydraulic Control:	Woody debris, frequent impoundments.	
	Sinuosity:	Low sinuosity	
	Fluvial	2%	
	Relative Entrenchment:	Unconfined	
	Fluvial Geomorphology:	Poorly defined Stability Index: 0.27	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.45	
	Wetted Width (m):	5.0	
	Floodplain	0.5	
	Bankfull Width (m):	5.0	
	Floodplain Observations:	Predominantely coniferous forest	
Substrate:	Left Downstream Bank:	Organics	
	Bed:	Organics	
	Right Downstream Bank:	Organics	
Water Chemistry:	Time measured:	11:45	Additional Comments:
	Temperature	10.16 °C	
	Conductivity:	69.55 mS/cm	
	pH:	7.19	
	Turbidity:	0 NTU	
	DO:	9.05 mg/L	
		83.78 %	

Project:	21455151	Date Surveyed:	2019-09-09

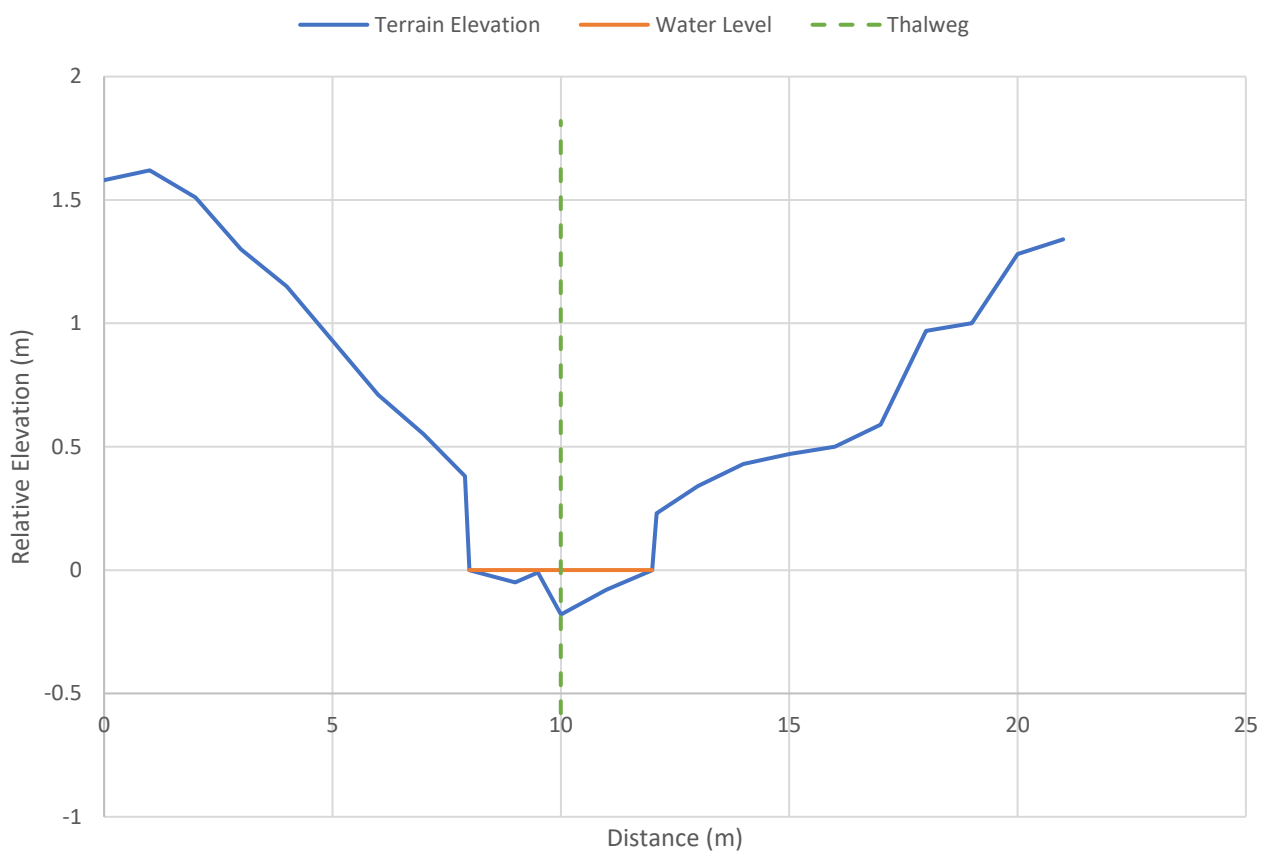
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.9	1.58	
1	0.86	1.62	
2	0.97	1.51	
3	1.18	1.3	
4	1.33	1.15	
6	1.77	0.71	
7	1.93	0.55	
7.9	2.1	0.38	LDB TOB
8	2.48	0	LDB EOW
9	2.53	-0.05	
9.5	2.49	-0.01	
10	2.66	-0.18	CL
11	2.56	-0.08	
12	2.48	0	RDB EOW
12.1	2.25	0.23	RDB TOB
13	2.14	0.34	
14	2.05	0.43	
15	2.01	0.47	
16	1.98	0.5	
17	1.89	0.59	
18	1.51	0.97	
19	1.48	1	
20	1.2	1.28	
21	1.14	1.34	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-09 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2019-09-09

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-WC-09
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.25	0.06	0		LDB
0.35	0.12	0.003		
0.45	0.17	0.017		
0.55	0.13	0.011		
0.65	0.15	0.01		
0.75	0.16	0.005		
0.85	0.16	0.01		
0.95	0.14	0.033		
1.05	0.14	0.021		
1.15	0.07	0.02		
1.25	0.06	0.004		
1.35	0.06	0.003		
1.45	0.08	0.003		
1.55	0.10	0.003		
1.65	0.12	0		RDB

Flow Rate (m^3/s):	**0.002**
Notes:	Transect recorded ~100m upstream of crossing RoW.

Project:	21455151	Date Surveyed:	2019-09-09

2019
Water Crossing Surveys

RA1-WC-57

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-57

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-10				
Location Description:	Medium-sized unnamed watercourse that intersects wetland and forested terrain.				
Coordinates of Crossing:	Zone 16	Easting:	518319	Northing:	5743417
Coordinates of Cross Section:	Zone 16	Easting:	518320	Northing:	5743418
Personnel Present:	KE, MR				
Weather Conditions:	Rain, 10°C				
Project:	21455151		Date Surveyed:	2019-09-10	

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-57

Current Metering Section:	Surface Geology:	Sand and silt	
	General Description:	Medium-sized permanent watercourse with well-defined bed and banks, unconfined and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed	
	Sinuosity:	Moderate sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Un-confined	
	Fluvial Geomorphology:	In Regime Stability Index: 0.04	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.2	
	Wetted Width (m):	12.0	
	Floodplain	>1.2	
	Bankfull Width (m):	35.0	
	Floodplain Observations:	Coniferous forest with shrubs and willows closer to the channel.	
Substrate:	Left Downstream Bank:	Silt with fine sand and organics.	
	Bed:	Silt with fine sand and organics.	
	Right Downstream Bank:	Silt with fine sand and organics.	
Water Chemistry:	Time measured:	16:21	Additional Comments:
	Temperature	10.62 °C	
	Conductivity:	54.1 mS/cm	
	pH:	7.25	
	Turbidity:	1.19 NTU	
	DO:	7.91 mg/L	
		74 %	

Project:	21455151	Date Surveyed:	2019-09-10

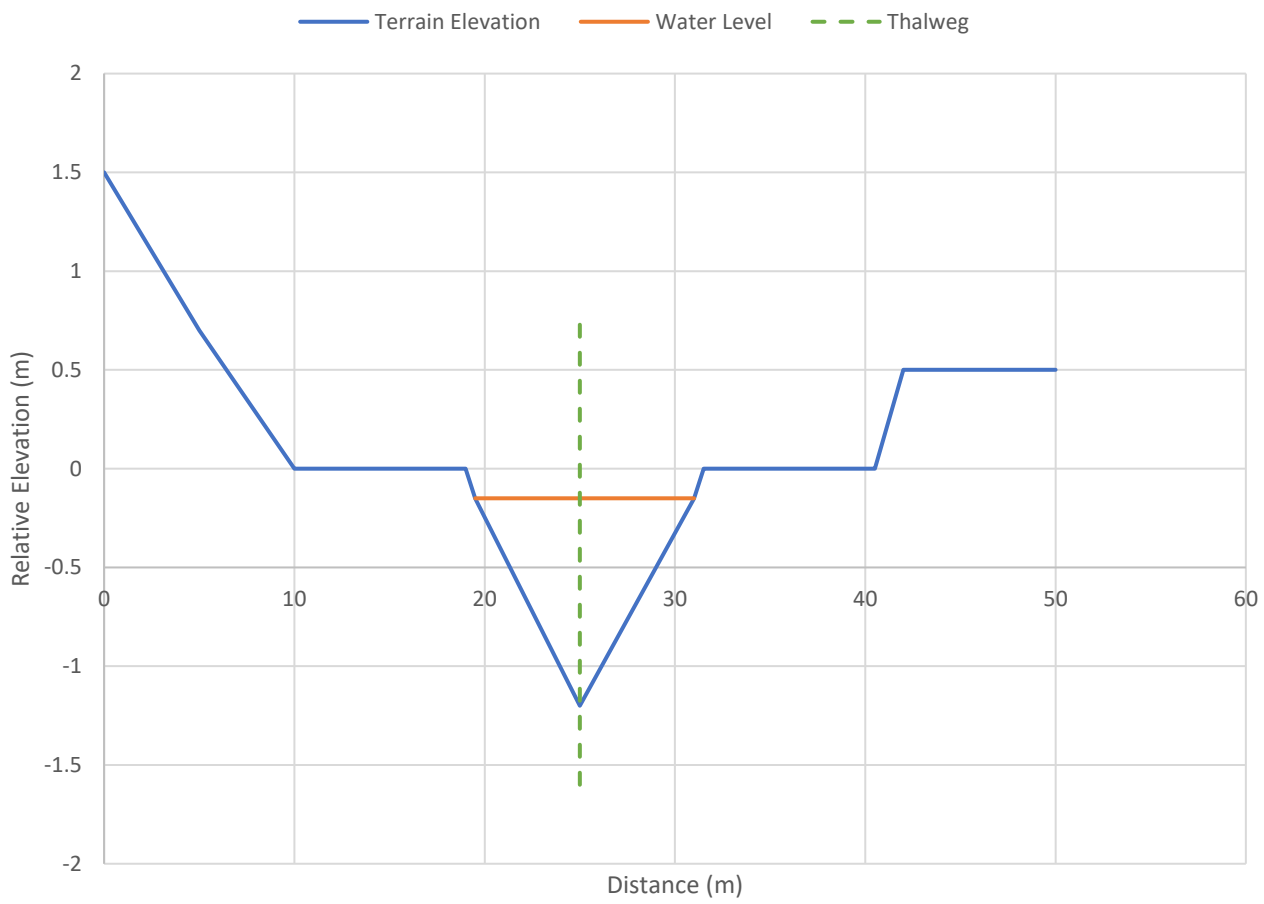
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-57

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0		1.5	
5		0.7	
10		0	
19		0	LDB
19.5		-0.15	LDB EOW
25		-1.2	
31		-0.15	RDB EOW
31.5		0	RDB
40.5		0	
42		0.5	
45		0.5	
50		0.5	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-57 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Cross-sectional survey based on estimates from field observations. Channel too deep with a soft organic, silty bottom so flow

Project:	21455151	Date Surveyed:	2019-09-10

2019
Water Crossing Surveys

RA4-WC-12

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-12

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

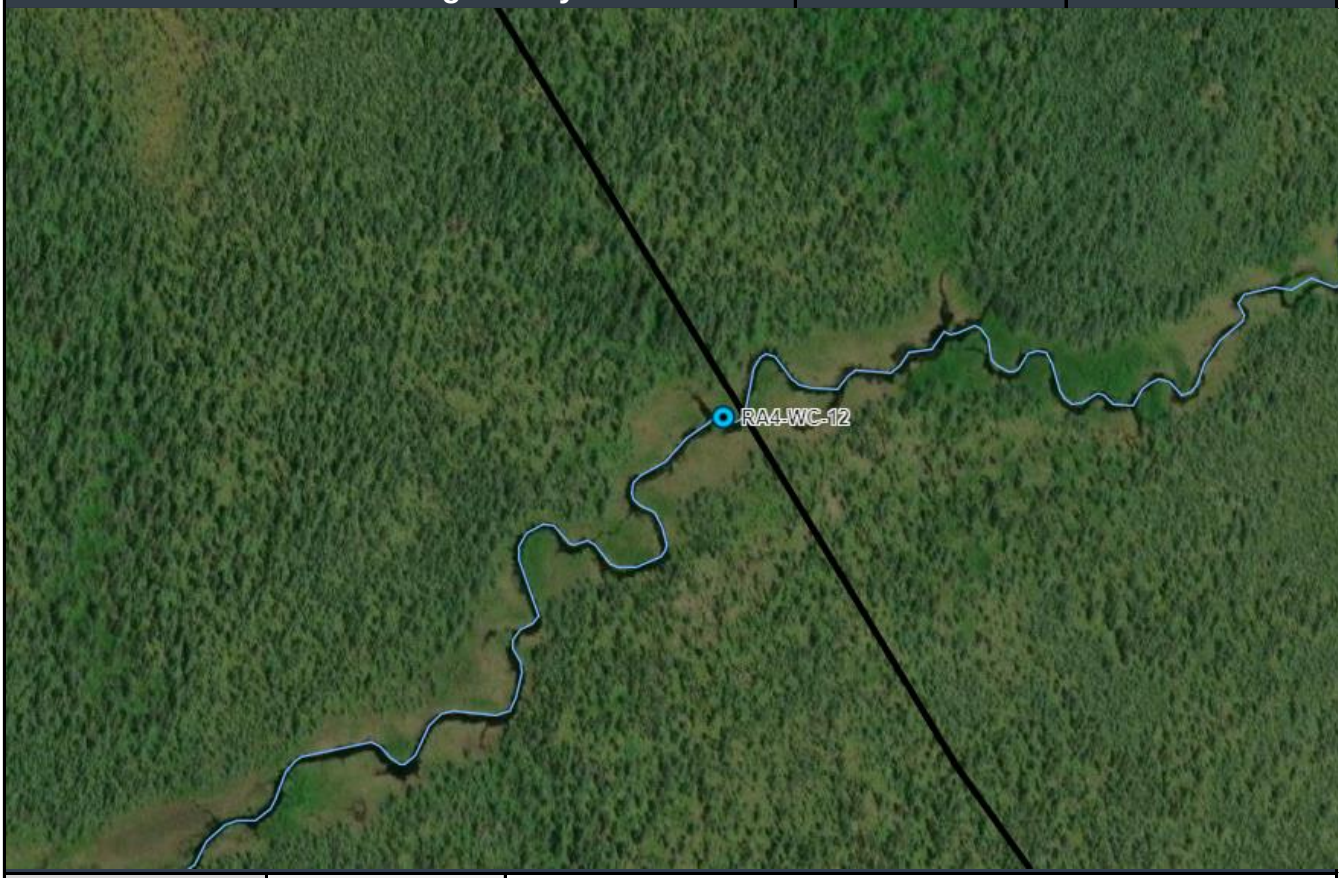
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-09				
Location Description:	Small unnamed watercourse that intersects marshland/fen/bog terrain with braided channels and deep organic sediment.				
Coordinates of Crossing:	Zone 16	Easting:	518647	Northing:	5635590
Coordinates of Cross Section:	Zone 16	Easting:	518056	Northing:	5635605
Personnel Present:	KE, MR				
Weather Conditions:	Cloudy, 12°C				
Project:	21455151		Date Surveyed:		2019-09-09

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-12



Current Metering Section:	Surface Geology:	Predominately organics.		
	General Description:	Medium-sized permanent watercourse with poorly defined bed and banks, unconfined and stable channel conditions (i.e., well vegetated with some evidence of erosion and sedimentationsuch as slumping and undercut banks).		
	Hydraulic Control:	None observed.		
	Sinuosity:	High sinuosity		
	Fluvial	Relatively flat.		
	Relative Entrenchment:	Moderately entrenched		
	Fluvial Geomorphology:	Poorly defined Stability Index: 0.125		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.6		
	Wetted Width (m):	8.0		
	Floodplain	2.0		
	Bankfull Width (m):	100.0		
	Floodplain Observations:	Flat floodplain, likely extending beyond bankfull width. Dominated by shrubs and coniferous forest.		
Substrate:	Left Downstream Bank:	Predominately organics.		
	Bed:	Predominately organics.		
	Right Downstream Bank:	Predominately organics.		
Water Chemistry:	Time measured:	11:05		Additional Comments:
	Temperature	11.9	°C	
	Conductivity:	28.7	mS/cm	
	pH:	6.44		
	Turbidity:	0.04	NTU	
	DO:	9.05	mg/L	
		86.7	%	

Project:	21455151	Date Surveyed:	2019-09-09

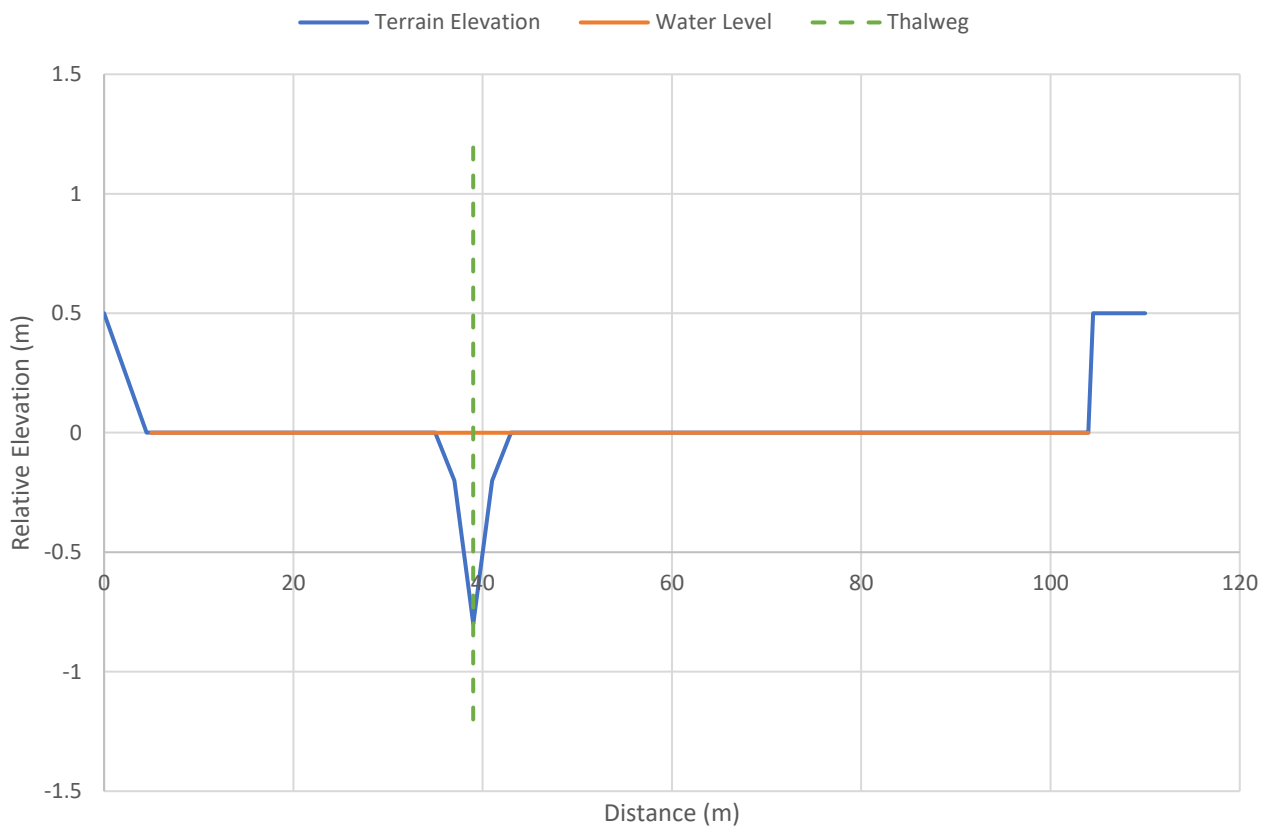
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-12

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0		0.5	
4.5		0	
5		0	LDB
35		0	
37		-0.2	Channel
39		-0.8	Channel
41		-0.2	Channel
43		0	
44		0	
104		0	RDB
104.5		0.5	
110		0.5	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA4-WC-12 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade safely

Flow Rate (m^3/s):	-
Notes:	Cross-sectional survey based on field estimates. Manual flow measurements not complete due to water depth and soft organic channel bottom.

Project:	21455151	Date Surveyed:	2019-09-09

2019
Water Crossing Surveys

RA4-WC-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-18

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

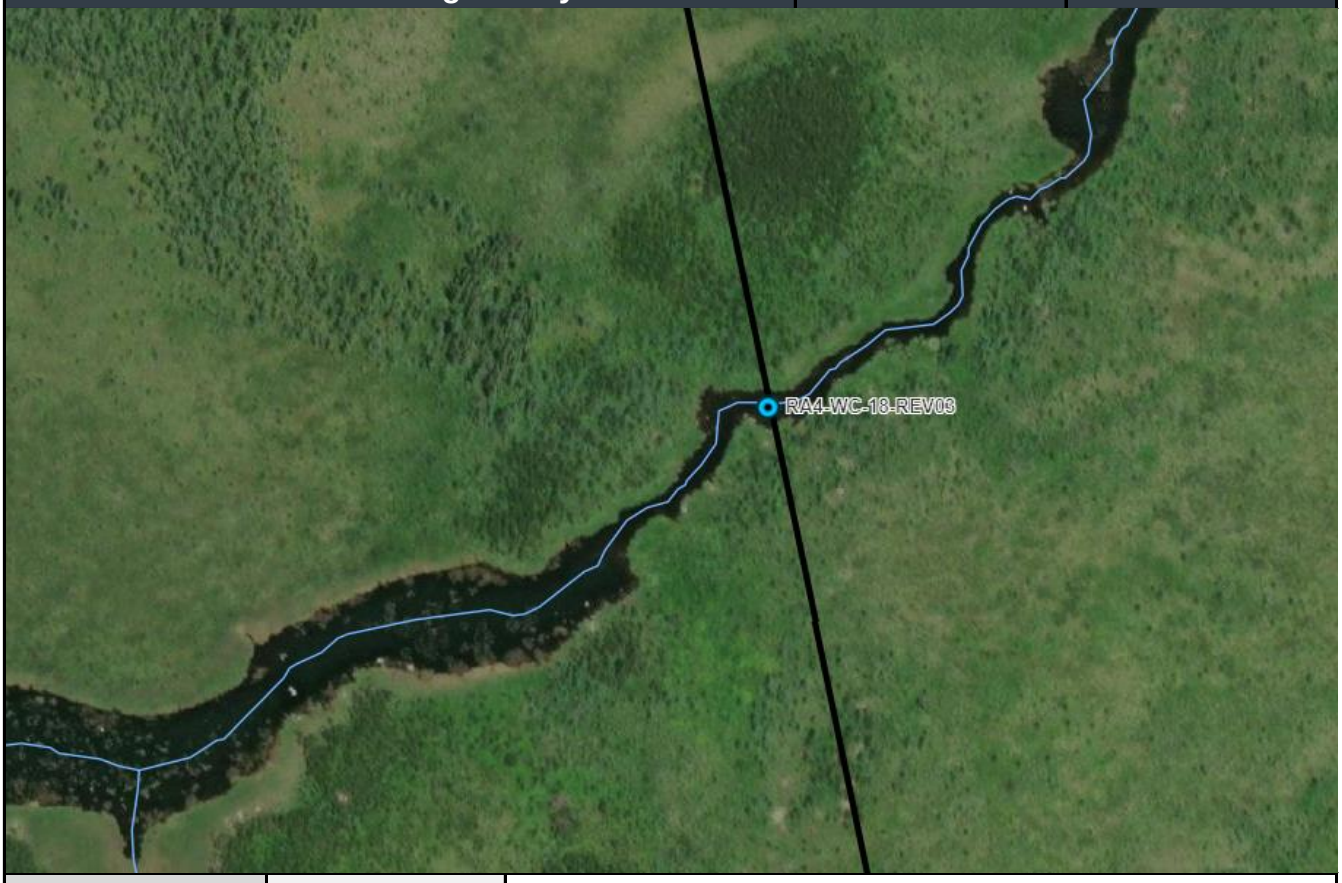
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-07				
Location Description:	Medium-sized unnamed watercourse intersecting fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	521894	Northing:	5647392
Coordinates of Cross Section:	Zone 16	Easting:	521894	Northing:	5647392
Personnel Present:	KE, MR				
Weather Conditions:	Cloudy, 13°C				
Project:	21455151		Date Surveyed:		2019-09-07

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-18



Current Metering Section:	Surface Geology:	Thick grass/forbes organic layer over cobbles and boulders.	
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, unconfined and moderately stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation).	
	Hydraulic Control:	Loose beaver dam 15 m upstream	
	Sinuosity:	High sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Unconfined	
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.23	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.5	
	Wetted Width (m):	9.0	
	Floodplain	0.6	
	Bankfull Width (m):	10.5	
	Floodplain Observations:	Overbank area is relatively flat (<0.4m over 15m); floodplain likely extends beyond bankfull width	
Substrate:	Left Downstream Bank:	30% coarse sand, 40% medium gravel, 20% cobble, 10% boulder	
	Bed:	10% coarse sand, 20% medium gravel, 10% coarse gravel, 30% cobble, 30% boulder	
	Right Downstream Bank:	20% coarse sand, 30% fine gravel, 40% cobble, 10% boulder	
Water Chemistry:	Time measured:	16:59	Additional Comments:
	Temperature	14.81 °C	
	Conductivity:	82.09 mS/cm	
	pH:	7.85	
	Turbidity:	0.56 NTU	
	DO:	9.86 mg/L	
		99.83 %	

Project:	21455151	Date Surveyed:	2019-09-07

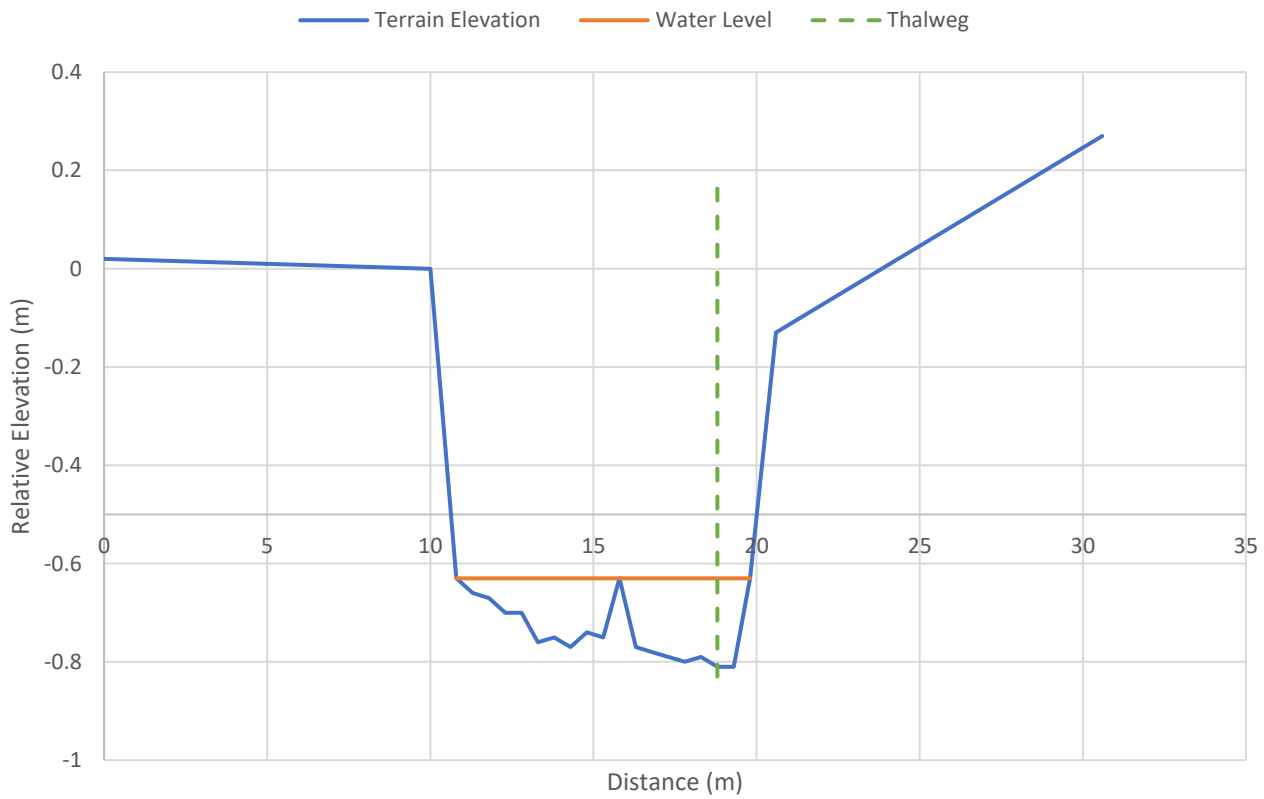
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-18

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.98	0.02	LDB -10m
10	1	0	LDB TOB
10.8	1.63	-0.63	LDB EOW
11.3	1.66	-0.66	
11.8	1.67	-0.67	
12.3	1.7	-0.7	
12.8	1.7	-0.7	
13.3	1.76	-0.76	
13.8	1.75	-0.75	
14.3	1.77	-0.77	
14.8	1.74	-0.74	
15.3	1.75	-0.75	CL
15.8	1.63	-0.63	
16.3	1.77	-0.77	
16.8	1.78	-0.78	
17.3	1.79	-0.79	
17.8	1.8	-0.8	
18.3	1.79	-0.79	
18.8	1.81	-0.81	
19.3	1.81	-0.81	
19.8	1.63	-0.63	RDB EOW
20.6	1.13	-0.13	RDB TOB
30.6	0.73	0.27	RDB -10m

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA4-WC-18 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2019-09-07

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA4-WC-18
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.80	0.08	0.024		LDB
1.30	0.11	0.042		
1.80	0.12	0.032		
2.30	0.15	0.008		
2.80	0.15	0.006		
3.30	0.21	0.013		
3.80	0.20	0.025		
4.30	0.22	0.012		
4.80	0.19	0.034		
5.30	0.20	0.003		
5.80	0.08	0.008		Boulder
6.30	0.22	0.024		
6.80	0.23	0.026		
7.30	0.24	0.031		
7.80	0.25	0.034		
8.30	0.24	0.017		
8.80	0.26	0.047		
9.30	0.26	0.047		
9.80	0.23	0.032		RDB

Flow Rate (m^3/s):	**0.046**
Notes:	

Project:	21455151	Date Surveyed:	2019-09-07

2019
Water Crossing Surveys

RA4-WC-25

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-25

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

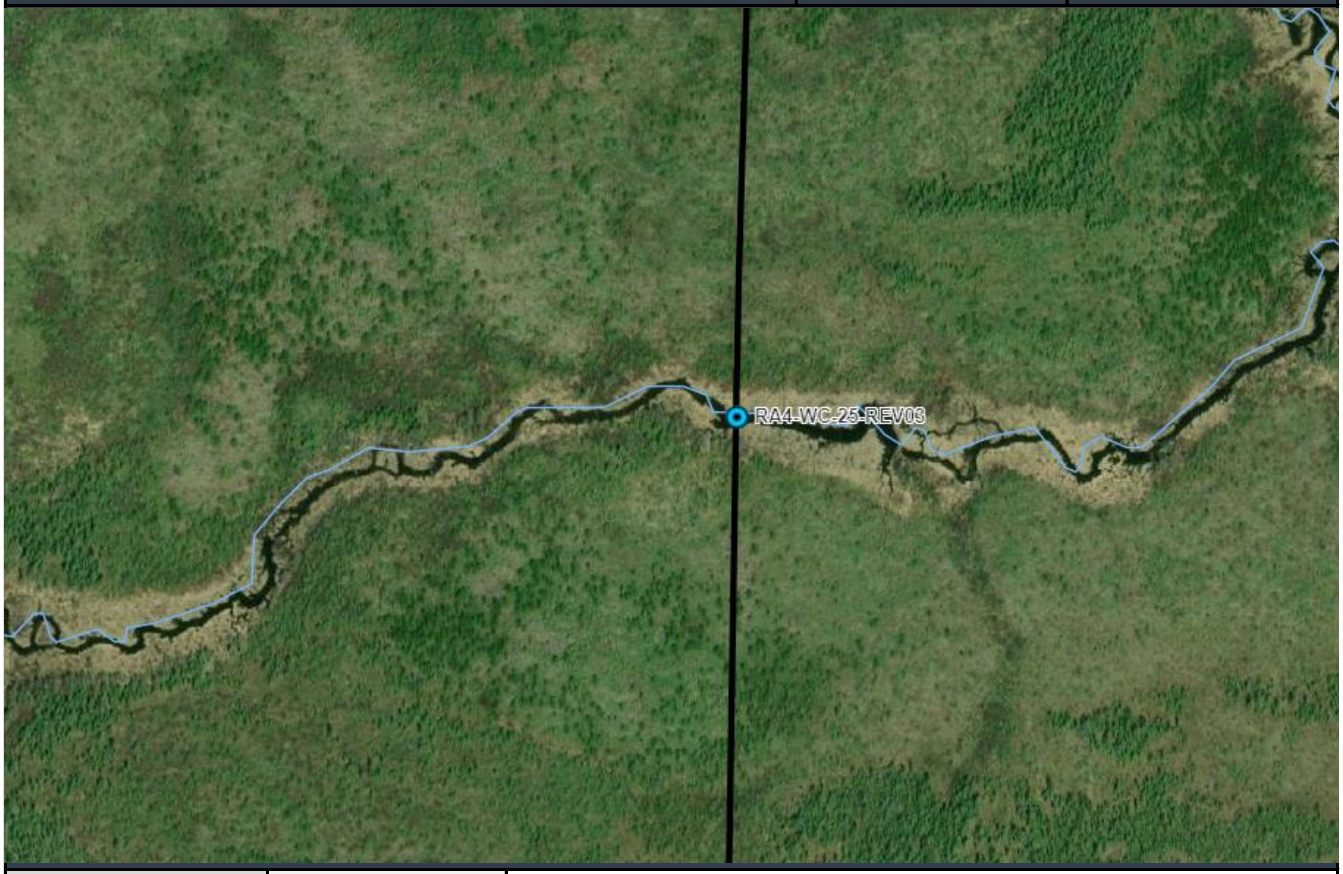
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-06 and 2019-09-10				
Location Description:	Small unnamed watercourse intersecting wooded terrain.				
Coordinates of Crossing:	Zone 16	Easting:	519869	Northing:	5662127
Coordinates of Cross Section:	Zone 16	Easting:	519870	Northing:	5662127
Personnel Present:	KE, MR				
Weather Conditions:	Overcast, 12°C				
Project:	21455151		Date Surveyed:	2019-09-06 and 2019-09-10	

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-25



Current Metering Section:	Surface Geology:	Oragnics	
	General Description:	Meandering creek approximately 6m wide, 0.4m deep. Abundant small bodied fish. Boulder/cobble substrate with sand and gravel patches.	
	Hydraulic Control:	Riffles near crossing, beaver dam downstream and woody debris throughout.	
	Sinuosity:	High sinuosity	
	Fluvial	1.368	
	Relative Entrenchment:	Entrenched	
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.39	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.4	
	Wetted Width (m):	3.2	
	Floodplain	1.3	
	Bankfull Width (m):	5.0	
	Floodplain Observations:	Predominantely grasses with mixed forest.	
Substrate:	Left Downstream Bank:	20% organics, 15% fine sand, 50% coarse sand, 20% fine gravel, 5% boulders	
	Bed:	Sand, gravel, cobbles, and organics	
	Right Downstream Bank:	20% organics, 15% fine sand, 50% coarse sand, 20% fine gravel, 5% boulders	
Water Chemistry:	Time measured:	17:28	Additional Comments:
	Temperature	12.9 °C	
	Conductivity:	90.71 mS/cm	
	pH:	7.76	
	Turbidity:	1.8 NTU	
	DO:	10.46 mg/L	
		103.14 %	

Project:	21455151	Date Surveyed:	2019-09-06 and 2019-09-10

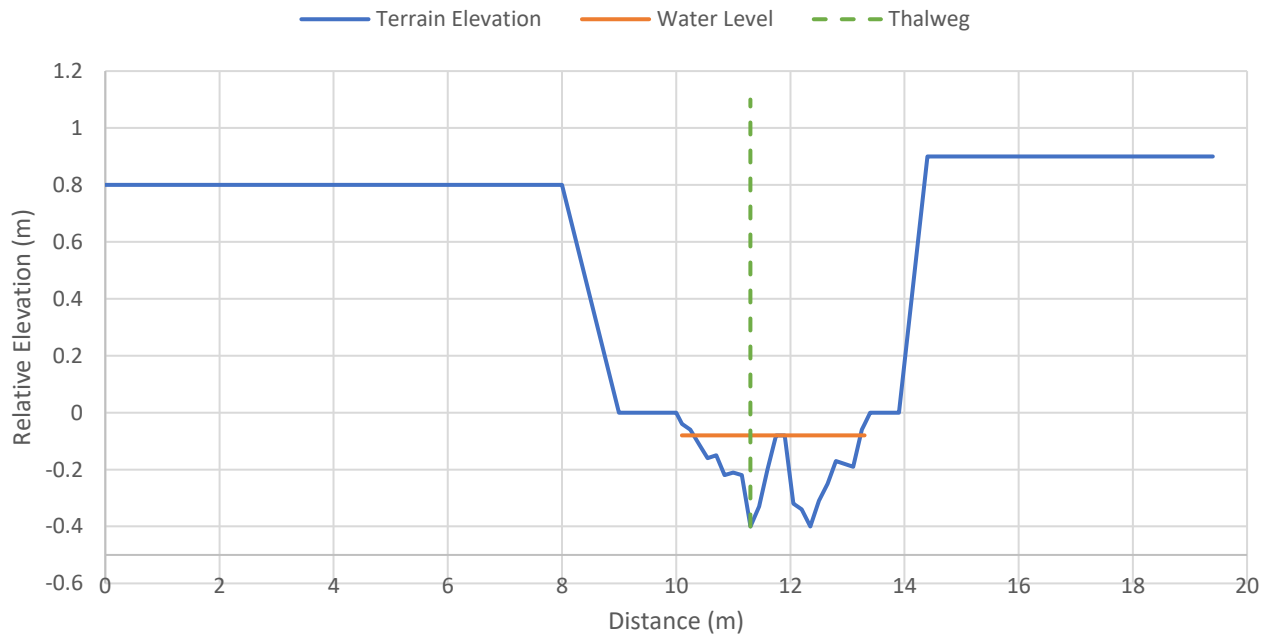
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-25

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.8	0.8	
8	0.8	0.8	
9	0	0	
10	0	0	LDB TOB
10.1	0.04	-0.04	LDB EOW
10.25	0.06	-0.06	
10.4	0.11	-0.11	
10.55	0.16	-0.16	
10.7	0.15	-0.15	
10.85	0.22	-0.22	
11	0.21	-0.21	
11.15	0.22	-0.22	
11.3	0.4	-0.4	
11.45	0.33	-0.33	
11.6	0.2	-0.2	
11.75	0.08	-0.08	CL
11.9	0.08	-0.08	
12.05	0.32	-0.32	
12.2	0.34	-0.34	
12.35	0.4	-0.4	
12.5	0.31	-0.31	
12.65	0.25	-0.25	
12.8	0.17	-0.17	
12.95	0.18	-0.18	
13.1	0.19	-0.19	
13.25	0.06	-0.06	
13.3	0.04	-0.04	RDB EOW
13.4	0	0	RDB TOB
13.9	0	0	
14.4	0.9	0.9	
19.4	0.9	0.9	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA4-WC-25 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2019-09-06 and 2019-09-10

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA4-WC-25
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
10.10	0.04	0		LDB
10.25	0.06	0.01		
10.40	0.11	0.035		
10.55	0.16	0.08		
10.70	0.15	0.027		
10.85	0.22	0.047		
11.00	0.21	0.048		
11.15	0.22	0.05		
11.30	0.40	0.031		
11.45	0.33	0.048		Max depth.
11.60	0.20	0.05		
11.75	0.08	0.015		Boulder
11.90	0.08	0.016		Boulder
12.05	0.32	0.02		
12.20	0.34	0.014		
12.35	0.40	0.011		Max Depth.
12.50	0.31	0.006		
12.65	0.25	0.022		
12.80	0.17	0.019		RDB
12.95	0.18	0.06		
13.10	0.19	0.013		
13.25	0.06	0.006		
13.30	0.04	0		

Flow Rate (m^3/s):	**0.020**
Notes:	

Project:	21455151	Date Surveyed:	2019-09-06 and 2019-09-10

2019
Water Crossing Surveys

RA4-WC-27

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-27

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-07				
Location Description:	Large unnamed watercourse intersecting large wetland.				
Coordinates of Crossing:	Zone 16	Easting:	522053	Northing:	5691379
Coordinates of Cross Section:	Zone 16	Easting:	522053	Northing:	5691380
Personnel Present:	KE, MR				
Weather Conditions:	Overcast, 12°C				
Project:	21455151		Date Surveyed:		2019-09-07

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-27

Current Metering Section:	Surface Geology:	Organic deposits		
	General Description:	Large-sized permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., dense aquatic vegetation with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	Multiple beaver lodges observed.		
	Sinuosity:	Low sinuosity		
	Fluvial	1.50%		
	Relative Entrenchment:	Un-confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.03		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	~2		
	Wetted Width (m):	53.0		
	Floodplain	3.0		
	Bankfull Width (m):	70.0		
	Floodplain Observations:	Wetland vegetation in immedeate floodplain with coniferous forest farther from channel		
Substrate:	Left Downstream Bank:	Organics		
	Bed:	Organics and silt		
	Right Downstream Bank:	Organics		
Water Chemistry:	Time measured:	13:23		Additional Comments:
	Temperature	15.382	°C	
	Conductivity:	89.53	mS/cm	
	pH:	7.7		
	Turbidity:	1.401	NTU	
	DO:	10.37	mg/L	
		107.78	%	

Project:	21455151	Date Surveyed:	2019-09-07

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-27

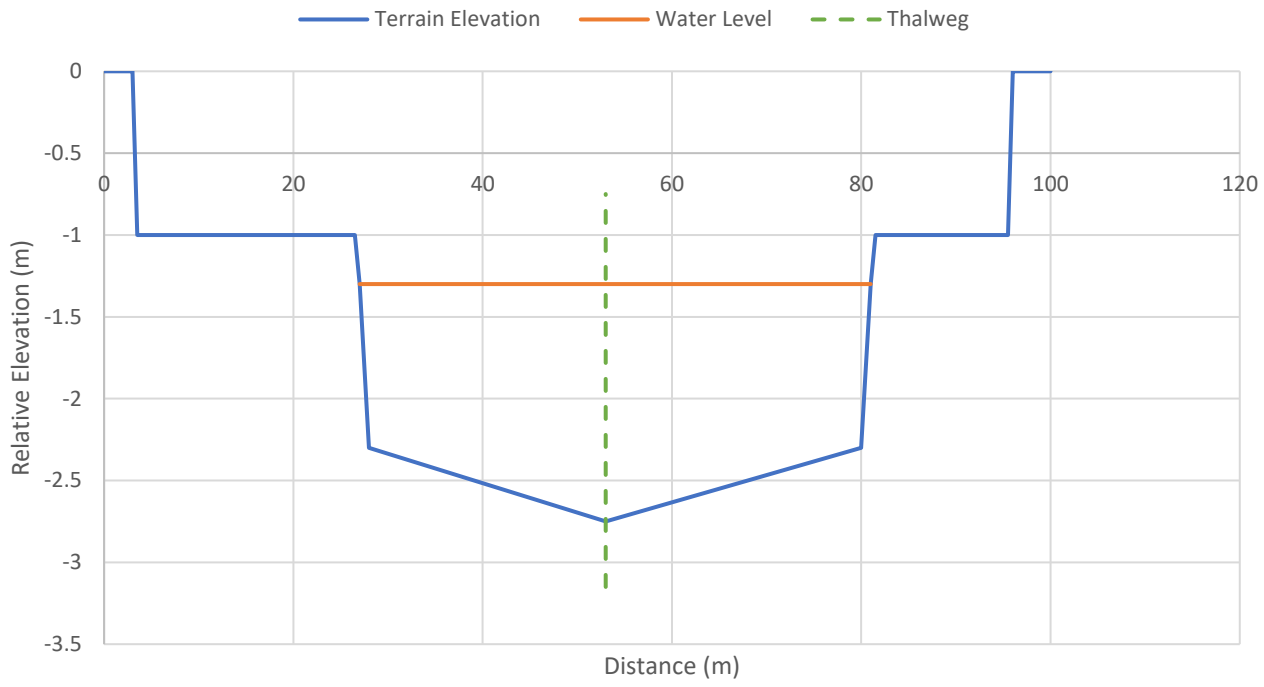
Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0		0	
3		0	
3.5		-1	
26.5		-1	LDB TOB
27		-1.3	LDB EOW
28		-2.3	
53		-2.75	EST. Depth
80		-2.3	
81		-1.3	RDB EOW
81.5		-1	RDB TOB
95.5		-1	
96		0	
100		0	

Notes:	ed on field estimates. Channel not surveyed due to water depth and soft channel bot

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA4-WC-27 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade

Flow Rate (m^3/s):	-

Notes:	Manual flow measurement not completed due to water depth and soft channel bottom.

Project:	21455151	Date Surveyed:	2019-09-07

2019
Water Crossing Surveys

RA4-WC-34

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	2019-09-06				
Location Description:	Albany River				
Coordinates of Crossing:	Zone 16	Easting:	525100	Northing:	5705282
Coordinates of Cross Section:	Zone 16	Easting:	525100	Northing:	5705282
Personnel Present:	KE, MR				
Weather Conditions:	Cloudy, 13°C				
Project:	21455151		Date Surveyed:		2019-09-06

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Current Metering Section:	Surface Geology:	Organic deposits	
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed	
	Sinuosity:	Low sinuosity	
	Fluvial	0.397	
	Relative Entrenchment:	Slightly entrenched	
	Fluvial Geomorphology:	In Regime Stability Index: 0.11	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>2	
	Wetted Width (m):	50.0	
	Floodplain	~5	
	Bankfull Width (m):	70.0	
	Floodplain Observations:	Small grasses and shrubs near the channel with mature mixed forest.	
Substrate:	Left Downstream Bank:	15% coarse sand, 10% medium gravel, 15% cobbles, 60% boulders	
	Bed:	Predominately boulders with cobbles and coarse sand.	
	Right Downstream Bank:	Not surveyed, visually similar to LDB	
Water Chemistry:	Time measured:	14:03	Additional Comments:
	Temperature	14.22 °C	
	Conductivity:	84.62 mS/cm	
	pH:	8.11	
	Turbidity:	0.042 NTU	
	DO:	10.34 mg/L	
		105 %	

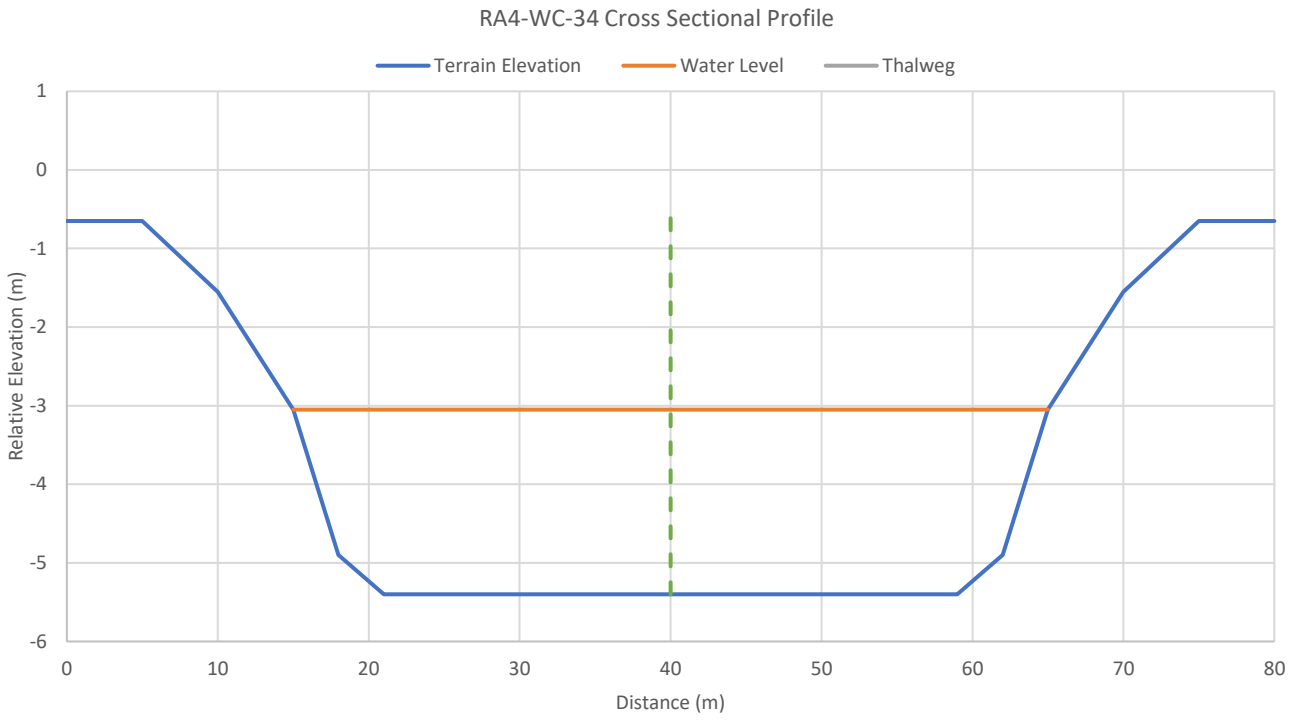
Project:	21455151	Date Surveyed:	2019-09-06

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0		-0.65	
5		-0.65	LDB TOB
10		-1.55	
15		-3.05	LDB EOW
18		-4.9	
21		-5.4	EST. depth
59		-5.4	CL
62		-4.9	
65		-3.05	RDB EOW
70		-1.55	
75		-0.65	RDB TOB
80		-0.65	
Notes:	Based on field estimates. Channel not surveyed due to water depth.		
Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank			

Water Crossing RA4-WC-34 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade.

Flow Rate (m^3/s):	-
Notes:	Manual flow measurements not completed due to water depth.

Project:	21455151	Date Surveyed:	2019-09-06

2020
Water Crossing Surveys

RA1-4-WC-33

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 25 m upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	19-10-2020				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	564512	Northing:	5733024
Coordinates of Cross Section:	Zone 16	Easting:	569513	Northing:	5733030
Personnel Present:	JD, JF, JB, AL				
Weather Conditions:	Overcast, -5°C				
Project:	21455151		Date Surveyed:		2020-10-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Current Metering Section:	Surface Geology:	Predominantly organic materials.	
	General Description:	Medium-sized permanent watercourse with poorly defined bed and banks, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	Two small beaver dams located upstream of crossing location.	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat.	
	Relative Entrenchment:	Slightly entrenched	
	Fluvial Geomorphology:	In Regime Stability Index: 0	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.55	
	Wetted Width (m):	5.2	
	Floodplain	0.7	
	Bankfull Width (m):	5.7	
	Floodplain Observations:	Broad and flat topography with heavy cover of shrub and small trees.	
Substrate:	Left Downstream Bank:	Predominantly organics	
	Bed:	Predominantly organics	
	Right Downstream Bank:	Predominantly organics	
Water Chemistry:	Time measured:	11:00:00 AM	Additional Comments:
	Temperature	1.9 °C	1 Turbidity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	16 mS/cm	
	pH:	6.5	
	Turbidity:	N/A[1] NTU	
	DO:	11.3 mg/L	
		83 %	

Project:	21455151	Date Surveyed:	2020-10-19

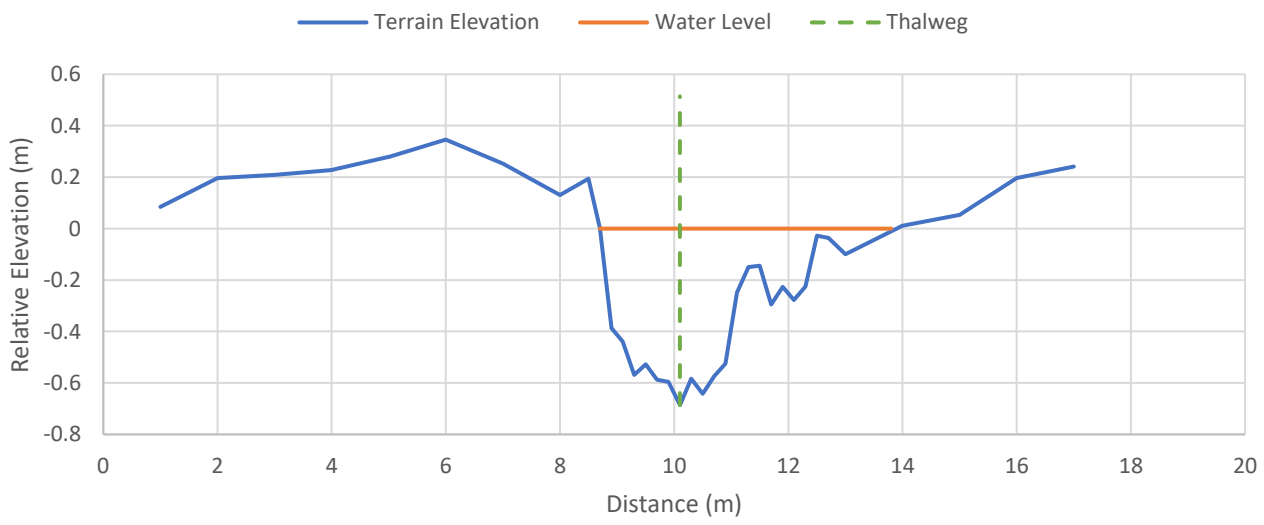
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
1	1.66	0.085	
2	1.549	0.196	
3	1.536	0.209	
4	1.517	0.228	
5	1.466	0.279	
6	1.399	0.346	
7	1.492	0.253	
8	1.615	0.13	LDB ToB
8.5	1.551	0.194	
8.7	1.745	0	LDB EOW
8.9	2.132	-0.387	
9.1	2.184	-0.439	
9.3	2.314	-0.569	
9.5	2.272	-0.527	
9.7	2.332	-0.587	
9.9	2.341	-0.596	Centreline
10.1	2.431	-0.686	
10.3	2.329	-0.584	
10.5	2.387	-0.642	
10.7	2.318	-0.573	
10.9	2.27	-0.525	
11.1	1.994	-0.249	
11.3	1.895	-0.15	
11.5	1.889	-0.144	
11.7	2.04	-0.295	
11.9	1.972	-0.227	
12.1	2.023	-0.278	
12.3	1.97	-0.225	
12.5	1.773	-0.028	
12.7	1.781	-0.036	RDB ToB
13	1.845	-0.1	
14	1.734	0.011	
15	1.691	0.054	
16	1.548	0.197	
17	1.504	0.241	
18	1.448		

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-4-WC-33 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-19

Marten Falls CAR Water Crossing Survey		Crossing Location:	RA1-4-WC-33

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
8.50	0.00	0		
8.70	0.19	0.008		
8.90	0.57	0.038		
9.10	0.62	0.006		
9.30	0.75		0.108 0.005	
9.50	0.70	0.1		
9.70	0.77		0.101 0.006	
9.90	0.78		0.108 0.009	
10.10	0.87		0.076 0.005	
10.30	0.77		0.028 0	
10.50	0.83		0.002 0.028	
10.70	0.74	0.013		
10.90	0.69	0.004		
11.10	0.43	0.008		
11.30	0.32	0		
11.50	0.32	-0.005		
11.70	0.48	0		
11.90	0.40	0.004		
12.10	0.45	0.002		
12.30	0.40	0.003		
12.50	0.21	0		
12.70	0.21	0.001		
13.00	0.20	-0.002		
14.00	0.17	0		
15.00	0.10	0		
16.00	0.00	0		

Flow Rate (m^3/s):	**0.060**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-19

2020
Water Crossing Surveys

RA1-4-WC-35

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 25 m upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	16-10-2020				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	573750	Northing:	5732816
Coordinates of Cross Section:	Zone 16	Easting:	573754	Northing:	5732807
Personnel Present:	JD, JF, JB, AL				
Weather Conditions:	Overcast, -3°C, snow cover				
Project:	21455151		Date Surveyed:	2020-10-16	

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35

Current Metering Section:	Surface Geology:	Predominantly organic materials.	
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	Beaver dam and associated raised water levels located downstream of crossing	
	Sinuosity:	High sinuosity	
	Fluvial	1%	
	Relative Entrenchment:	Slightly entrenched	
	Fluvial Geomorphology:	In Regime Stability Index: 0.04	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.7	
	Wetted Width (m):	2.7	
	Floodplain	0.9	
	Bankfull Width (m):	3.2	
	Floodplain Observations:	Broad and flat topography with heavy cover of shrub and small trees.	
Substrate:	Left Downstream Bank:	Predominantly organics	
	Bed:	Predominantly organics and sand	
	Right Downstream Bank:	Predominantly organics	
Water Chemistry:	Time measured:	3:50:00 PM	Additional Comments:
	Temperature	5.4 °C	1 Turbidity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	20.6 mS/cm	
	pH:	5.05	
	Turbidity:	N/A NTU	
	DO:	6.62 mg/L	
		51 %	

Project:	21455151	Date Surveyed:	2020-10-16

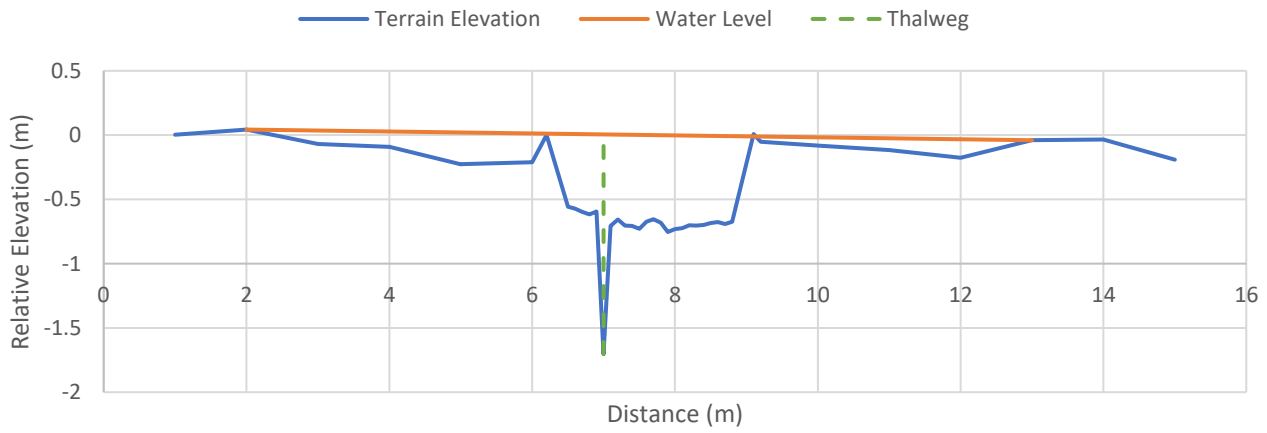
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
1	1.514	0.004	
2	1.475	0.043	
3	1.588	-0.07	
4	1.609	-0.091	
5	1.745	-0.227	
6	1.73	-0.212	LDB ToB
6.2	1.518	0	LDB EOW
6.5	2.075	-0.557	
6.6	2.09	-0.572	
6.7	2.115	-0.597	
6.8	2.134	-0.616	
6.9	2.113	-0.595	
7	3.221	-1.703	Thalweg
7.1	2.225	-0.707	
7.2	2.174	-0.656	
7.3	2.223	-0.705	
7.4	2.224	-0.706	
7.5	2.246	-0.728	
7.6	2.193	-0.675	
7.7	2.172	-0.654	
7.8	2.199	-0.681	
7.9	2.272	-0.754	
8	2.249	-0.731	
8.1	2.242	-0.724	
8.2	2.219	-0.701	
8.3	2.221	-0.703	
8.4	2.218	-0.7	
8.5	2.203	-0.685	
8.6	2.194	-0.676	
8.7	2.21	-0.692	
8.8	2.192	-0.674	
9.1	1.51	0.008	RDB EOW
9.2	1.57	-0.052	RDB ToB
10	1.6	-0.082	
11	1.635	-0.117	
12	1.694	-0.176	
13	1.558	-0.04	
14	1.553	-0.035	
15	1.71	-0.192	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-4-WC-35 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-16

Marten Falls CAR Water Crossing Survey		Crossing Location:	RA1-4-WC-35

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
6.20	0.00	0.000		
6.50	0.56	0.000		
6.60	0.58	0.044		
6.70	0.60	0.028		
6.80	0.63	0.060		
6.90	0.63	0.042		
7.00	0.70	0.075		
7.10	0.72	0.085		
7.20	0.70	0.070		
7.30	0.72	0.072		
7.40	0.73	0.100		
7.50	0.74	0.118		
7.60	0.69	0.133		
7.70	0.65	0.137		
7.80	0.69	0.137		
7.90	0.74	0.120		
8.00	0.74	0.141		
8.10	0.71	0.127		
8.20	0.71	0.135		
8.30	0.71	0.160		
8.40	0.70	0.122		
8.50	0.69	0.152		
8.60	0.68	0.147		
8.70	0.70	0.122		
8.80	0.68	0.023		
9.10	0.11	0.000		

Flow Rate (m^3/s):	**0.166**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-16

2020
Water Crossing Surveys

RA1-4-WC-37

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-37

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 25 m upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	14-10-2020				
Location Description:	Small unnamed watercourse that intersects mostly wooded terrain.				
Coordinates of Crossing:	Zone 16	Easting:	577409	Northing:	575626
Coordinates of Cross Section:	Zone 16	Easting:	573754	Northing:	5732807
Personnel Present:	JD, JF, JB, AL				
Weather Conditions:	Sunny, 6°C				
Project:	21455151		Date Surveyed:		2020-10-14

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-37

Current Metering Section:	Surface Geology:	Predominantly organic materials.		
	General Description:	Small permanent watercourse with moderately defined bed and banks, and moderately stable channel conditions (i.e., well vegetated with some evidence of erosion and sedimentation) such as undercutting.		
	Hydraulic Control:	Impoundment (i.e., road crossing with culvert) located upstream of crossing location		
	Sinuosity:	Low sinuosity		
	Fluvial	0.4%		
	Relative Entrenchment:	Slightly entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0.15		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.25		
	Wetted Width (m):	0.45		
	Floodplain	0.55		
	Bankfull Width (m):	0.5		
	Floodplain Observations:	Broad and flat topography with heavy cover of trees.		
Substrate:	Left Downstream Bank:	Predominantly organics and fine sand		
	Bed:	Predominantly organics and fine sand		
	Right Downstream Bank:	Predominantly organics and fine sand		
Water Chemistry:	Time measured:	1:15:00 PM		Additional Comments:
	Temperature	5.2	°C	1 Turbidity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	137.7	mS/cm	
	pH:	7.07		
	Turbidity:	N/A[1]	NTU	
	DO:	9.75	mg/L	
		79.1	%	

Project:	21455151	Date Surveyed:	2020-10-14

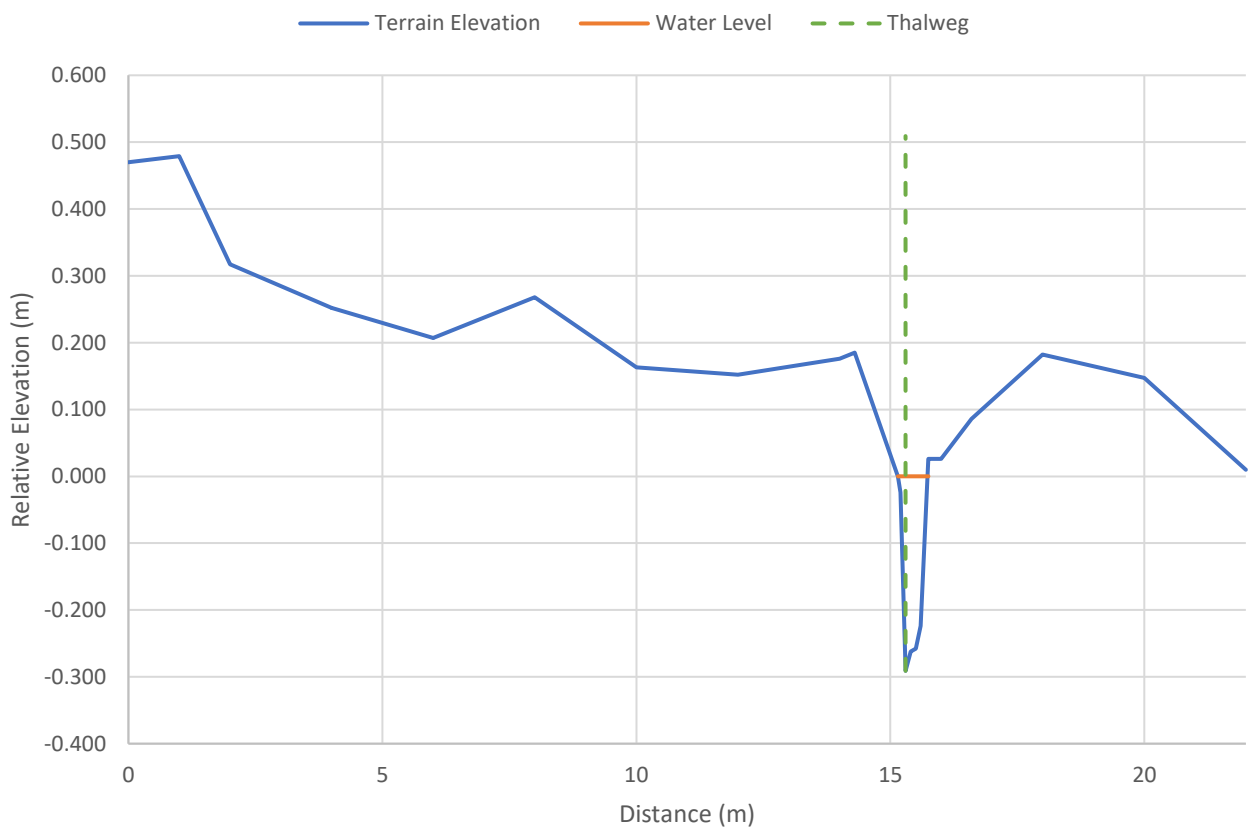
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-37

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	1.330	0.470	
1	1.321	0.479	
2	1.483	0.317	
4	1.548	0.252	
6	1.593	0.207	
8	1.532	0.268	
10	1.637	0.163	
12	1.648	0.152	
14	1.624	0.176	
14.3	1.615	0.185	LDB ToB
15.15	1.800	0.000	LDB EOW
15.2	1.824	-0.024	
15.3	2.091	-0.291	Thalweg
15.4	2.062	-0.262	
15.5	2.058	-0.258	
15.6	2.024	-0.224	
15.75	1.774	0.026	RDB EOW
16	1.774	0.026	
16.6	1.714	0.086	RDB ToB
18	1.618	0.182	
20	1.653	0.147	
22	1.790	0.010	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-4-WC-37 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-14

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-4-WC-37
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
15.15	0.00	0.000		
15.20	0.05	0.000		
15.30	0.28	0.069		
15.40	0.28	0.031		
15.50	0.26	0.050		
15.60	0.20	0.055		
15.75	0.00	0.000		

Flow Rate (m^3/s):	**0.005**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-14

2020
Water Crossing Surveys

RA1-WC-14

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-14

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 60 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	19-10-2020				
Location Description:	Small unnamed watercourse that intersects fen/bog terrain				
Coordinates of Crossing:	Zone 16	Easting:	529516	Northing:	5656009
Coordinates of Cross Section:	Zone 16	Easting:	529516	Northing:	5656009
Personnel Present:	KE, JK				
Weather Conditions:	Partly cloudy, -4°C				
Project:	21455151		Date Surveyed:		2020-10-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-14

Current Metering Section:	Surface Geology:	Predominantly organic materials.	
	General Description:	Small permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	Beaver dam located approximately 70 m downstream of crossing; noting that several other beaver dams are located along the reach, but were shown to be breached (i.e., do not represent barriers).	
	Sinuosity:	Moderate sinuosity	
	Bed Slope:	Relatively flat.	
	Fluvial	Slightly entrenched	
	Fluvial Geomorphology:	In Regime Stability Index: 0.18	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.70	
	Wetted Width (m):	3.00	
	Bankfull Depth (m):	1.70	
	Floodplain	3.5	
	Floodplain Observations:	Broad and flat topography with heavy cover of tall grasses.	
Substrate:	Left Downstream Bank:	Predominantly organics with some silt	
	Bed:	Predominantly organics with small portions of silt	
	Right Downstream Bank:	Predominantly organics with some silt	
Water Chemistry:	Time measured:	10:30:00 AM	Additional Comments:
	Temperature	2.27 °C	1 Conductivity and Turbidity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	N/A[1] mS/cm	
	pH:	6.6	
	Turbidity:	N/A[1] NTU	
	DO:	10.9 mg/L	
		80.81 %	

Project:	21455151	Date Surveyed:	2020-10-19

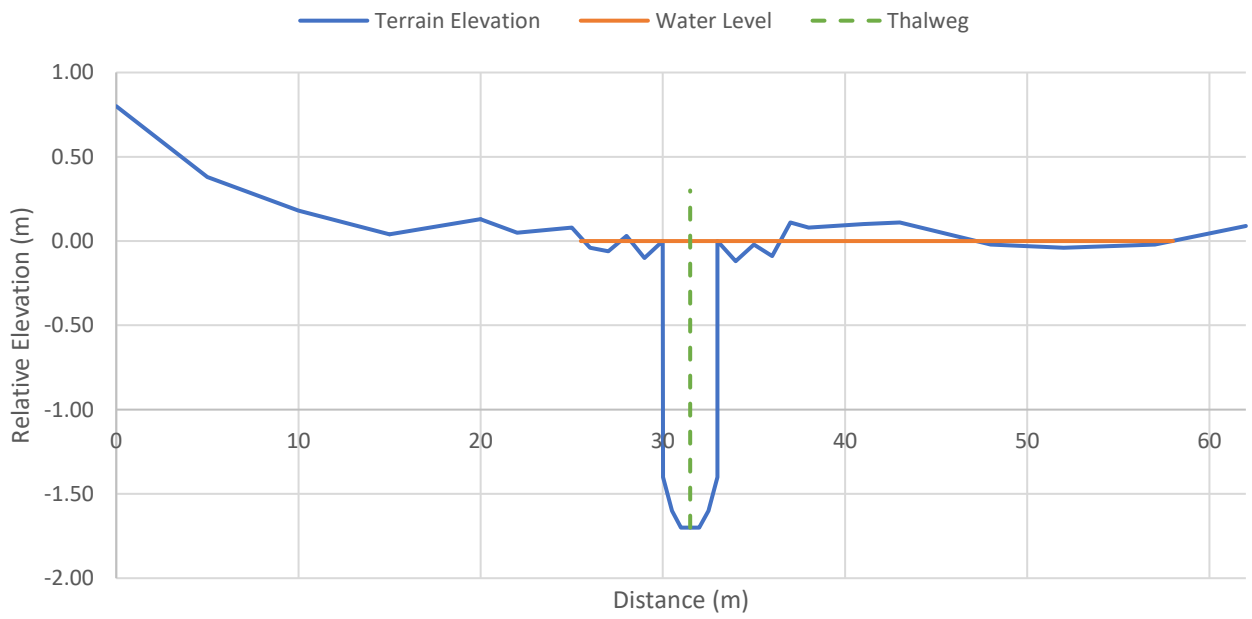
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-14

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.72	0.80	
5	1.14	0.38	
10	1.34	0.18	
15	1.48	0.04	
20	1.39	0.13	
22	1.47	0.05	
25	1.44	0.08	
26	1.56	-0.04	
27	1.58	-0.06	
28	1.49	0.03	
29	1.62	-0.10	
30	1.52	0.00	RDB EOW
30.01	2.92	-1.40	
30.5	3.12	-1.60	
31	3.22	-1.70	
31.5	3.22	-1.70	
32	3.22	-1.70	
32.5	3.12	-1.60	
32.99	2.92	-1.40	
33	1.52	0.00	LDB EOW
34	1.64	-0.12	
35	1.54	-0.02	
36	1.61	-0.09	
37	1.41	0.11	
38	1.44	0.08	
41	1.42	0.10	
43	1.41	0.11	
48	1.54	-0.02	
52	1.56	-0.04	
57	1.54	-0.02	
62	1.43	0.09	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-14 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-19

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-WC-14
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.00	0.06	0.000		LDB
1.10	0.22	0.000		
1.20	0.22	0.008		
1.30	0.24	-0.006		
1.40	0.20	0.013		
1.50	0.24	0.109		
1.60	0.28	0.068		
1.70	0.26	0.088		
1.80	0.26	0.092		
1.90	0.24	0.091		
2.00	0.26	0.080		
2.10	0.28	0.051		
2.20	0.28	0.015		
2.30	0.26	0.025		
2.40	0.26	0.027		
2.50	0.28	0.068		
2.60	0.31	0.059		
2.70	0.22	0.065		
2.80	0.24	0.028		
2.90	0.26	0.053		
3.00	0.26	0.049		
3.10	0.25	0.040		
3.20	0.22	0.065		
3.30	0.20	0.058		
3.40	0.20	0.041		
3.50	0.23	0.028		
3.60	0.18	-0.024		
3.65	0.10	0.000		RDB

Flow Rate (m^3/s):	**0.040**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-19

2020
Water Crossing Surveys

RA1-WC-26

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-26

Photograph A: Near crossing location; view looking downstream.

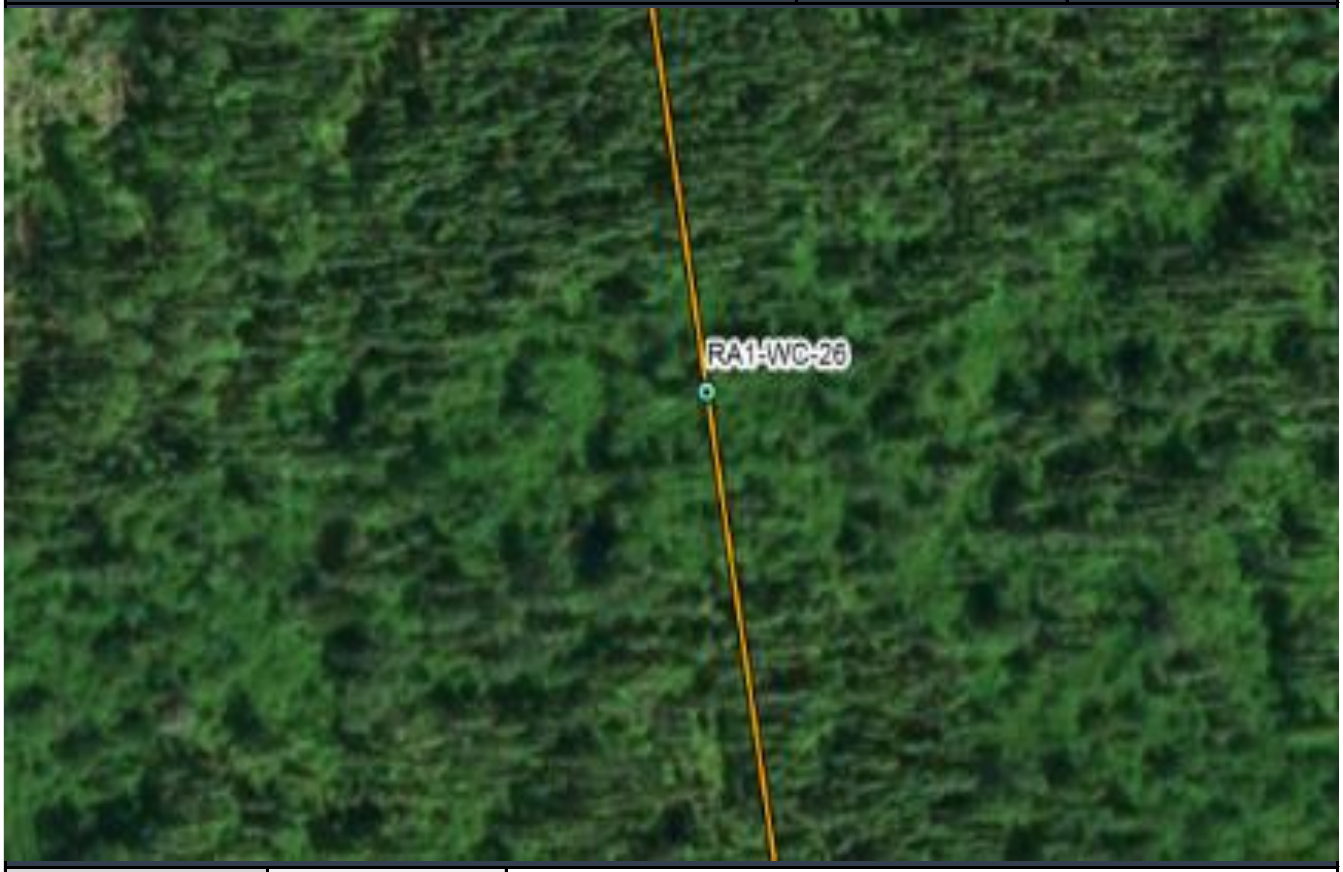
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 60 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	20-10-2020				
Location Description:	Small unnamed watercourse that intersects wooded terrain.				
Coordinates of Crossing:	Zone 16	Easting:	519365	Northing:	5700626
Coordinates of Cross Section:	Zone 16	Easting:	519375	Northing:	5700590
Personnel Present:	KE, JW				
Weather Conditions:	Sunny, -5°C				
Project:	21455151		Date Surveyed:		2020-10-20

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-26



Current Metering Section:	Surface Geology:	Predominantly organic materials.
	General Description:	Small permanent watercourse with poorly defined bed and banks, and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation such as slumping and undercut banks).
	Hydraulic Control:	None observed
	Sinuosity:	Low sinuosity
	Fluvial	Relatively flat.
	Relative Entrenchment:	Slightly entrenched
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.23
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.15
	Wetted Width (m):	1.9
	Floodplain	0.3
	Bankfull Width (m):	2.8
	Floodplain Observations:	Broad and flat topography with heavy cover of small trees.
Substrate:	Left Downstream Bank:	Predominantly organics with some silt
	Bed:	Predominantly organics with some silt
	Right Downstream Bank:	Predominantly organics with some silt

Water Chemistry:	Time measured:	11:45:00 AM		Additional Comments:
	Temperature	1.08	°C	1 Conductivity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	N/A[1]	mS/cm	
	pH:	6.25		
	Turbidity:	0.89	NTU	
	DO:	10.41	mg/L	
		74.19	%	

Project:	21455151	Date Surveyed:	2020-10-20

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-26

Cross Section Survey

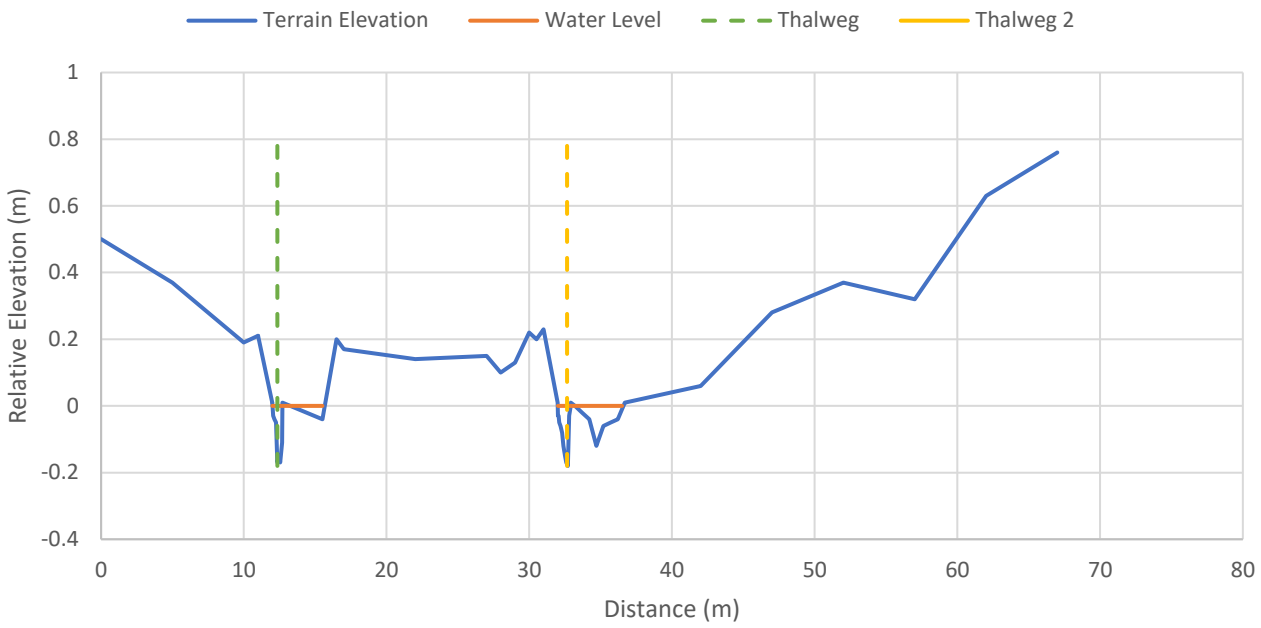
Distance (m)	Rod	Elevation	Comments
0	1.16	0.5	
5	1.29	0.37	
10	1.47	0.19	
11	1.45	0.21	
11.99	1.65	0.01	LDB ToB
12	1.66	0	LDB EOW
12.05	1.69	-0.03	
12.15	1.7	-0.04	
12.25	1.71	-0.05	
12.35	1.83	-0.17	
12.45	1.81	-0.15	2nd Channel
12.55	1.83	-0.17	
12.68	1.77	-0.11	RDB EOW
12.7	1.65	0.01	RDB ToB
15.5	1.7	-0.04	
16	1.58	0.08	
16.5	1.46	0.2	
17	1.49	0.17	
22	1.52	0.14	
27	1.51	0.15	
28	1.56	0.1	
29	1.53	0.13	
30	1.44	0.22	
30.5	1.46	0.2	
31	1.43	0.23	
31.99	1.65	0.01	LDB ToB
32	1.69	-0.03	LDB EOW
32.05	1.69	-0.03	
32.1	1.71	-0.05	
32.2	1.72	-0.06	
32.3	1.74	-0.08	
32.4	1.78	-0.12	
32.5	1.81	-0.15	1st Channel
32.6	1.83	-0.17	
32.7	1.84	-0.18	
32.8	1.69	-0.03	
32.9	1.66	0	RDB EOW
32.91	1.65	0.01	RDB ToB
33.2	1.66	0	
33.7	1.68	-0.02	
34.2	1.7	-0.04	
34.7	1.78	-0.12	
35.2	1.72	-0.06	
35.7	1.71	-0.05	
36.2	1.7	-0.04	
36.7	1.65	0.01	
42	1.6	0.06	
47	1.38	0.28	
52	1.29	0.37	
57	1.34	0.32	
62	1.03	0.63	
67	0.9	0.76	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Project:	21455151	Date Surveyed:	2020-10-20

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-26

Water Crossing RA1-WC-26 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.25	0.04	0		LDB - 1st channel
0.30	0.04	0.06		
0.40	0.06	0.063		
0.50	0.07	0.046		
0.60	0.09	0.058		
0.70	0.13	0.042		
0.80	0.16	0.045		
0.90	0.18	0.024		
1.00	0.19	0		
1.10	0.04	0.008		
1.20	0.01	0		RDB
0.55	0.01	0		LDB - 2nd channel
0.60	0.04	0.027		
0.70	0.05	0.05		
0.80	0.06	0.084		
0.90	0.18	0.025		
1.00	0.16	0.045		
1.10	0.18	0.07		RDB

Flow Rate (m^3/s):	**0.006**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-20

2020
Water Crossing Surveys

RA1-WC-27

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-27

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 60 m upstream of crossing; view looking downstream.

Photograph E: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	24-10-2020				
Location Description:	Albany River				
Coordinates of Crossing:	Zone 16	Easting:	519259	Northing:	5702108
Coordinates of Cross Section:	Zone 16	Easting:	N/A	Northing:	N/A
Personnel Present:	KE, JW				
Weather Conditions:	Overcast with light snow, -7°C				
Project:	21455151		Date Surveyed:		2020-10-24

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-27

Current Metering Section:	Surface Geology:	Predominantly alluvial materials consisting of cobble, sand, gravel, and boulders.
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, unconfined meander pattern, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	Bedrock outliers
	Sinuosity:	Moderate sinuosity
	Fluvial	Moderate
	Relative Entrenchment:	Moderately entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0.13
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.50
	Wetted Width (m):	180.00
	Floodplain	N/A - water depths too deep to allow safe collection
	Bankfull Width (m):	200.0
	Floodplain Observations:	Broad and sloping topography with heavy cover of large trees.
Substrate:	Left Downstream Bank:	Not sampled, although appeared to be relatively identical to right downstream bank (based on visual observations)
	Bed:	Predominantly boulder with cobble and trace amounts of fine sand, medium gravel, and coarse gravel.
	Right Downstream Bank:	Predominantly silt with cobble and trace amounts of medium gravel, coarse gravel, and boulder.

Water Chemistry:	Time measured:	11:19:00 AM		Additional Comments:
	Temperature	2.3	°C	Cobble- and boulder-dominated banks with well-established forest in the floodplain.
	Conductivity:	N/A[1]	mS/cm	
	pH:	8.18		
	Turbidity:	1.19	NTU	1 Conductivity reading unavailable on multiparameter water quality meter. N/A = Not Available
	DO:	14.41	mg/L	
		106.61	%	

Project:	21455151	Date Surveyed:	2020-10-24

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-27

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.150	4.790	
1	0.330	4.610	
2	0.450	4.490	
3	0.450	4.490	
4	0.740	4.200	
5	0.600	4.340	
6	1.070	3.870	
7	1.500	3.440	
8	1.820	3.120	
9	1.950	2.990	
10	2.450	2.490	
11	2.680	2.260	
12	3.050	1.890	
13	3.400	1.540	
14	3.650	1.290	
15	4.120	0.820	
16	4.340	0.600	
17	4.550	0.390	
18	4.710	0.230	RDB
19	4.820	0.120	
20	4.920	0.020	
21	1.690	0.000	EOW
21.5	1.820	-0.130	
22	1.880	-0.190	
22.5	1.890	-0.200	
23	1.890	-0.200	
23.5	1.920	-0.230	
24	1.930	-0.240	
24.5	1.930	-0.240	
25	1.900	-0.210	
25.5	1.940	-0.250	
26	1.950	-0.260	
26.5	1.960	-0.270	
27	1.970	-0.280	
27.5	2.000	-0.310	
28	2.050	-0.360	
28.5	2.070	-0.380	
29	2.080	-0.390	
29.5	2.070	-0.380	
30	2.120	-0.430	
30.5	2.100	-0.410	
31	2.140	-0.450	
31.5	2.240	-0.550	
32	2.220	-0.530	
32.5	2.310	-0.620	
33	2.390	-0.700	
33.5	2.370	-0.680	
34	2.760	-1.070	
34.5	2.570	-0.880	
35	2.510	-0.820	
35.5	2.480	-0.790	
36	2.380	-0.690	
36.5	2.220	-0.530	
37	2.410	-0.720	
37.5	2.400	-0.710	
38	2.620	-0.930	
38.5	2.710	-1.020	

Project:	21455151	Date Surveyed:	2020-10-24

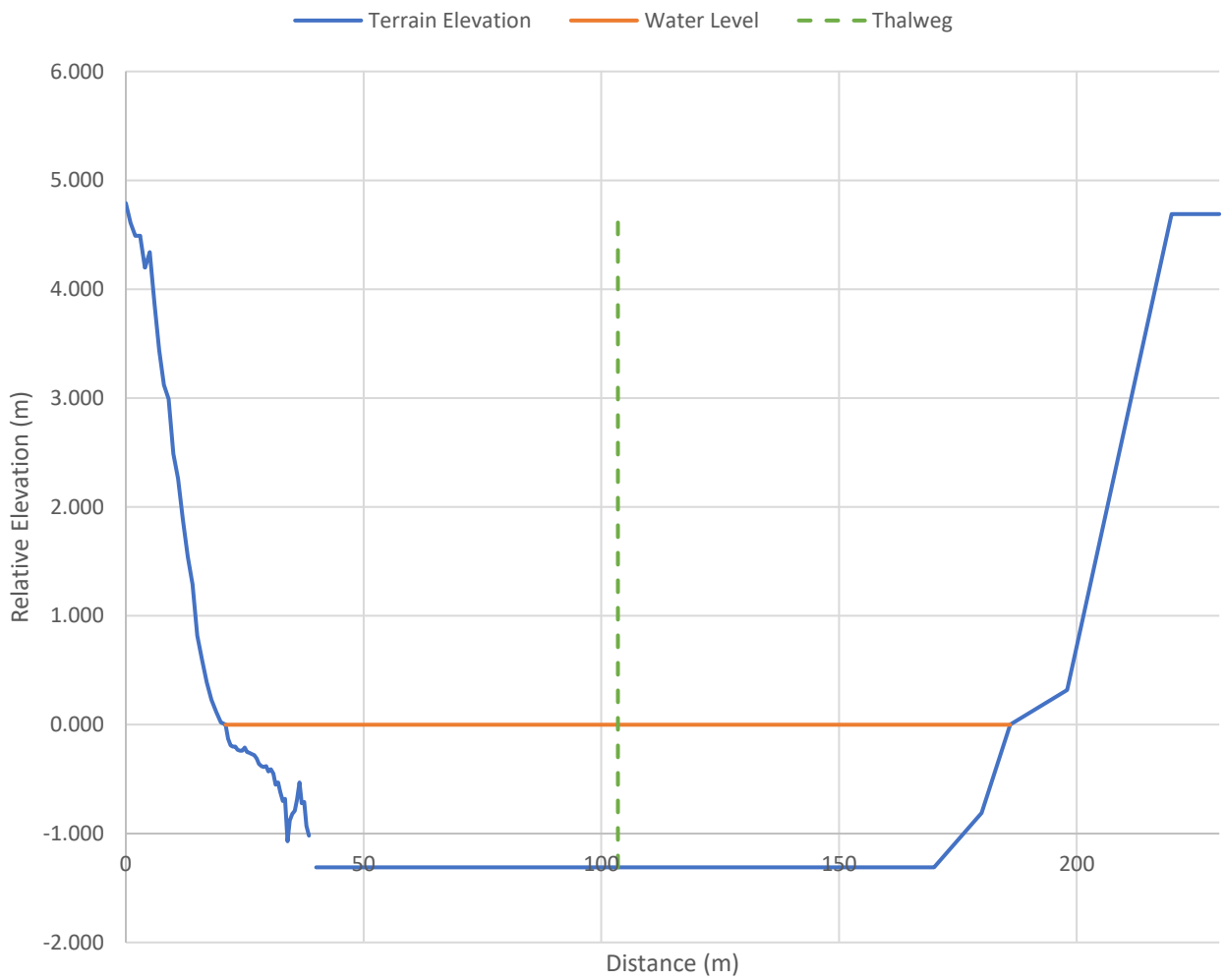
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-27

Cross Section Survey Continued

40	3.000	-1.310	Estimate
43	3.000	-1.310	Estimate
170	3.000	-1.310	Estimate
180	2.500	-0.810	Estimate
186	1.690	0.000	Estimate EOW
198	1.370	0.320	Estimate LDB
220	-3.000	4.690	Estimate
230	-3.000	4.690	Estimate

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-27 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Water depths too deep at crossing location to safely collect topographic channel data and flow measurements. Cross-sectional survey bed was estimated visually from the ground and helicopter along a 190 m section, as detailed on cross-sectional survey.

Project:	21455151	Date Surveyed:	2020-10-24

2020
Water Crossing Surveys
RA1-WC-28

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-28

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 25 m upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	24-10-2020				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	520172	Northing:	5703814
Coordinates of Cross Section:	Zone 16	Easting:	520172	Northing:	5703814
Personnel Present:	KE, JW				
Weather Conditions:	Overcast with light snow, -7°C				
Project:	21455151		Date Surveyed:		2020-10-24

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-28

Current Metering Section:	Surface Geology:	Predominantly organic materials.
	General Description:	Medium-sized permanent watercourse with well-defined bed and banks, unconfined meander pattern, and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation).
	Hydraulic Control:	Old beaver dams
	Sinuosity:	Low sinuosity
	Fluvial	Relatively flat
	Relative Entrenchment:	Slightly entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0.14
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.6
	Wetted Width (m):	2.0
	Floodplain	0.6
	Bankfull Width (m):	2.5
	Floodplain Observations:	Broad and flat topography with heavy cover of shrub and tall grass.
Substrate:	Left Downstream Bank:	Predominantly silt
	Bed:	Predominantly fine sand with trace clay and coarse sand
	Right Downstream Bank:	Predominantly silt

Water Chemistry:	Time measured:	2:44:00 PM		Additional Comments:
	Temperature	0.01	°C	Overhanging grass- and shrub-dominated banks with grasses and shrubs in the floodplain.
	Conductivity:	N/A[1]	mS/cm	
	pH:	6.27		
	Turbidity:	9.12	NTU	1 Conductivity reading unavailable on multiparameter water quality meter. N/A = Not Available
	DO:	11.2	mg/L	
		77.59	%	

Project:	21455151	Date Surveyed:	2020-10-24

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-28

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.93	1.42	
1	0.94	1.41	
2	0.97	1.38	
3	0.7	1.65	
4	0.87	1.48	
5	1.01	1.34	
6	1.03	1.32	
7	1.11	1.24	
8	1.05	1.3	
9	1.23	1.12	
10	1.26	1.09	
11	1.27	1.08	
12	1.36	0.99	
13	1.33	1.02	
14	1.26	1.09	
15	1.48	0.87	
16	1.5	0.85	
17	1.4	0.95	
18	1.37	0.98	
19	1.58	0.77	
20	1.7	0.65	
21	1.71	0.64	
22	1.73	0.62	
23	1.67	0.68	
24	1.7	0.65	
25	1.62	0.73	
26	1.52	0.83	
27	1.49	0.86	LDB
27.5	1.68	0.67	
27.75	1.79	0.56	
28	2.05	0.3	
28.25	2.25	0.1	
28.5	2.35	0	LDB EOW
28.75	2.62	-0.27	
29	2.6	-0.25	
29.25	2.62	-0.27	
29.5	2.56	-0.21	
29.6	2.35	0	RDB EOW
29.75	1.91	0.44	
30	1.7	0.65	
30.25	1.53	0.82	RDB
30.75	1.61	0.74	
32	1.6	0.75	
33	1.6	0.75	
34	1.71	0.64	
35	1.54	0.81	
36	1.46	0.89	
37	1.91	0.44	
38	1.46	0.89	
39	1.46	0.89	
40	1.41	0.94	
41	1.35	1	
42	1.33	1.02	
43	1.56	0.79	
44	1.53	0.82	
45	1.33	1.02	

Project:	21455151	Date Surveyed:	2020-10-24

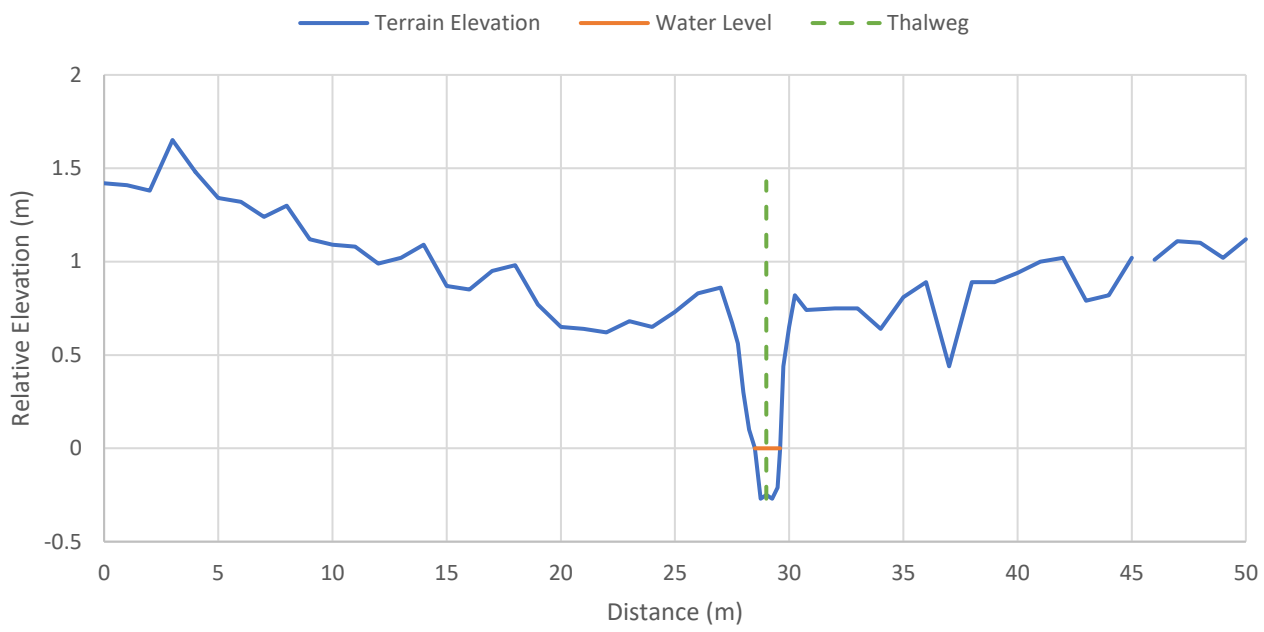
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-28

Cross Section Survey Continued

46	1.34	1.01	
47	1.24	1.11	
48	1.25	1.1	
49	1.33	1.02	
50	1.23	1.12	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-28 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.25	0.06	0.000		LDB
0.35	0.20	0.003		
0.45	0.20	0.009		
0.55	0.22	0.002		
0.65	0.26	0.035		
0.75	0.28	0.063		
0.85	0.30	0.127		
0.95	0.28	0.195		
1.05	0.30	0.172		
1.15	0.30	0.158		
1.25	0.26	0.167		
1.35	0.22	0.152		
1.45	0.20	0.117		
1.55	0.16	0.014		
1.65	0.14	0.004		
1.70	0.14	0.000		RDB

Flow Rate (m^3/s):	**0.032**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-24

2020
Water Crossing Surveys

RA1-4-WC-33

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

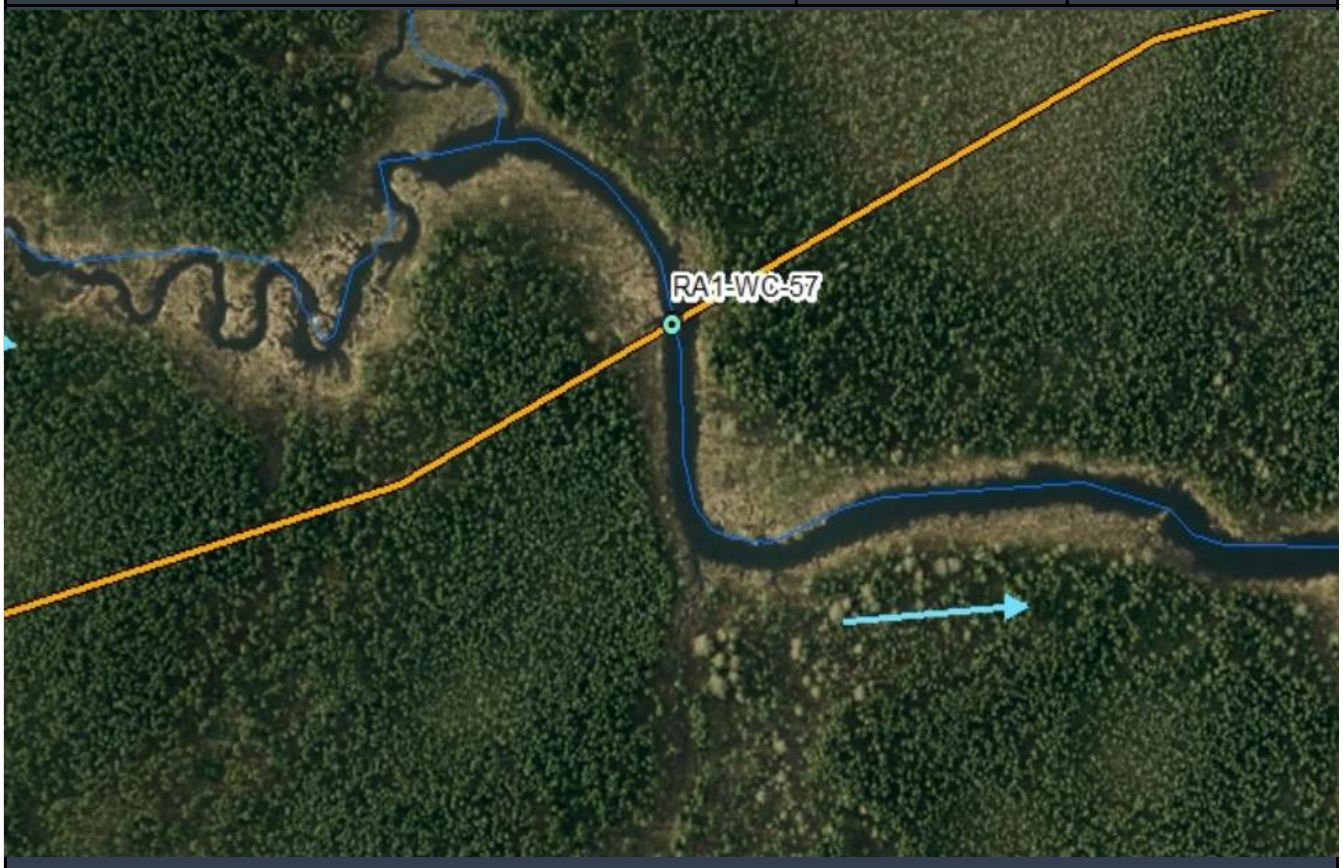
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 25 m upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	20-10-2020				
Location Description:	Large unnamed watercourse that intersects wooded terrain.				
Coordinates of Crossing:	Zone 16	Easting:	518328	Northing:	5743412
Coordinates of Cross Section:	Zone 16	Easting:	518382	Northing:	5743348
Personnel Present:	JD, JF, JB				
Weather Conditions:	Overcast, -1°C, light wind				
Project:	21455151		Date Surveyed:		2020-10-20

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33



Current Metering Section:	Surface Geology:	Predominantly organic materials.	
	General Description:	Large-sized permanent watercourse with moderately defined bed and banks, and moderately stable channel conditions (i.e., dense aquatic vegetation with limited evidence of erosion and sedimentation) and wetted conditions in the riparian zone.	
	Hydraulic Control:	None observed	
	Sinuosity:	Moderate sinuosity	
	Fluvial	Relatively flat.	
	Relative Entrenchment:	Slightly entrenched	
	Fluvial Geomorphology:	In Regime Stability Index: 0	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	2	
	Wetted Width (m):	22.0	
	Floodplain	>2.5	
	Bankfull Width (m):	26.0	
	Floodplain Observations:	Broad and flat topography with moderate cover of shrubs, tall grass, and large trees.	
Substrate:	Left Downstream Bank:	Predominantly organics	
	Bed:	Predominantly organics with silt	
	Right Downstream Bank:	Predominantly organics	
Water Chemistry:	Time measured:	2:15:00 PM	Additional Comments:
	Temperature	1 °C	1 Turbidity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	23 mS/cm	
	pH:	5.8	
	Turbidity:	N/A[1] NTU	
	DO:	10.25 mg/L	
		73.3 %	

Project:	21455151	Date Surveyed:	2020-10-20

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Cross Section Survey

	Distance (m)	Rod	Elevation	Comments	
	-	-	-	Too deep to wade with soft bottom	

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade with soft bottom

Flow Rate (m^3/s):	-
Notes:	Water depths too deep at crossing location to safely collect topographic channel data and flow measurements.

Project:	21455151	Date Surveyed:	2020-10-20

2020
Water Crossing Surveys

RA1-WC-66

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-66

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

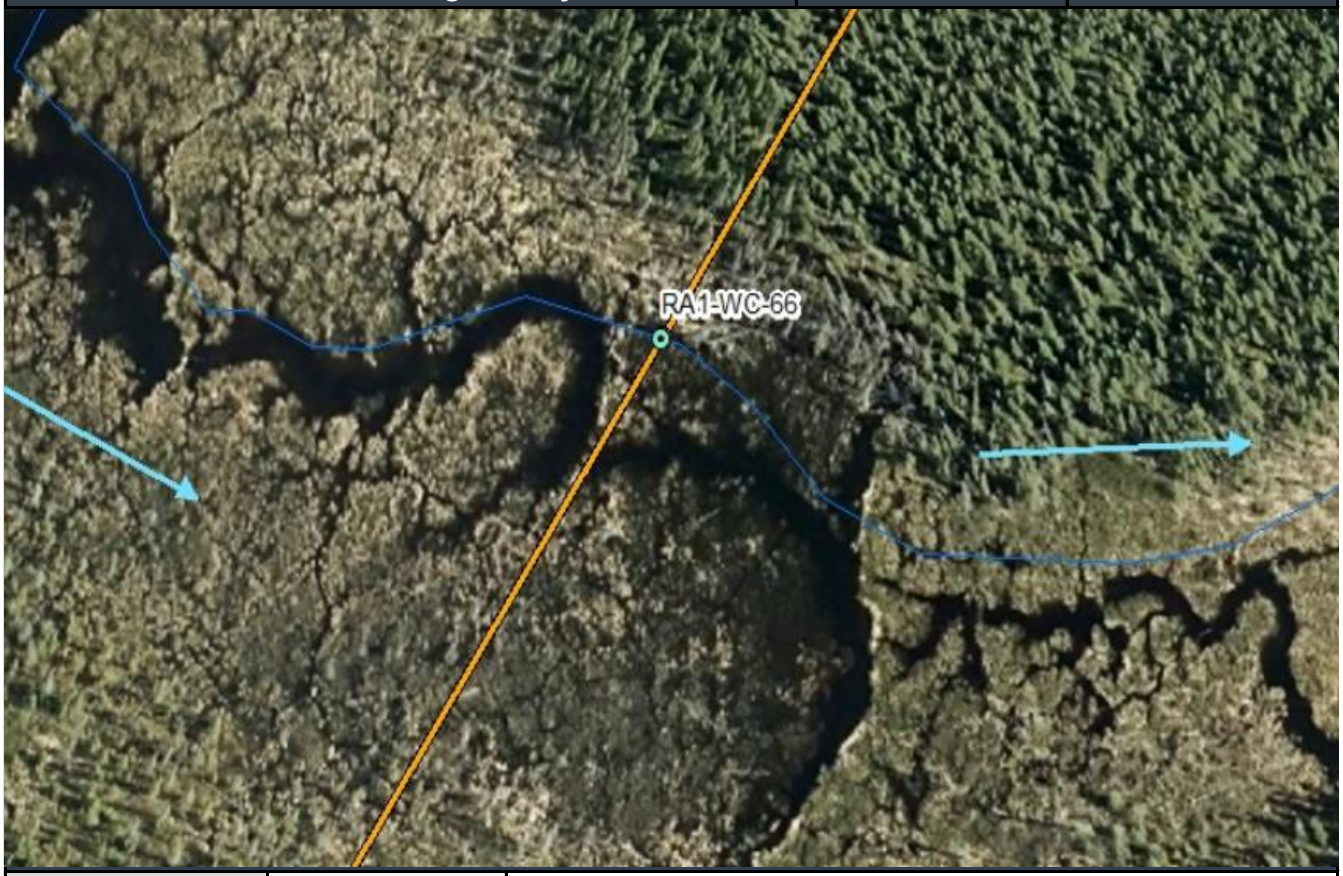
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100 m upstream of crossing; view looking downstream.

Photograph E: Approx. 100 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	20-10-2020				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	527707	Northing:	5740168
Coordinates of Cross Section:	Zone 16	Easting:	527708	Northing:	5740174
Personnel Present:	JD, JF, JB				
Weather Conditions:	Sunny, -3°C, light wind				
Project:	21455151		Date Surveyed:		2020-10-20

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-66



Current Metering Section:	Surface Geology:	Predominantly organic materials.
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).
	Hydraulic Control:	Three old/abandoned dams located downstream of the crossing, coupled wioth beaver activity in immediate vicinity of the crossing.
	Sinuosity:	Low sinuosity
	Fluvial	Relatively flat.
	Relative Entrenchment:	Slightly entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.8
	Wetted Width (m):	9.0
	Floodplain	1.2
	Bankfull Width (m):	17.0
	Floodplain Observations:	Broad and flat topography with heavy cover of shrubs and tall grass.
Substrate:	Left Downstream Bank:	Predominantly organics
	Bed:	Predominantly silt with small portions of organics
	Right Downstream Bank:	Predominantly organics

Water Chemistry:	Time measured:	11:00:00 AM		Additional Comments:
	Temperature	0.5	°C	1 Turbidity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	25.6	mS/cm	
	pH:	6.33		
	Turbidity:	N/A[1]	NTU	
	DO:	10.28	mg/L	
		72.3	%	

Project:	21455151	Date Surveyed:	2020-10-20

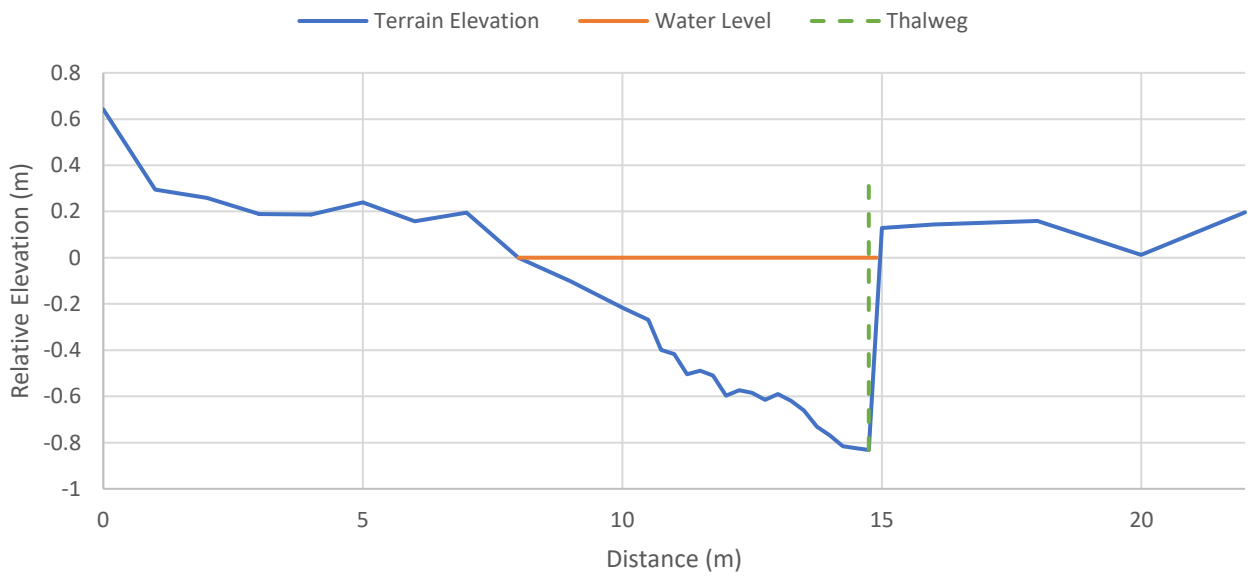
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-66

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.921	0.642	
1	1.268	0.295	
2	1.304	0.259	
3	1.374	0.189	
4	1.376	0.187	
5	1.323	0.24	
6	1.406	0.157	
7	1.368	0.195	LDB
8	1.563	0	LDB EOW
9	1.664	-0.101	
10	1.779	-0.216	
10.5	1.832	-0.269	
10.75	1.962	-0.399	
11	1.98	-0.417	
11.25	2.067	-0.504	
11.5	2.052	-0.489	
11.75	2.073	-0.51	
12	2.16	-0.597	
12.25	2.136	-0.573	
12.5	2.148	-0.585	
12.75	2.178	-0.615	
13	2.153	-0.59	
13.25	2.182	-0.619	
13.5	2.224	-0.661	
13.75	2.294	-0.731	
14	2.331	-0.768	
14.25	2.379	-0.816	
14.5	2.387	-0.824	
14.75	2.395	-0.832	
15	1.434	0.129	RDB
16	1.419	0.144	
18	1.404	0.159	
20	1.551	0.012	
22	1.367	0.196	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-66 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-20

Marten Falls CAR Water Crossing Survey			Crossing Location:		RA1-WC-66
Manual Flow Measurements					
Distance (m)	Depth (m)	Velocity (m/s)			Comments
		60% Depth	80% / 20% Depth		
1.00	0.09	0			
2.00	0.21	0			
2.50	0.27	0.02			
2.75	0.40	0.029			
3.00	0.41	0.02			
3.25	0.50	0.03			
3.50	0.49	0.075			
3.75	0.50	0.075			
4.00	0.58	0.12			
4.25	0.57	0.087			
4.50	0.58	0.103			
4.75	0.60	0.113			
5.00	0.59	0.112			
5.25	0.61	0.095			
5.50	0.66	0.104			
5.75	0.72	0.172			
6.00	0.75		0.183	0.149	
6.25	0.80		0.157	0.194	
6.50	0.82		0.16	0.138	
6.75	0.83		0.131	0.091	
7.00	0.00	0			

Flow Rate (m^3/s):	**0.290**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-20

2020
Water Crossing Surveys

RA4B-WC-01

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4B-WC-01

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100 m upstream of crossing; view looking downstream.

Photograph E: Approx. 100 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	15-10-2020				
Location Description:	Ogoki River				
Coordinates of Crossing:	Zone 16	Easting:	512216	Northing:	5636644
Coordinates of Cross Section:	Zone 16	Easting:	N/A	Northing:	N/A
Personnel Present:	JF, AL, JB				
Weather Conditions:	Overcast, -2°C, snow				
Project:	21455151		Date Surveyed:		2020-10-15

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4B-WC-01

Current Metering Section:	Surface Geology:	Predominantly alluvial materials comprising cobble, boulder, sand, and gravel.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., cobble and boulder dominated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Low sinuosity		
	Fluvial	Moderate slope		
	Relative Entrenchment:	Moderately entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0.07		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A - water depths too deep to safely collect measurements		
	Wetted Width (m):	80.0		
	Floodplain	N/A - water depths too deep to safely collect measurements		
	Bankfull Width (m):	110.0		
	Floodplain Observations:	Broad and sloping topography with moderate cover of large trees.		
Substrate:	Left Downstream Bank:	Predominantly coarse gravel and cobble with some coarse sand and medium gravel, the occasional boulder, and trace ammounts of fine sand and fine gravel.		
	Bed:	Predominantly cobble and boulder with trace amounts of fine sand, coarse sand, fine gravel, and medium gravel.		
	Right Downstream Bank:	Predominantly coarse gravel and cobble with some coarse sand and medium gravel, the occasional boulder, and trace ammounts of fine sand and fine gravel.		
Water Chemistry:	Time measured:	11:00:00 AM		Additional Comments:
	Temperature	6	°C	1 Turbidity and Dissolved Oxygen Percent readings unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	65	mS/cm	
	pH:	5.93		
	Turbidity:	N/A[1]	NTU	
	DO:	11.75	mg/L	
		N/A[1]	%	

Project:	21455151	Date Surveyed:	2020-10-15

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4B-WC-01

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Water depth too deep at crossing location to safely collect cross-sectional data and flow measurements.

Project:	21455151	Date Surveyed:	2020-10-15

2020
Water Crossing Surveys

RA4-WC-15

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-15

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 75 m downstream of crossing; view looking downstream.

Photograph E: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	15-10-2020				
Location Description:	Ogoki River				
Coordinates of Crossing:	Zone 16	Easting:	517655	Northing:	5638092
Coordinates of Cross Section:	Zone 16	Easting:	517710	Northing:	5638229
Personnel Present:	KE, JW				
Weather Conditions:	Overcast, -7°C				
Project:	21455151		Date Surveyed:		2020-10-15

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-15

Current Metering Section:	Surface Geology:	Predominantly bedrock and boulder
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	Island features and bedrock outliers
	Sinuosity:	Low sinuosity
	Bed Slope:	Moderate
	Fluvial	Moderately entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0.07
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A - water depths too deep to allow safe collection
	Wetted Width (m):	150.0
	Bankfull Depth (m):	N/A - water depths too deep to allow safe collection
	Floodplain	190.0
	Floodplain Observations:	Broad and sloping topography with moderate cover of large trees.
Substrate:	Left Downstream Bank:	Predominantly bedrock with small portions of boulder
	Bed:	Predominantly boulder with cobble and bedrock
	Right Downstream Bank:	Not sampled (water depths too deep to safely collect material), but based on visual estimates, the substrate appeared to be relatively identical to the left downstream bank.

Water Chemistry:	Time measured:	11:00:00 AM		Additional Comments:
	Temperature	0.13	°C	1 Conductivity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	N/A[1]	mS/cm	
	pH:	7.79		
	Turbidity:	9.05	NTU	
	DO:	14.6	mg/L	
		102.34	%	

Project:	21455151	Date Surveyed:	2020-10-15

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-15

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.66	2.03	
1	0.78	1.91	
2	0.8	1.89	
3	0.82	1.87	
4	0.96	1.73	
5	1.01	1.68	
6	0.86	1.83	
7	0.88	1.81	
8	0.95	1.74	
9	1	1.69	
10	1.23	1.46	
11	1.32	1.37	
12	1.45	1.24	
13	1.53	1.16	
14	1.55	1.14	
15	1.57	1.12	
16	1.61	1.08	
17	1.65	1.04	
18	1.71	0.98	
19	1.73	0.96	
20	1.83	0.86	
21	1.91	0.78	
22	1.92	0.77	
23	1.88	0.81	
24	1.97	0.72	
25	2.02	0.67	
26	2.07	0.62	
27	2.1	0.59	
28	2.12	0.57	
29	2.12	0.57	
30	2.2	0.49	
31	2.25	0.44	
32	2.38	0.31	
33	2.52	0.17	LDB
33.7	2.69	0	EOW
34	2.79	-0.1	
34.5	2.87	-0.18	
35	2.95	-0.26	
35.5	2.98	-0.29	
36	3.04	-0.35	
36.5	3.08	-0.39	
37	3.09	-0.4	
37.5	3.09	-0.4	
38	3.08	-0.39	
38.5	3.1	-0.41	
39.5	3.18	-0.49	
40	3.18	-0.49	
40.5	3.18	-0.49	
41	3.18	-0.49	
41.5	3.18	-0.49	
42	3.22	-0.53	
42.5	3.27	-0.58	
43	3.31	-0.62	
43.5	3.38	-0.69	
44	3.36	-0.67	
44.5	3.33	-0.64	

Project:	21455151	Date Surveyed:	2020-10-15

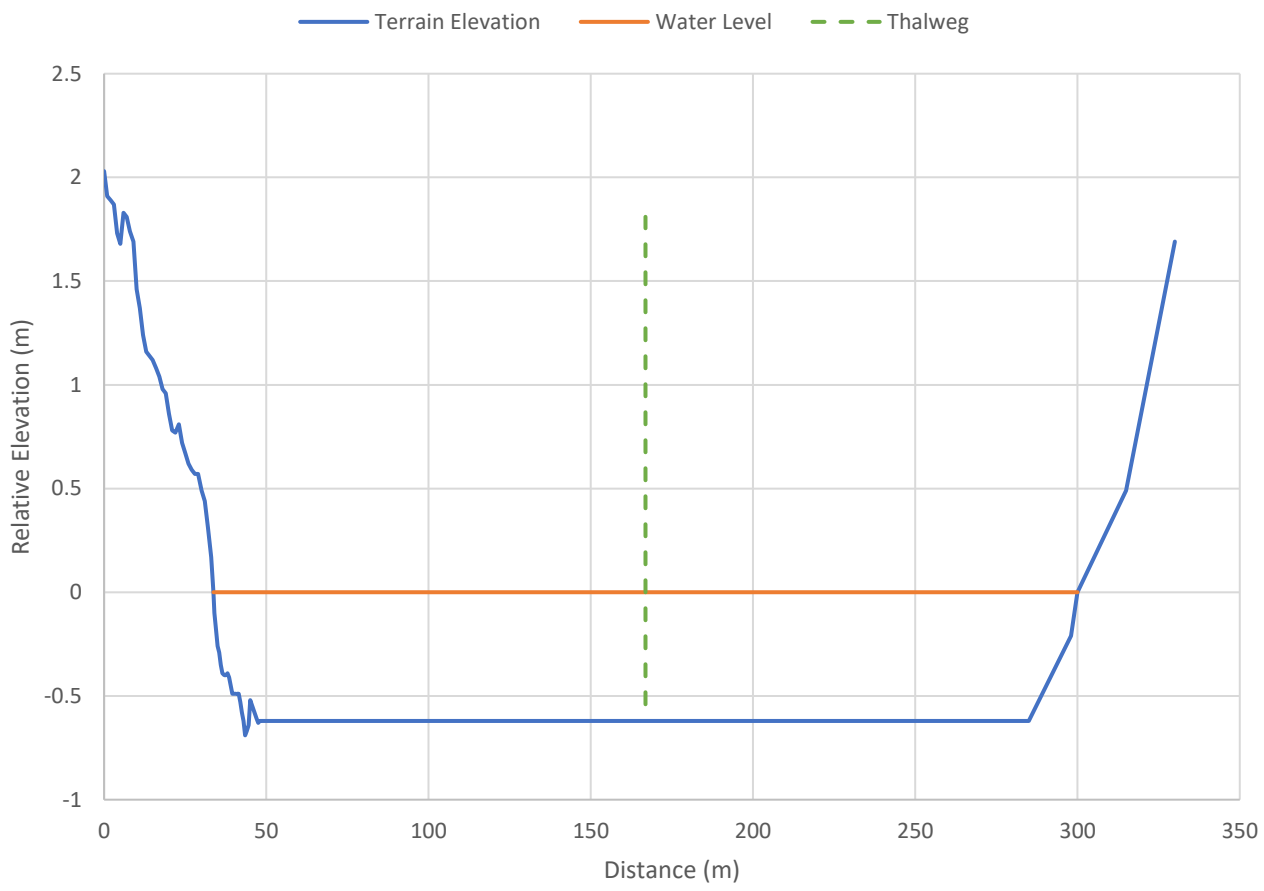
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-15

Cross Section Survey Continued

45	3.21	-0.52		
47	3.3	-0.61		
47.5	3.32	-0.63		
48	3.31	-0.62		
48.5	3.31	-0.62		
50	3.31	-0.62	Estimated	
285	3.31	-0.62	Estimated	
298	2.9	-0.21	Estimated	
300	2.69	0	Estimated EOW	
315	2.2	0.49	Estimated	
330	1	1.69	Estimated	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA4-WC-15 Cross Sectional Profile



Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade.

Flow Rate (m^3/s):	-
Notes:	Water depths too deep at crossing location to safely collect topographic channel data and flow measurements. Channel bed elevations were estimated visually from the ground and helicopter at several points as indicated in the cross-sectional survey table.

Project:	21455151	Date Surveyed:	2020-10-15

2020
Water Crossing Surveys

RA4-WC-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-18

Photograph A: Near crossing location; view looking downstream.

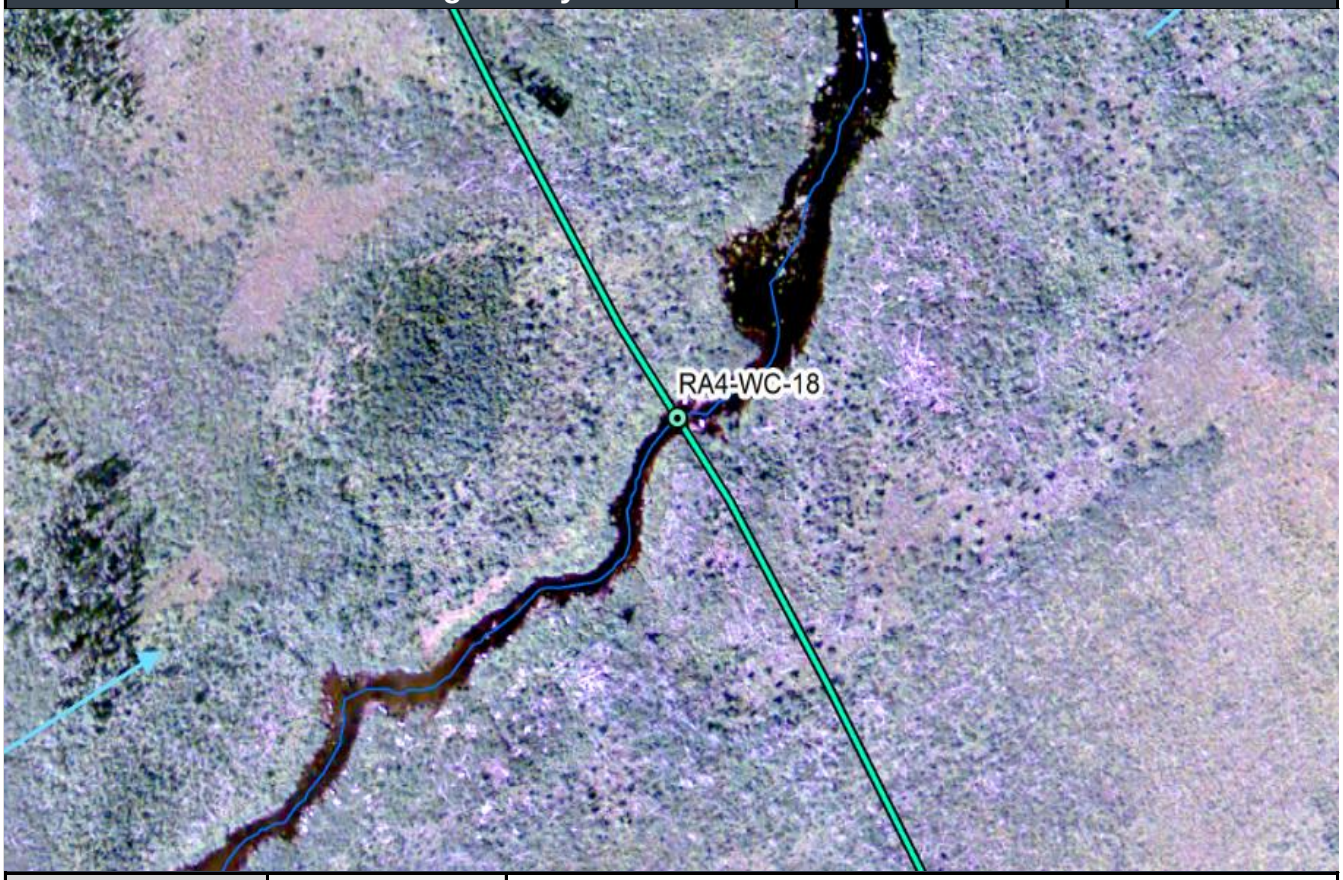
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 100 m upstream of crossing; view looking downstream.

Photograph D: Approx. 100 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	15-10-2020				
Location Description:	Large unnamed river that intersects mostly wooded terrain.				
Coordinates of Crossing:	Zone 16	Easting:	521904	Northing:	5647400
Coordinates of Cross Section:	Zone 16	Easting:	521912	Northing:	5647403
Personnel Present:	JD, JF, JB, AL				
Weather Conditions:	Overcast, -2°C, medium wind				
Project:	21455151		Date Surveyed:		2020-10-15

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-18



Current Metering Section:	Surface Geology:	Predominantly alluvial materials consisting of cobble and boulder
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	old/abandoned beaver dam located downstream of the crossing that was shown to be breached.
	Sinuosity:	Low sinuosity
	Fluvial	1%
	Relative Entrenchment:	Slightly entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.4
	Wetted Width (m):	14.0
	Floodplain	0.9
	Bankfull Width (m):	16.0
	Floodplain Observations:	Broad and flat topography with heavy cover of shrub and tall grass.
Substrate:	Left Downstream Bank:	Predominantly organics
	Bed:	Predominantly cobble and boulder with trace amounts of fine sand, coarse gravel, fine gravel, medium gravel, and coarse gravel.
	Right Downstream Bank:	Predominantly organics

Water Chemistry:	Time measured:	2:10:00 PM		Additional Comments:
	Temperature	5	°C	1 Multiparameter meter error. Turbidity and Dissolved Oxygen readings unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	58	mS/cm	
	pH:	6.6		
	Turbidity:	N/A[1]	NTU	
	DO:	N/A[1]	mg/L	
		N/A[1]	%	

Project:	21455151	Date Surveyed:	2020-10-15

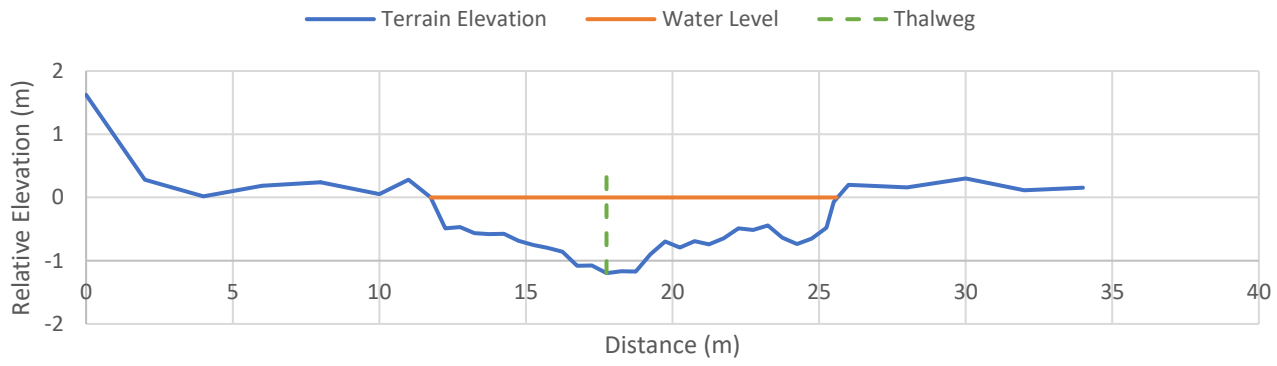
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-18

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.077	1.623	
2	1.42	0.28	
4	1.68	0.02	
6	1.515	0.185	
8	1.46	0.24	
10	1.649	0.051	
11	1.419	0.281	LDB
11.75	1.7	0	LDB EOW
12.25	2.191	-0.491	
12.75	2.168	-0.468	
13.25	2.264	-0.564	
13.75	2.281	-0.581	
14.25	2.277	-0.577	
14.75	2.386	-0.686	
15.25	2.451	-0.751	
15.75	2.497	-0.797	
16.25	2.556	-0.856	
16.75	2.779	-1.079	
17.25	2.777	-1.077	
17.75	2.897	-1.197	
18.25	2.869	-1.169	
18.75	2.872	-1.172	
19.25	2.598	-0.898	
19.75	2.394	-0.694	
20.25	2.494	-0.794	
20.75	2.39	-0.69	
21.25	2.442	-0.742	
21.75	2.347	-0.647	
22.25	2.191	-0.491	
22.75	2.213	-0.513	
23.25	2.143	-0.443	
23.75	2.337	-0.637	
24.25	2.438	-0.738	
24.75	2.35	-0.65	
25.25	2.18	-0.48	
25.5	1.771	-0.071	RDB EOW
26	1.5	0.2	RDB
28	1.542	0.158	
30	1.4	0.3	
32	1.584	0.116	
34	1.547	0.153	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA4-WC-18 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-15

Marten Falls CAR Water Crossing Survey		Crossing Location:	RA4-WC-18

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.50	0.40	0.029		LDB
1.00	0.37	0.062		
1.50	0.38	0.065		
2.00	0.45	0.090		
2.50	0.44	0.195		
3.00	0.51	0.150		
3.50	0.54	0.290		
4.00	0.60	0.310		
4.50	0.60	0.462		
5.00	0.70	0.378		
5.50	0.74	0.473		
6.00	0.82		0.481 0.324	
6.50	0.74	0.446		
7.00	0.71	0.389		
7.50	0.85		0.401 0.300	
8.00	0.65	0.237		
8.50	0.76		0.375 0.255	
9.00	0.66	0.302		
9.50	0.68	0.280		
10.00	0.60	0.325		
10.50	0.44	0.255		
11.00	0.45	0.204		
11.50	0.39	0.178		
12.00	0.56	0.225		
12.50	0.68	0.013		
13.00	0.60	0.019		
13.50	0.45	0.012		RDB

Flow Rate (m^3/s):	**2.065**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-15

2020
Water Crossing Surveys

RA4-WC-22

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-22

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 100 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	25-10-2020				
Location Description:	Large unnamed river that intersects mostly wooded terrain.				
Coordinates of Crossing:	Zone 16	Easting:	520882	Northing:	5657365
Coordinates of Cross Section:	Zone 16	Easting:	520895	Northing:	5657358
Personnel Present:	KE, JW				
Weather Conditions:	Overcast, -7°C				
Project:	21455151		Date Surveyed:		2020-10-25

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-22

Current Metering Section:	Surface Geology:	Predominantly till and bedrock
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, some examples of meander confinement, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	Bedrock outliers
	Sinuosity:	Moderate sinuosity
	Fluvial	Moderate
	Relative Entrenchment:	Slightly entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0.11
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.4
	Wetted Width (m):	9.0
	Floodplain	1.0
	Bankfull Width (m):	9.2
	Floodplain Observations:	Narrow and sloping topography with moderate cover of large trees and shrubs.
Substrate:	Left Downstream Bank:	Predominantly silt with the occasional boulder and bedrock outlier
	Bed:	Predominantly bedrock with small portions of coarse sand, medium gravel, cobble, and boulder.
	Right Downstream Bank:	Predominantly bedrock.

Water Chemistry:	Time measured:	2:14:00 PM		Additional Comments:
	Temperature	0.15	°C	Grass-dominated banks with some bedrock-dominated sections, and well-established coniferous forest in the floodplain. 1 Conductivity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	N/A[1]	mS/cm	
	pH:	7.57		
	Turbidity:	27.91	NTU	
	DO:	14.47	mg/L	
		101.3	%	

Project:	21455151	Date Surveyed:	2020-10-25

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-22

Cross Section Survey

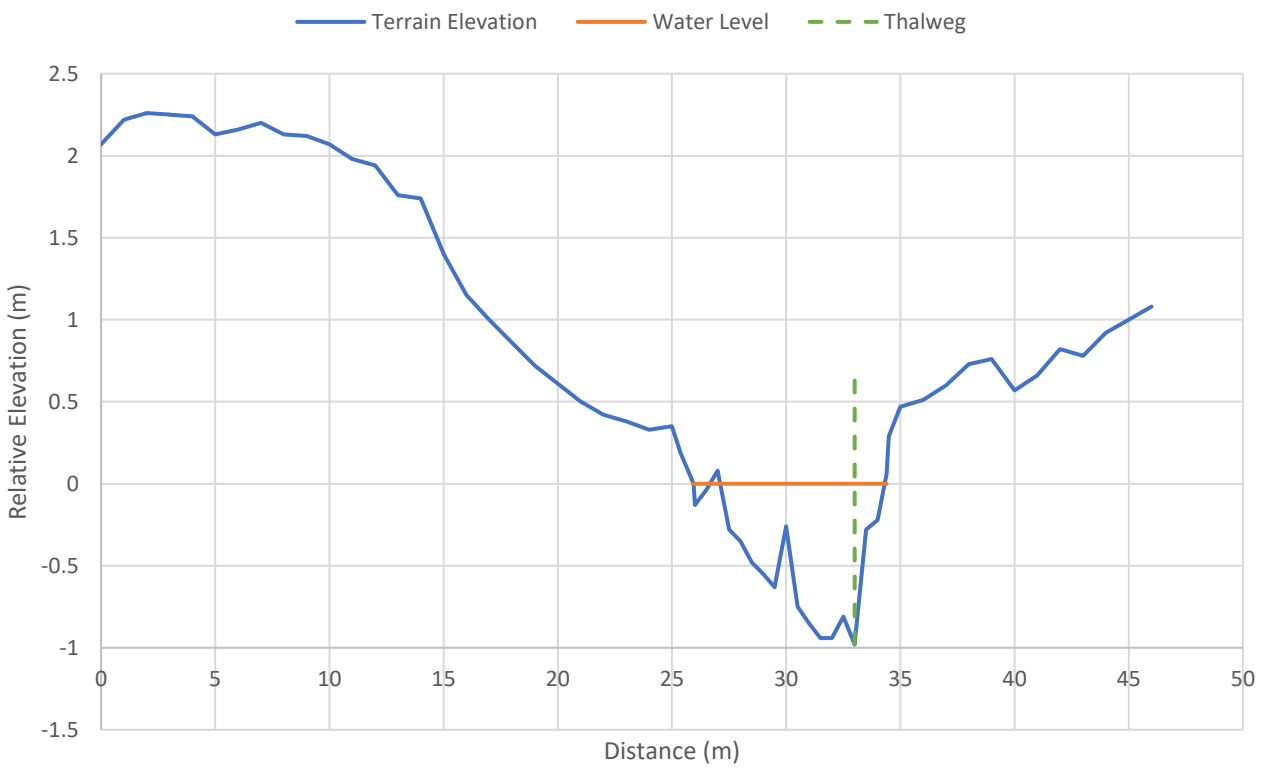
Distance (m)	Rod	Elevation	Comments
0	0.63	2.07	
1	0.48	2.22	
2	0.44	2.26	
3	0.45	2.25	
4	0.46	2.24	
5	0.57	2.13	
6	0.54	2.16	
7	0.5	2.2	
8	0.57	2.13	
9	0.58	2.12	
10	0.63	2.07	
11	0.72	1.98	
12	0.76	1.94	
13	0.94	1.76	
14	0.96	1.74	
15	1.3	1.4	
16	1.55	1.15	
17	1.7	1	
19	1.98	0.72	
21	2.2	0.5	
22	2.28	0.42	
23	2.32	0.38	
24	2.37	0.33	
25	2.35	0.35	
25.38	2.511	0.189	RDB
25.95	2.7	0	EOW
26	2.83	-0.13	
26.5	2.74	-0.04	
27	2.62	0.08	
27.5	2.98	-0.28	
28	3.05	-0.35	
28.5	3.18	-0.48	
29	3.25	-0.55	
29.5	3.33	-0.63	
30	2.96	-0.26	
30.5	3.45	-0.75	
31	3.55	-0.85	
31.5	3.64	-0.94	
32	3.64	-0.94	
32.5	3.51	-0.81	
33	3.68	-0.98	
33.5	2.98	-0.28	
34	2.92	-0.22	
34.4	2.64	0.06	EOW
34.5	2.41	0.29	LDB
35	2.23	0.47	
36	2.19	0.51	
37	2.1	0.6	
38	1.97	0.73	
39	1.94	0.76	
40	2.13	0.57	
41	2.04	0.66	
42	1.88	0.82	
43	1.92	0.78	
44	1.78	0.92	
45	1.7	1	
46	1.62	1.08	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Project:	21455151	Date Surveyed:	2020-10-25

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-22

Water Crossing RA4-WC-22 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-25

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.50	0.26	0.000		LDB
1.75	0.26	0.114		Left downstream braid
2.00	0.28	0.070		
2.25	0.26	0.066		
2.50	0.26	0.019		
2.75	0.24	0.496		
3.00	0.26	0.918		
3.25	0.28	0.825		
3.50	0.28	0.960		
3.75	0.24	0.995		
4.00	0.26	0.917		
4.25	0.20	0.927		
4.50	0.26	0.830		
4.75	0.22	0.855		
5.00	0.18	0.523		
5.25	0.18	0.822		
5.50	0.14	0.856		
5.75	0.10	0.783		
6.00	0.10	0.374		
6.20	0.04	0.000		RDB
				Second channel
7.80	0.06	0.000		LDB
8.00	0.10	0.139		Right downstream braid
8.25	0.06	0.017		
8.50	0.18	0.075		
8.75	0.12	0.247		
9.00	0.12	0.034		
9.25	0.14	0.038		
9.50	0.38	0.350		
9.75	0.40	0.510		
10.00	0.16	0.493		
10.25	0.18	0.427		
10.30	0.00	0.000		RDB

Flow Rate (m^3/s):	**0.746**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-25

2020
Water Crossing Surveys

RA4-WC-31

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-31

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 60 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	18-10-2020				
Location Description:	Small unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	523972	Northing:	5698738
Coordinates of Cross Section:	Zone 16	Easting:	523970	Northing:	5698712
Personnel Present:	KE, JW				
Weather Conditions:	Sunny, -2°C				
Project:	21455151		Date Surveyed:	2020-10-18	

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-31

Current Metering Section:	Surface Geology:	Predominantly organic materials
	General Description:	Small permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation).
	Hydraulic Control:	None observed.
	Sinuosity:	Low sinuosity
	Fluvial	0.9%
	Relative Entrenchment:	Slightly entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0.05
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.4
	Wetted Width (m):	2.5
	Floodplain	0.8
	Bankfull Width (m):	3.7
	Floodplain Observations:	Narrow and sloping topography with heavy cover of large trees and shrubs.
Substrate:	Left Downstream Bank:	Predominantly silt.
	Bed:	Predominantly cobble, boulder, and fine sand with coarse sand and gravel and trace amounts od medium gravel.
	Right Downstream Bank:	Predominantly silt.

Water Chemistry:	Time measured:	1:40:00 PM		Additional Comments:
	Temperature	3.84	°C	Shrubs/willows noted at banks with well-established coniferous forest in the floodplain. 1 Conductivity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	N/A[1]	mS/cm	
	pH:	5.97		
	Turbidity:	0.55	NTU	
	DO:	12.15	mg/L	
		94.41	%	

Project:	21455151	Date Surveyed:	2020-10-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-31

Cross Section Survey

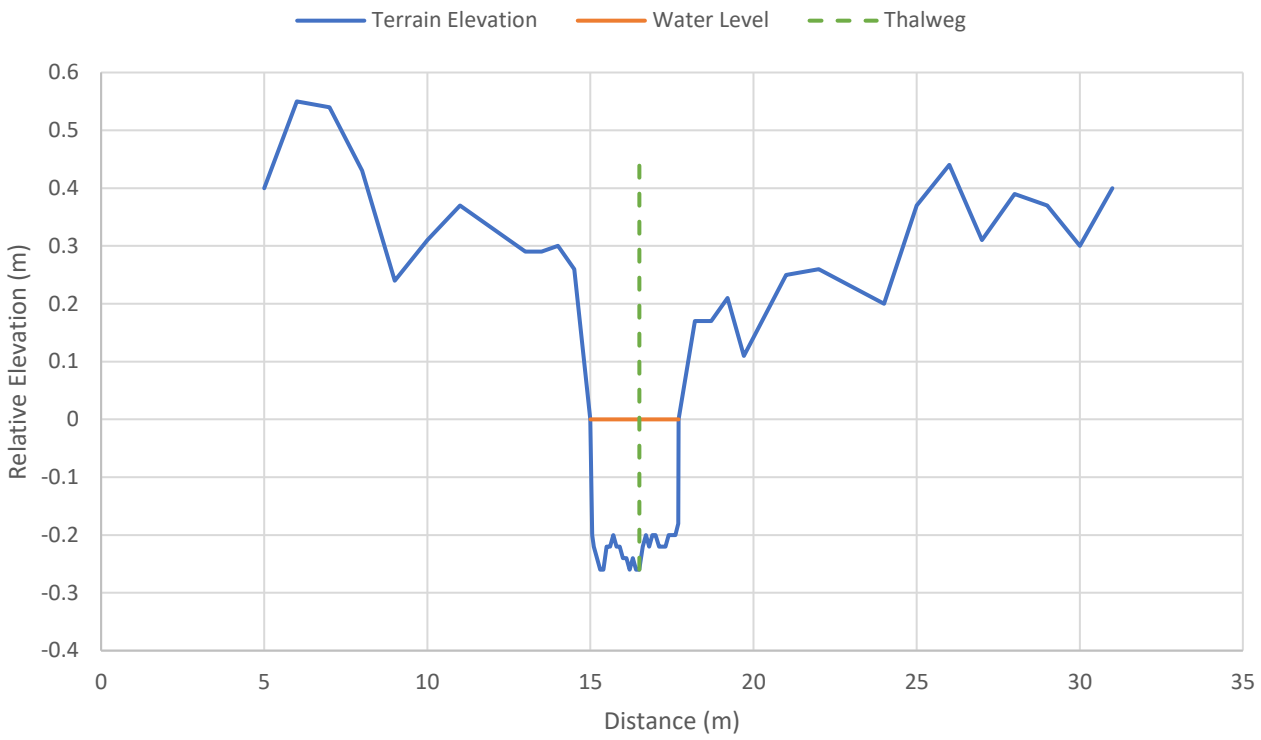
Distance (m)	Rod	Elevation	Comments
5	1.47	0.4	
6	1.32	0.55	
7	1.33	0.54	
8	1.44	0.43	
9	1.63	0.24	
10	1.56	0.31	
11	1.5	0.37	
12	1.54	0.33	
13	1.58	0.29	
13.5	1.58	0.29	
14	1.57	0.3	
14.5	1.61	0.26	LDB
15	1.87	0	EOW
15.05	2.07	-0.2	
15.1	2.09	-0.22	
15.2	2.11	-0.24	
15.3	2.13	-0.26	
15.4	2.13	-0.26	
15.5	2.09	-0.22	
15.6	2.09	-0.22	
15.7	2.07	-0.2	
15.8	2.09	-0.22	
15.9	2.09	-0.22	
16	2.11	-0.24	
16.1	2.11	-0.24	
16.2	2.13	-0.26	
16.3	2.11	-0.24	
16.4	2.13	-0.26	
16.5	2.13	-0.26	
16.6	2.09	-0.22	
16.7	2.07	-0.2	
16.8	2.09	-0.22	
16.9	2.07	-0.2	
17	2.07	-0.2	
17.1	2.09	-0.22	
17.2	2.09	-0.22	
17.3	2.09	-0.22	
17.4	2.07	-0.2	
17.5	2.07	-0.2	
17.6	2.07	-0.2	
17.69	2.05	-0.18	
17.7	1.87	0	EOW
18.2	1.7	0.17	RDB
18.7	1.7	0.17	
19.2	1.66	0.21	
19.7	1.76	0.11	
21	1.62	0.25	
22	1.61	0.26	
23	1.64	0.23	
24	1.67	0.2	
25	1.5	0.37	
26	1.43	0.44	
27	1.56	0.31	
28	1.48	0.39	
29	1.5	0.37	
30	1.57	0.3	
31	1.47	0.4	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Project:	21455151	Date Surveyed:	2020-10-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-31

Water Crossing RA4-WC-31 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-18

Marten Falls CAR Water Crossing Survey		Crossing Location:	RA4-WC-31

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.95	0.20	0.000		
1.00	0.22	0.015		
1.10	0.24	0.052		
1.20	0.26	0.054		
1.30	0.26	0.148		
1.40	0.22	0.139		
1.50	0.22	0.308		
1.60	0.20	0.234		
1.70	0.22	0.226		
1.80	0.22	0.120		
1.90	0.24	0.190		
2.00	0.24	0.186		
2.10	0.26	0.225		
2.20	0.24	0.279		
2.30	0.26	0.221		
2.40	0.26	0.161		
2.50	0.22	0.067		
2.60	0.20	0.210		
2.70	0.22	0.111		
2.80	0.20	0.108		
2.90	0.20	0.197		
3.00	0.22	0.217		
3.10	0.22	0.122		
3.20	0.22	0.078		
3.30	0.20	0.176		
3.40	0.20	0.066		
3.50	0.20	0.067		
3.60	0.18	0.000		

Flow Rate (m^3/s):	**0.090**
Notes:	

Project:	21455151	Date Surveyed:	2020-10-18

2020
Water Crossing Surveys

RA4-WC-34

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 60 m upstream of crossing; view looking downstream.

Photograph E: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	26-10-2020				
Location Description:	Albany River				
Coordinates of Crossing:	Zone 16	Easting:	525077	Northing:	5705308
Coordinates of Cross Section:	Zone 16	Easting:	N/A	Northing:	N/A
Personnel Present:	KE, JW				
Weather Conditions:	Mostly cloudy, -5°C				
Project:	21455151		Date Surveyed:		2020-10-26

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Current Metering Section:	Surface Geology:	Predominantly bedrock.	
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., bedrock-dominated banks with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed.	
	Sinuosity:	Low sinuosity	
	Fluvial	Moderate	
	Relative Entrenchment:	Moderately entrenched.	
	Fluvial Geomorphology:	In Regime Stability Index: 0	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A - water depths too deep at crossing location to safely collect measurements	
	Wetted Width (m):	70.0	
	Floodplain	N/A - water depths too deep at crossing location to safely collect measurements	
	Bankfull Width (m):	77.0	
	Floodplain Observations:	Broad and sloping topography with moderate cover of large trees.	
Substrate:	Left Downstream Bank:	Predominantly boulder.	
	Bed:	N/A - water depths too deep at crossing location to safely collect measurements	
	Right Downstream Bank:	Predominantly boulder.	
Water Chemistry:	Time measured:	12:30:00 PM	Additional Comments:
	Temperature	0.82 °C	Bedrock-dominated banks and a well-established coniferous forest in the floodplain.
	Conductivity:	N/A[1] mS/cm	
	pH:	8.23	
	Turbidity:	33.1 NTU	1 Dissolved Oxygen Percentage reading unavailable on multiparameter water quality meter. N/A = Not Available
	DO:	11.12 mg/L	
		N/A[1] %	

Project:	21455151	Date Surveyed:	2020-10-26

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade.

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade.

Flow Rate (m^3/s):	-
Notes:	Water depths too deep at crossing location to safely collect corss-sectional data and flow measurements.

Project:	21455151	Date Surveyed:	2020-10-26

2020
Water Crossing Surveys

RA4-WC-42

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-42

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

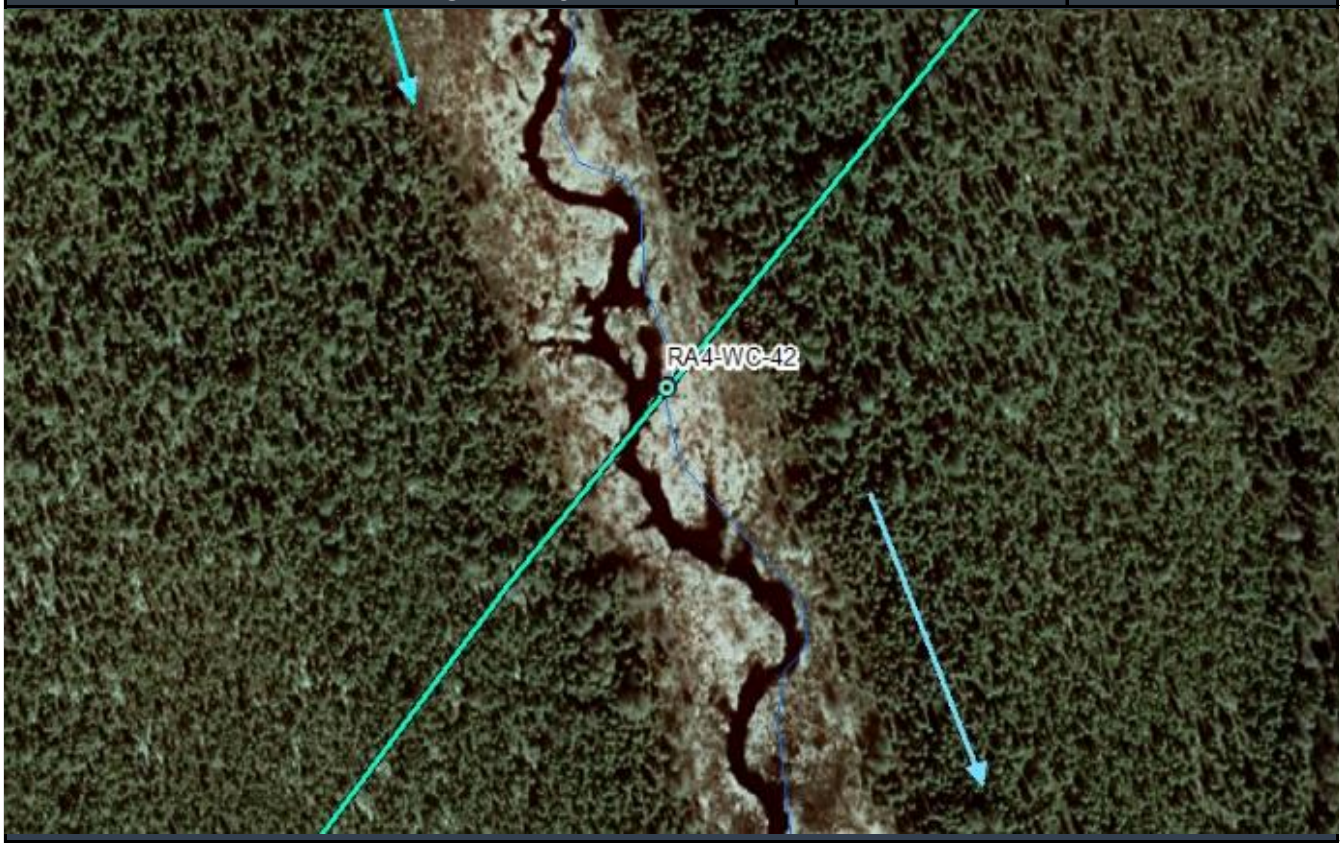
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100 m upstream of crossing; view looking downstream.

Photograph E: Approx. 100 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	19-10-2020				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	525260	Northing:	5740757
Coordinates of Cross Section:	Zone 16	Easting:	528262	Northing:	5716758
Personnel Present:	JD, JF, JB, AL				
Weather Conditions:	Overcast, -5°C, light wind				
Project:	21455151		Date Surveyed:		2020-10-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-42



Current Metering Section:	Surface Geology:	Predominantly alluvial materials consisting of silt.		
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, some examples of meander confinement, unconfined and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation), and wetted conditions in the riparian zone due to beaver activity.		
	Hydraulic Control:	Beaver dam located upstream of crossing.		
	Sinuosity:	Moderate sinuosity		
	Bed Slope:	Relatively flat.		
	Fluvial	Slightly entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.9		
	Wetted Width (m):	4.2		
	Bankfull Depth (m):	1.3		
	Floodplain	55.0		
	Floodplain Observations:	Broad and flat topography with heavy cover of tall grass.		
Substrate:	Left Downstream Bank:	Predominantly organics.		
	Bed:	Predominantly silt with organics.		
	Right Downstream Bank:	Predominantly organics.		
Water Chemistry:	Time measured:	2:55:00 PM		Additional Comments:
	Temperature	1.5	°C	Water depths at crossing location were too deep to safely collect cross-section and flow measurements.
	Conductivity:	20	mS/cm	
	pH:	5.6		
	Turbidity:	N/A[1]	NTU	1 Turbidity reading unavailable on multiparameter water quality meter.
	DO:	11.3	mg/L	
		82	%	N/A = Not Available
Project:	21455151		Date Surveyed:	2020-10-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-42

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade.

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade.

Flow Rate (m^3/s):	-
Notes:	Water depths at crossing were too deep to safely collect cross-section and flow measurements.

Project:	21455151	Date Surveyed:	2020-10-19

2020
Water Crossing Surveys

RA4-WC-45

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-45

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100 m upstream of crossing; view looking downstream.

Photograph E: Approx. 100 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	18-10-2020				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	530775	Northing:	5723140
Coordinates of Cross Section:	Zone 16	Easting:	530773	Northing:	5723169
Personnel Present:	JD, JF, JB				
Weather Conditions:	Overcast, -2°C				
Project:	21455151		Date Surveyed:		2020-10-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-45

Current Metering Section:	Surface Geology:	Predominantly organic materials.		
	General Description:	Small permanent watercourse with moderately defined bed and banks, and and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None.		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat.		
	Relative Entrenchment:	Slightly entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	Greater than 1.1 (water too deep to safely wade)		
	Wetted Width (m):	7.0		
	Floodplain	Greater than 1.15 (water too deep to safely wade)		
	Bankfull Width (m):	100.0		
	Floodplain Observations:	Broad and flat topography with heavy cover of tall grass, with flooded overbank area.		
Substrate:	Left Downstream Bank:	Predominantly clay and silt with organics.		
	Bed:	Predominantly clay and silt with organics.		
	Right Downstream Bank:	Predominantly clay and silt with organics.		
Water Chemistry:	Time measured:	2:40:00 PM		Additional Comments:
	Temperature	2.3	°C	Water depths were too deep at crossing location to safely collect cross-sectional data and flow measurements. 1 Turbidity reading unavailable on multiparameter water quality meter. N/A = Not Available
	Conductivity:	18	mS/cm	
	pH:	5.7		
	Turbidity:	N/A[1]	NTU	
	DO:	10.7	mg/L	
		80	%	

Project:	21455151	Date Surveyed:	2020-10-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-45

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade.

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade.

Flow Rate (m^3/s):	-
Notes:	Water depths at crossing location were too deep to safely collect cross-section and flow measurements.

Project:	21455151	Date Surveyed:	2020-10-18

2020
Water Crossing Surveys

RA4-WC-55

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 60 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	22-10-2020				
Location Description:	Wabassy River				
Coordinates of Crossing:	Zone 16	Easting:	539017	Northing:	5735943
Coordinates of Cross Section:	Zone 16	Easting:	539017	Northing:	5735948
Personnel Present:	KE, JW				
Weather Conditions:	Overcast, -1°C				
Project:	21455151		Date Surveyed:		2020-10-22

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Current Metering Section:	Surface Geology:	Predominantly organic materials
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, unconfined meander pattern and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	None observed.
	Sinuosity:	High sinuosity
	Fluvial	Moderate.
	Relative Entrenchment:	Moderately entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0.11
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.2
	Wetted Width (m):	45.0
	Floodplain	1.95
	Bankfull Width (m):	50.0
	Floodplain Observations:	Broad and sloping topography with sparse cover of large trees and shrubs.
Substrate:	Left Downstream Bank:	Predominantly fine gravel.
	Bed:	Predominantly fine sand and cobble with trace amounts of coarse sand and fine gravel, and the occasional boulder.
	Right Downstream Bank:	Not sampled but appeared to be relatively identical to left downstream bank (based on visual observations).

Water Chemistry:	Time measured:	12:22:00 PM		Additional Comments:
	Temperature	1.05	°C	Regenerating forest noted along banks.
	Conductivity:	N/A[1]	mS/cm	
	pH:	7.91		1 Conductivity reading unavailable on multiparameter water quality meter.
	Turbidity:	1.56	NTU	
	DO:	14.44	mg/L	N/A = Not Available
		102	%	

Project:	21455151	Date Surveyed:	2020-10-22

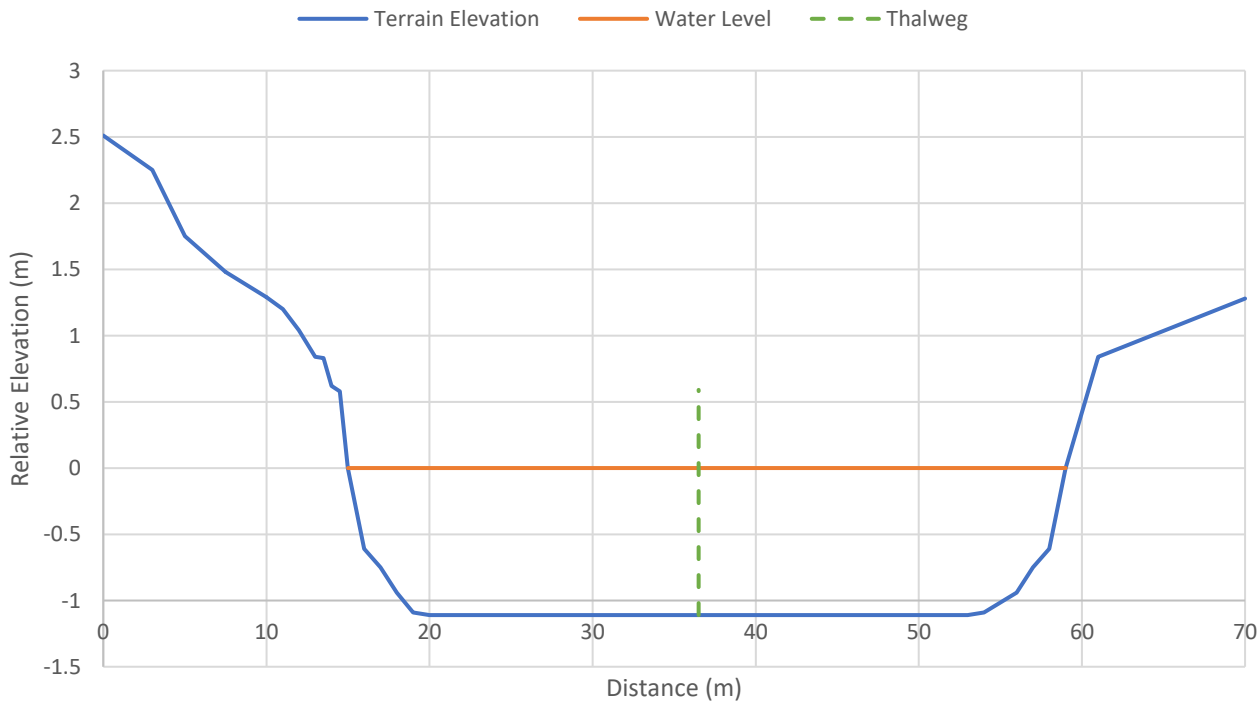
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
0	0.97	2.51	
3	1.23	2.25	
5	1.73	1.75	
7.5	2	1.48	
10	2.19	1.29	
11	2.28	1.2	
12	2.44	1.04	
13	2.64	0.84	
13.5	2.65	0.83	
14	2.86	0.62	
14.5	2.9	0.58	
15	3.48	0	LDB EOW
16	4.09	-0.61	
17	4.23	-0.75	
18	4.42	-0.94	
19	4.57	-1.09	
20	4.59	-1.11	
40	4.59	-1.11	Estimated depth
53	4.59	-1.11	Estimated depth
54	4.57	-1.09	Estimated depth
56	4.42	-0.94	Estimated depth
57	4.23	-0.75	Estimated depth
58	4.09	-0.61	Estimated depth
59	3.48	0	Depth determined by rangefinder
61	2.64	0.84	Depth determined by rangefinder
70	2.2	1.28	Estimated depth

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA4-WC-55 Cross Sectional Profile



Project:	21455151	Date Surveyed:	2020-10-22

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA4-WC-55
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade.

Flow Rate (m^3/s):	**-**		
Notes:	Water depths too deep at crossing location to safely collect topographic channel data and flow measurement. The edge of water and right downstream bank survey points were measured using a laser rangefinder. Channel bed elevations were estimated visually from the ground and helicopter at several points as indicated in the cross-sectional survey table.		
Project:	21455151	Date Surveyed:	2020-10-22

2020
Water Crossing Surveys

RA4-WC-58

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-58

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100 m upstream of crossing; view looking downstream.

Photograph E: Approx. 100 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	18-10-2020				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	539631	Northing:	5736592
Coordinates of Cross Section:	Zone 16	Easting:	539622	Northing:	5736589
Personnel Present:	JD, JF, JB, AL				
Weather Conditions:	Overcast, 3°C				
Project:	21455151		Date Surveyed:		2020-10-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-58

Current Metering Section:	Surface Geology:	Predominantly organic materials.
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, and and stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	None observed.
	Sinuosity:	Moderate sinuosity
	Fluvial	Relatively flat.
	Relative Entrenchment:	Slightly entrenched
	Fluvial Geomorphology:	In Regime Stability Index: 0.08
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.8
	Wetted Width (m):	5.0
	Floodplain	0.9
	Bankfull Width (m):	15.0
	Floodplain Observations:	Broad and flat topography with heavy cover of tall grass and shrubs.
Substrate:	Left Downstream Bank:	Predominantly organics.
	Bed:	Predominantly organics.
	Right Downstream Bank:	Predominantly organics.

Water Chemistry:	Time measured:	11:10:00 AM		Additional Comments:
	Temperature	1.9	°C	Crossing location too deep to safely collect cross-section and flow measurements.
	Conductivity:	29.7	mS/cm	
	pH:	5.65		
	Turbidity:	N/A[1]	NTU	1 Turbidity reading unavailable on multiparameter water quality meter.
	DO:	10.81	mg/L	N/A = Not Available
		79.4	%	

Project:	21455151	Date Surveyed:	2020-10-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-58

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to safely wade with soft bottom sediment.

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade with soft bottom sediment.

Flow Rate (m^3/s):	-
Notes:	Water depths at crossing location were too deep to safely collect cross-section and flow measurements.

Project:	21455151	Date Surveyed:	2020-10-18

2021
Water Crossing Surveys

RA1-4-WC-01

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-01

Photograph A: Near crossing location; view looking downstream.

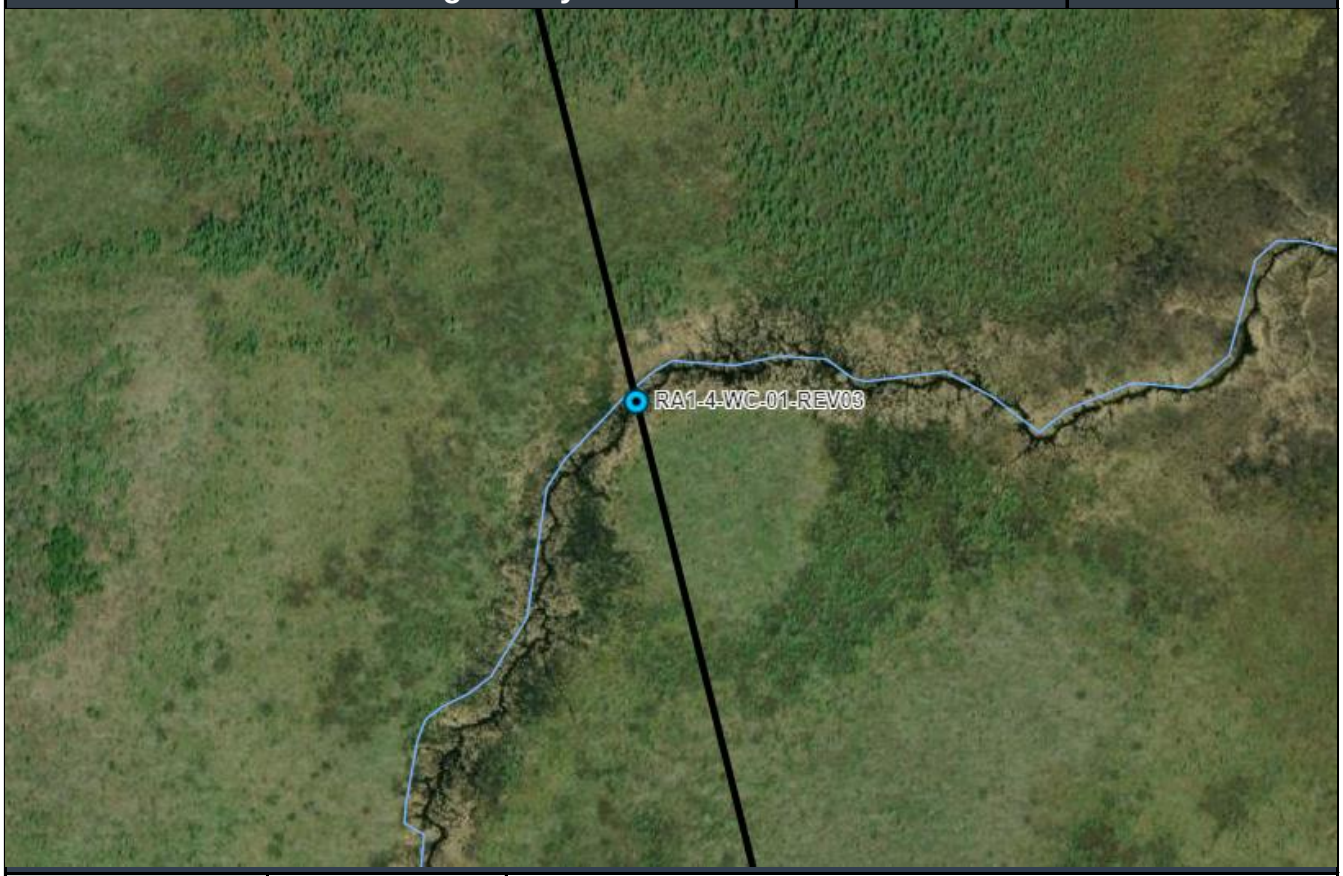
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 50m upstream of crossing; view looking downstream.

Photograph D: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/11/2021				
Location Description:	Low lying area with grasses and shrubs and flooded banks. Defined channel, braided through muc				
Coordinates of Crossing:	Zone 16	Easting:	519622	Northing:	5666913
Coordinates of Cross Section:	Zone 16	Easting:	519624	Northing:	5666914
Personnel Present:	JW, MH, MW				
Weather Conditions:	Rainy/overcast, 12°C				
Project:	21455151		Date Surveyed:	09/11/2021	

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-01



Current Metering Section:	Surface Geology:	Dominated by organics and silt.		
	General Description:	Small permanent unconfined winding channel. Surrounded by large floodplain with grasses, forbes, and shrubs.		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Unconfined and incised		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.24		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.74		
	Wetted Width (m):	N/A		
	Floodplain	1.0		
	Bankfull Width (m):	N/A		
	Floodplain Observations:	Vast floodplain dominated by grasses. Relatively flat.		
Substrate:	Left Downstream Bank:	Mostly organics with some silt		
	Bed:	Mostly organics with some silt		
	Right Downstream Bank:	Mostly organics with some silt		
Water Chemistry:	Time measured:	10:27		Additional Comments:
	Temperature	12.73	°C	
	Conductivity:	58	mS/cm	
	pH:	6.14		
	Turbidity:	0	NTU	
	DO:	9.96	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/11/2021

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-4-WC-01

Cross Section Survey

	Distance (m)	Rod	Elevation	Comments
	-	-	-	Cross-section not completed

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.30	-	-		RDB ROB
1.40	0.73	0.0345		RDB EOW
1.50	0.73	0.0439		
1.60	0.72	0.0318		
1.70	0.70	0.0339		
1.80	0.71	0.0346		
1.90	0.73	0.0486		
2.00	0.74	0.036		
2.10	0.69	0.0371		
2.20	0.64	0.0384		
2.30	0.68	0.039		
2.40	0.61	0.0348		
2.50	0.58	0.0352		LDB EOW
2.60	-	-		LDB TOB

Flow Rate (m^3/s):	**0.031**
Notes:	Cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	09/11/2021

2021
Water Crossing Surveys

RA1-4-WC-07

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-07

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location; view looking downstream.

Inspection Date (mm/dd/yyyy):	09/11/2021				
Location Description:	Crossing located on large winding watercourse with flooded banks and grassy riparian.				
Coordinates of Crossing:	Zone 16	Easting:	519091	Northing:	5682476
Coordinates of Cross Section:	Zone 16	Easting:	519088	Northing:	5682476
Personnel Present:	JW, MH				
Weather Conditions:	Overcast and rainy, 12°C				
Project:	21455151		Date Surveyed:		09/11/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-07

Current Metering Section:	Surface Geology:	Mostly organics and silt		
	General Description:	Large-sized permanent watercourse with poorly defined bed and banks, unconfined and unstable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	Beaver dam		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Unconfined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.24		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	Previously completed		
	Wetted Width (m):	Previously completed		
	Floodplain	Previously completed		
	Bankfull Width (m):	Previously completed		
	Floodplain Observations:	Banks are flooded and floodplain is vast.		
Substrate:	Left Downstream Bank:	80% organics, 20% silt		
	Bed:	80% organics, 20% silt		
	Right Downstream Bank:	80% organics, 20% silt		
Water Chemistry:	Time measured:	14:57		Additional Comments:
	Temperature	14.05	°C	low stability banks, low embededness and low compaction.
	Conductivity:	64	mS/cm	
	pH:	6.58		
	Turbidity:	2	NTU	
	DO:	6.29	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/11/2021

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-4-WC-07

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.40				LDB TOB
1.00	0.22	-		Weeds / flooded bank
1.50	0.15	-		Weeds /flooded bank
2.00	0.19	-		Weeds /flooded bank
2.50	0.20	-		Weeds /flooded bank
3.00	0.36	-		LDB EOW
3.50	0.62	-0.005		
4.00	0.71	0.203		
4.50	0.71	0.141		
5.00	0.62	0.185		
5.50	0.70	0.389		
6.00	0.66	0.282		
6.50	0.56	0.219		
7.00	0.48	0.222		
7.50	0.46	0.151		
8.00	0.44	0.316		
8.50	0.30	0.583		
9.00	0.31	0.318		
9.50	0.32	0.214		
10.00	0.38	0.468		
10.50	0.44	0.285		
11.00	0.38	-		Weeds
11.50	0.26	0.285		RDB edge of chanel
12.00	0.18	-0.006		Weeds / flooded bank
12.50	0.12	0		Weeds / flooded bank
13.00	0.16	-		Weeds / flooded bank
13.50	0.14	-		Weeds / flooded bank
14.00	0.10	-		Weeds / flooded bank
14.50	0.04	-		Weeds / flooded bank
15.00	0.06	-		Weeds / flooded bank
15.50	0.00	-		Weeds / flooded bank
17.00	0.00	-		RDB TOB

Flow Rate (m^3/s):	**0.977**
Notes:	Flow transect completed at beaver dam (~30m upstream from crossing) due to depth of water at crossing (too deep to wade). Cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	09/11/2021

2021
Water Crossing Surveys

RA1-WC-09

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09

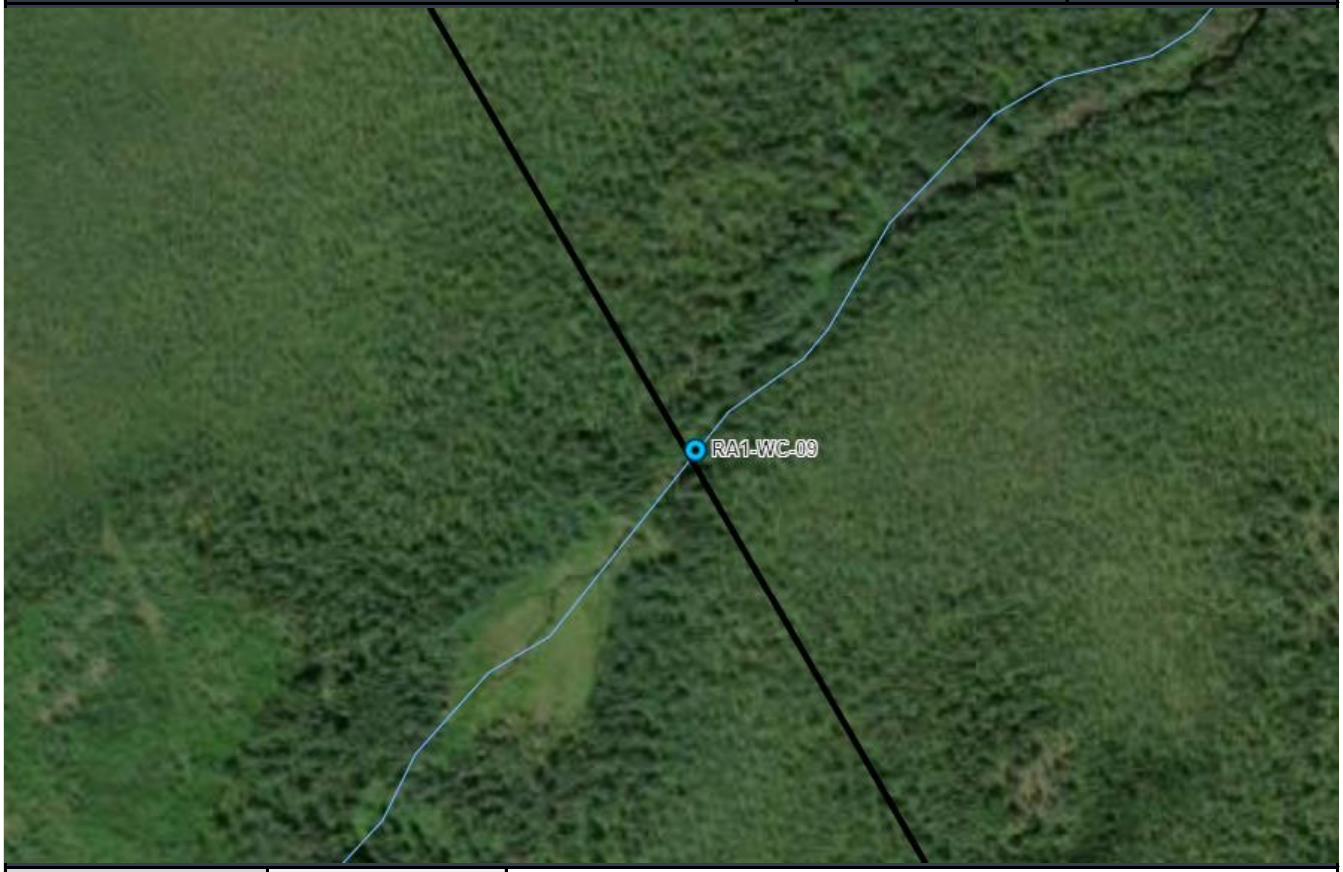
Photograph A: Aerial view near crossing location. View looking downward.

Photograph D: Near crossing location; view looking downstream.

Photograph E: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	09/17/2021				
Location Description:	Small, winding channel. Crossing is located on a small pooled area just downstream of a beaver dam.				
Coordinates of Crossing:	Zone 16	Easting:	532606	Northing:	5644605
Coordinates of Cross Section:	Zone 16	Easting:	532602	Northing:	5644607
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 15°C				
Project:	21455151		Date Surveyed:		09/17/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09



Current Metering Section:	Surface Geology:	Mostly organics and silt	
	General Description:	Small permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentationsuch as undercut banks).	
	Hydraulic Control:	Beaver dam	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Confined	
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.34	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A	
	Wetted Width (m):	N/A	
	Floodplain	N/A	
	Bankfull Width (m):	N/A	
	Floodplain Observations:	Dense mixed forest	
Substrate:	Left Downstream Bank:	50% organics, 50% silt	
	Bed:	60% organics, 40% silt	
	Right Downstream Bank:	50% organics, 50% silt	
Water Chemistry:	Time measured:	10:19	Additional Comments:
	Temperature	12.01 °C	Slumping, undercut banks, fully vegetated, moderately stable, low embededness, moderately compacted banks
	Conductivity:	84 mS/cm	
	pH:	5.4	
	Turbidity:	0 NTU	
	DO:	8.7 mg/L	
		74.8 %	

Project:	21455151	Date Surveyed:	09/17/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.00	-	-		RDB TOB
0.70	-	-		RDB EOW
0.80	0.42	0.013		
0.90	0.44	0.06		
1.00	0.45	0.036		
1.10	0.44	0.054		
1.20	0.46	0.076		
1.30	0.44	0.067		
1.40	0.43	0.094		
1.50	0.42	0.095		
1.60	0.45	0.083		
1.70	0.46	0.088		
1.80	0.48	0.054		
1.90	0.43	0.087		
2.00	0.40	0.098		
2.10	0.38	0.083		
2.20	0.40	0.056		
2.30	0.40	0.058		
2.40	0.40	0.074		
2.50	0.36	0.056		
2.60	0.30	0.029		
2.70	0.30	0.059		
2.80	0.24	0.038		
2.90	0.21	0.005		
3.00	-	-		LDB EOW
3.30	-	-		LDB TOB

Flow Rate (m^3/s):	**0.056**
Notes:	Cross-sectional survey not completed

Project:	21455151	Date Surveyed:	09/17/2021

2021
Water Crossing Surveys

RA1-4-WC-09B

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-09B

Photograph A: Aerial view near crossing location.

Inspection Date (mm/dd/yyyy):	09/12/2021				
Location Description:	Thick forest cover - no place to land. Visual inspection from helicopter used to complete rapid assessment.				
Coordinates of Crossing:	Zone 16	Easting:	525332	Northing:	5714194
Coordinates of Cross Section:	Zone 16	Easting:	N/A	Northing:	N/A
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 12°C				

Project:	21455151	Date Surveyed:	09/12/2021

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-4-WC-09B
Current Metering Section:	Surface Geology:	Primarily organics, silt, and sand substrate.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., densely vegetated.)		
	Hydraulic Control:	None observed.		
	Sinuosity:	High sinuosity		
	Bed Slope:	~0.5		
	Relative Entrenchment:	Unconfined		
	Fluvial Geomorphology:	In Regime Stability Index:		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	~3m		
	Wetted Width (m):	~3m		
	Bankfull Depth (m):	~3m		
	Bankfull Width (m):	~3m		
	Floodplain Observations:	Dense coniferous forest		
Substrate:	Left Downstream Bank:	Organics, silt and sand		
	Bed:	Organics, silt and sand		
	Right Downstream Bank:	Organics, silt and sand		
Water Chemistry:	Time measured:	-		Additional Comments:
				Water quality not completed.
	Temperature	-	°C	
	Conductivity:	-	mS/cm	
	pH:	-		
	Turbidity:	-	NTU	
	DO:	-	mg/L	
		-	%	

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Not completed

Flow Rate (m^3/s):	-
Notes:	Rapid assessment only (unable to land due to dense forest). Water quality, cross-sectional survey, and manual flow measurements not completed.

Project:	21455151	Date Surveyed:	09/12/2021

2021
Water Crossing Surveys

RA1-WC-02

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-02

Photograph A: Near crossing location; view looking downstream.

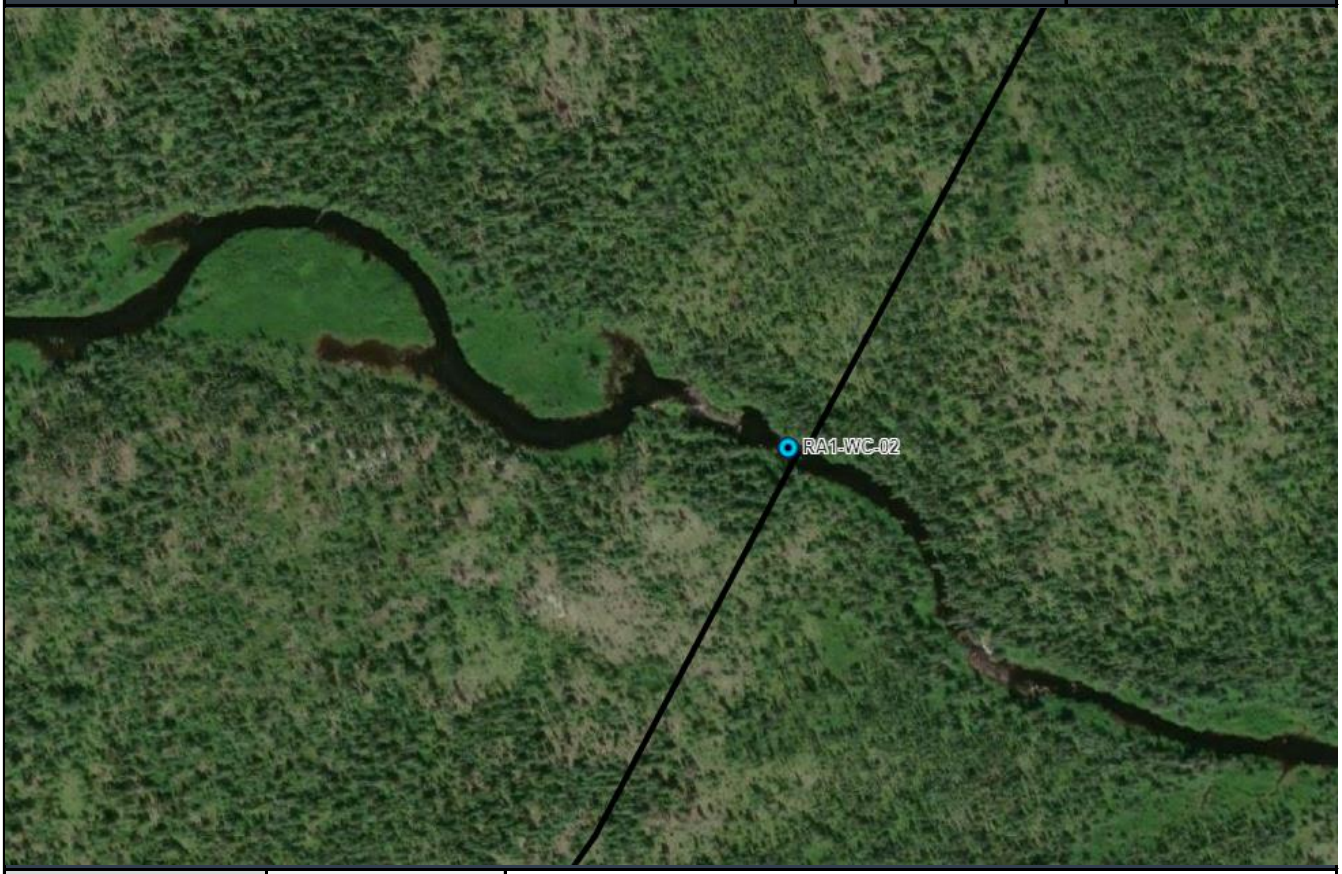
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 120m upstream of crossing; view looking downstream.

Photograph D: Approx. 120m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/14/2021				
Location Description:	Crossing is located at the base of a large pool on a large winding watercourse surrounded by conifer forest.				
Coordinates of Crossing:	Zone 16	Easting:	532383	Northing:	5632976
Coordinates of Cross Section:	Zone 16	Easting:	532383	Northing:	5632978
Personnel Present:	JW, MH				
Weather Conditions:	Rainy, 10°C				
Project:	21455151		Date Surveyed:		09/14/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-02



Current Metering Section:	Surface Geology:	Mostly boulders covered with silt.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	Some woody debris		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Confined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.4		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.3		
	Wetted Width (m):	8.0		
	Floodplain	N/A		
	Bankfull Width (m):	8.0		
	Floodplain Observations:	Shrubs and willows within 3 m of bank with dense, mature coniferous forest up to 25 m away		
Substrate:	Left Downstream Bank:	80% boulders and 20% silt		
	Bed:	50% boulders, 30% cobble, and 20% silt		
	Right Downstream Bank:	60% boulder and 40% silt		
Water Chemistry:	Time measured:	11:23		Additional Comments:
	Temperature	12.7	°C	Fully vegetated, stable.
	Conductivity:	10	mS/cm	
	pH:	6.81		
	Turbidity:	0	NTU	
	DO:	8.81	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/14/2021

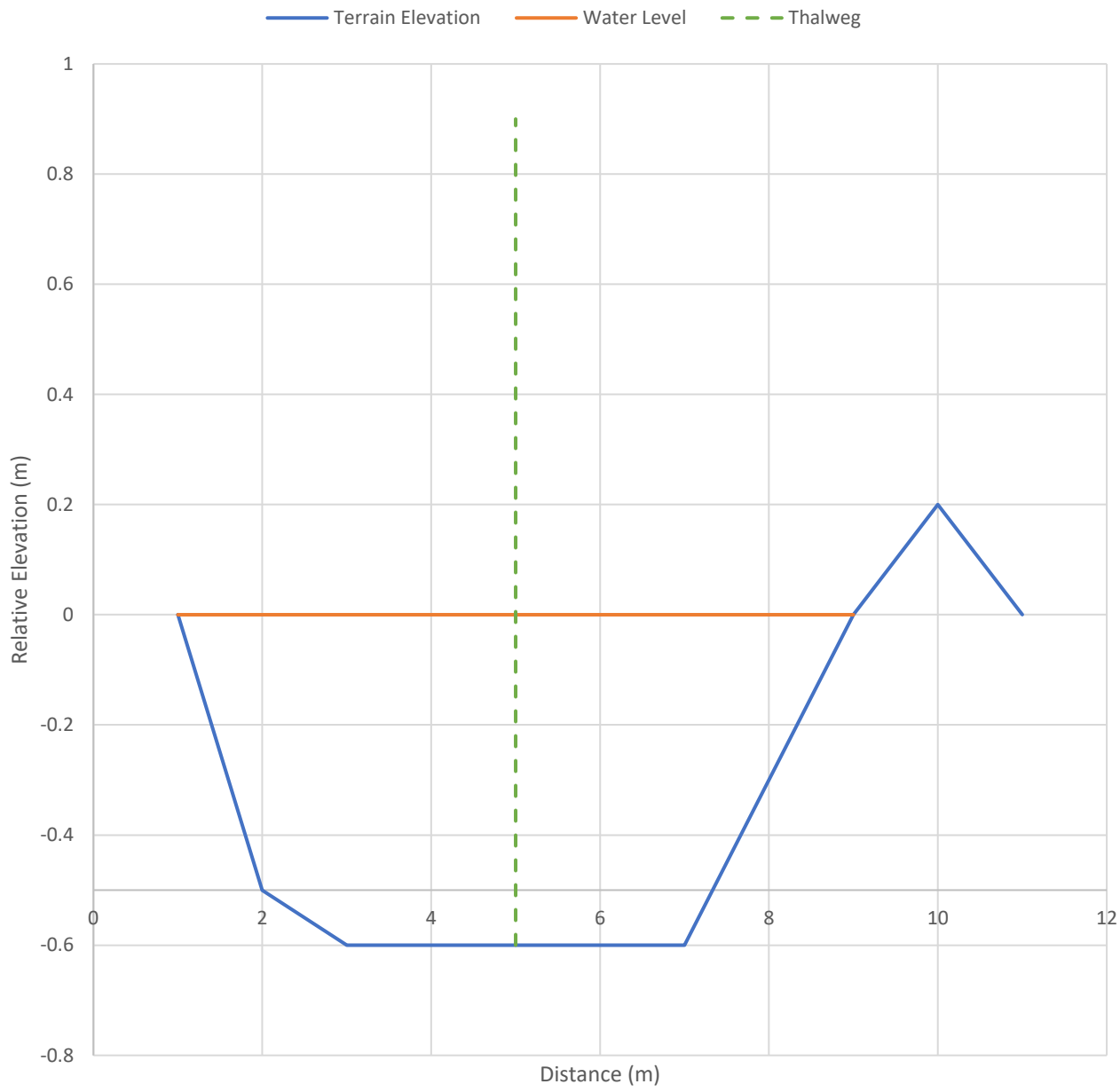
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-02

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
1	0.7	0	Estimated cross section
2	1.2	-0.5	
3	1.3	-0.6	
4	1.3	-0.6	
5	1.3	-0.6	
6	1.3	-0.6	
7	1.3	-0.6	
8	1	-0.3	
9	0.7	0	
10	0.5	0.2	
11	0.7	0	

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-02 Cross Sectional Profile



Project:	21455151	Date Surveyed:	09/14/2021

Marten Falls CAR Water Crossing Survey		Crossing Location:	RA1-WC-02

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.00	-	-		LDB TOP
0.60	0.30	-		LDB EOW
1.20	0.30	0.143		
1.80	0.34	0.167		
2.40	0.56	0.125		
3.00	0.56	0.125		
3.60	0.66	0.167		
4.20	0.75	0.167		
4.80	0.71	0.167		
5.40	0.86	0.200		
6.00	0.85	0.250		
6.60	0.83	0.250		
7.20	0.78	0.250		
7.80	0.78	0.167		
8.40	0.79	0.143		
9.00	0.76	0.143		
9.60	0.73	0.111		
10.20	0.60	0.100		
10.80	0.32	0.071		
11.40	0.14	0.077		
12.00	-	-		RDB EOW
12.60	-	-		RDB TOB

Flow Rate (m^3/s):	**1.148**
Notes:	Velocity was recorded using manual surface flow method (seconds per meter) due to inaccurate digital flow meter readings.

Project:	21455151	Date Surveyed:	09/14/2021

2021
Water Crossing Surveys

RA1-WC-23

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-23

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 125m upstream of crossing; view looking downstream.

Photograph D: Approx. 120m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/15/2021				
Location Description:	Wide and straight defined channel.				
Coordinates of Crossing:	Zone 16	Easting:	521732	Northing:	5691515
Coordinates of Cross Section:	Zone 16	Easting:	521738	Northing:	5691477
Personnel Present:	JW, MH				
Weather Conditions:	Sunny, 10°C				
Project:	21455151		Date Surveyed:		09/15/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-23

Current Metering Section:	Surface Geology:	Difficult to assess due to depth and width of channel.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.17		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>2m		
	Wetted Width (m):	~100m		
	Floodplain	N/A		
	Bankfull Width (m):	~85m		
	Floodplain Observations:	Flooded banks. Wide floodplain with some submergent vegetation within 5m of banks.		
Substrate:	Left Downstream Bank:	Not assessed due to depth, assume similar to RDB (100% silt)		
	Bed:	Not assessed due to depth, assume similar to RDB (100% silt)		
	Right Downstream Bank:	100% silt		
Water Chemistry:	Time measured:	10:34		Additional Comments:
	Temperature	11.58	°C	Fully vegetatied and stable. Moderately embeded, moderate compaction.
	Conductivity:	94	mS/cm	
	pH:	6.73		
	Turbidity:	0	NTU	
	DO:	6.98	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/15/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-23

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Watercourse is too deep to wade. No cross sectional survey or manual flow measurement completed.

Project:	21455151	Date Surveyed:	09/15/2021

2021
Water Crossing Surveys

RA1-WC-67

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-67

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 110m upstream of crossing; view looking downstream.

Photograph D: Approx. 125m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/18/2021				
Location Description:	Wide and straight well defined channel surrounded by conifer forest.				
Coordinates of Crossing:	Zone 16	Easting:	531917	Northing:	5741009
Coordinates of Cross Section:	Zone 16	Easting:	531908	Northing:	5741006
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 8°C				
Project:	21455151		Date Surveyed:		09/18/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-67

Current Metering Section:	Surface Geology:	Mostly organics, silt and clay.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated.)		
	Hydraulic Control:	Lots of woody debris (possibly from cutline) and a small tributuary.		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Confined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.25		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.1		
	Wetted Width (m):	18.0		
	Floodplain	N/A		
	Bankfull Width (m):	22.0		
	Floodplain Observations:	Dominated by shrubs and mature coniferous forest		
Substrate:	Left Downstream Bank:	80% organics, 20% clay		
	Bed:	80% silt, 10% organics, 10% fine sand		
	Right Downstream Bank:	80% organics, 20% clay		
Water Chemistry:	Time measured:	10:10		Additional Comments:
	Temperature	11.7	°C	Fully vegetated and stable banks. Low embededness and medium compaction. Some woody debris; leaning trees and roots; large organic debris.
	Conductivity:	51	mS/cm	
	pH:	6.57		
	Turbidity:	0.3	NTU	
	DO:	6.91	mg/L	
		63.8	%	

Project:	21455151	Date Surveyed:	09/18/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-67

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-3.50	-	-		LDB TOB
1.00	-	-		LDB EOW
2.00	0.48	0.62		
3.00	0.80		-0.045 -0.077	
4.00	0.98		0.058 -0.02	
5.00	1.00		0.086 0.143	
6.00	0.98		0.122 -0.049	
7.00	0.92		0.162 0.152	
8.00	0.94		0.164 -0.168	
9.00	0.93		0.218 0.176	
10.00	0.99		0.173 0.167	
11.00	0.94		0.132 0.116	
12.00	0.78		0.063 0.035	
13.00	0.78		0.066 0.051	
14.00	0.68	0.034		
15.00	0.61	0.091		
16.00	0.67	0.129		
17.00	0.48	0.051		
18.00	0.53	0.032		
19.00	0.45	0.08		
20.00	0.21	-0.003		
20.80	-	-		RDB EOW
21.20	-	-		RDB TOB

Flow Rate (m^3/s):	**1.450**
Notes:	Completed 40m upstream from crossing. Cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	09/18/2021

2021
Water Crossing Surveys

RA4-WC-02

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-02

Photograph A: Near crossing location; view looking downstream.

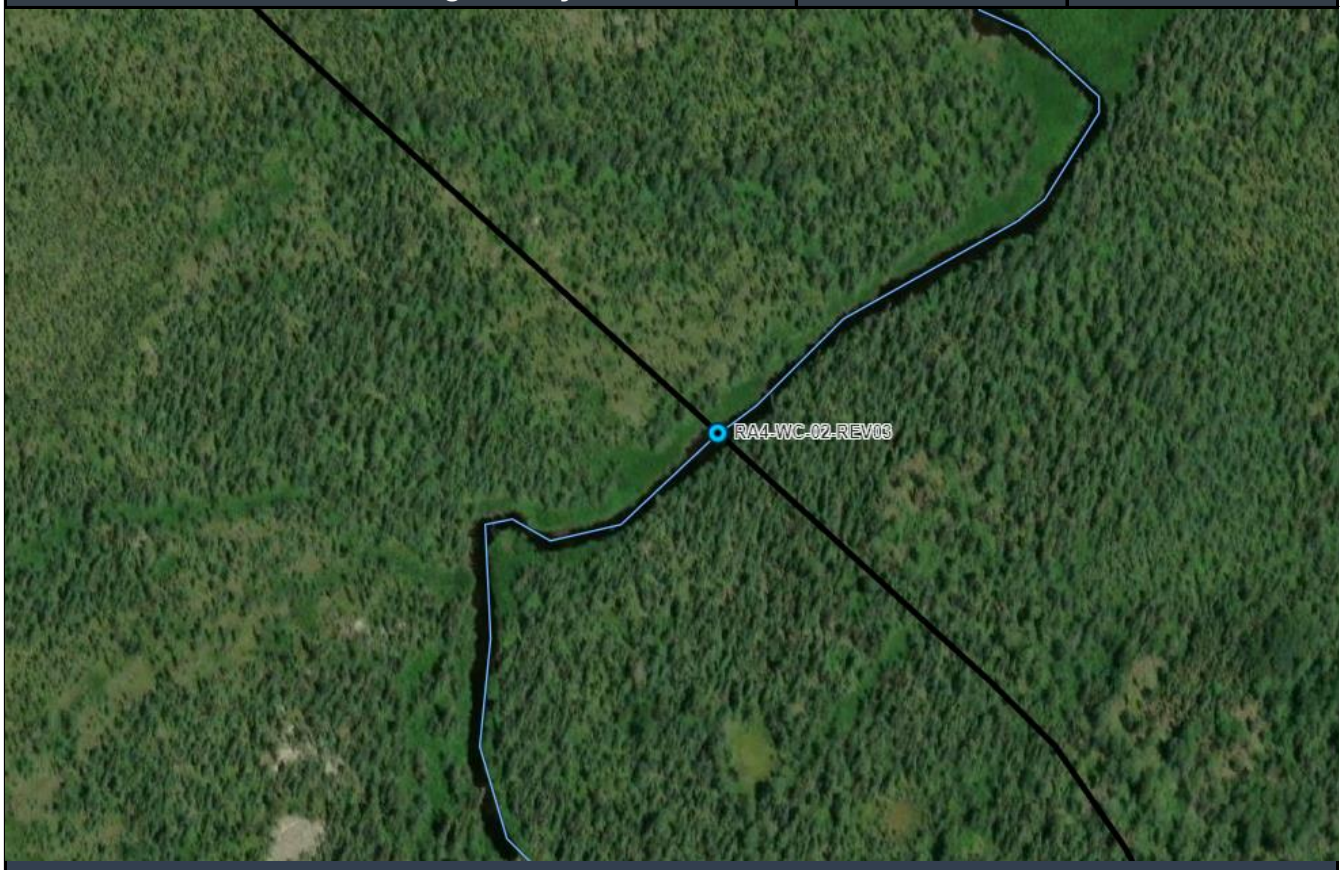
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 115m upstream of crossing; view looking downstream.

Photograph D: Approx. 120m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/17/2021				
Location Description:	Large well defined winding channel surrounded by conifer forest.				
Coordinates of Crossing:	Zone 16	Easting:	521688	Northing:	5624119
Coordinates of Cross Section:	Zone 16	Easting:	521683	Northing:	5624116
Personnel Present:	JW, MH				
Weather Conditions:	Partly cloud, 17°C				
Project:	21455151		Date Surveyed:		09/17/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-02



Current Metering Section:	Surface Geology:	Silt		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentationsuch as undercut banks).		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Occasionally Confined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.31		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1m		
	Wetted Width (m):	12m		
	Floodplain	N/A		
	Bankfull Width (m):	13m		
	Floodplain Observations:	Shrubs with a mature coniferous forest		
Substrate:	Left Downstream Bank:	100% silt		
	Bed:	100% silt		
	Right Downstream Bank:	100% silt		
Water Chemistry:	Time measured:	13:03		Additional Comments:
	Temperature	13.585	°C	Stable banks with low embededness and medium compaction. Banks are lined with shrubs
	Conductivity:	93	mS/cm	
	pH:	6.06		
	Turbidity:	0.6	NTU	
	DO:	10.14	mg/L	
		97.4	%	

Project:	21455151	Date Surveyed:	09/17/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-02

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.00	-	-		RDB TOB
0.60	-	-		RDB EOW
1.20	0.20	0.038		
1.80	0.22	0.057		
2.40	0.36	0.157		
3.00	0.54	0.22		
3.60	0.73	0.279		
4.20	1.00	0.068		
4.80	0.98	0.061		
5.40	0.81	0.258		
6.00	0.89	0.259		
6.60	1.00	0.219		
7.20	0.98	0.332		
7.80	0.94	0.332		
8.40	0.84	0.258		
9.00	0.80	0.204		
9.60	0.64	0.117		
10.20	0.69	0.191		
10.80	0.58	0.103		
11.40	0.49	0.029		
12.00	0.50	0.016		
12.60	0.49	0.013		
13.00	-	-		LDB EOW
14.60	-	-		LDB TOB

Flow Rate (m^3/s):	**1.500**
Notes:	Vast vegetation in the channel that could have potentially affected flow readings. Cross-sectional survey not completed

Project:	21455151	Date Surveyed:	09/17/2021

2021
Water Crossing Surveys

RA4-WC-21

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-21

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 120m upstream of crossing; view looking downstream.

Photograph D: Approx. 170m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/18/2021				
Location Description:	Large well defined channel with irregular meandering and unconfined with grasses and shrubs surrounding channel.				
Coordinates of Crossing:	Zone 16	Easting:	521131	Northing:	5656047
Coordinates of Cross Section:	Zone 16	Easting:	521136	Northing:	5656049
Personnel Present:	JW, MH				
Weather Conditions:	Mostly cloudy, 15°C				
Project:	21455151		Date Surveyed:		09/18/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-21

Current Metering Section:	Surface Geology:	Mostly organics		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Unconfined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.24		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5m		
	Wetted Width (m):	125m		
	Floodplain	N/A		
	Bankfull Width (m):	8m		
	Floodplain Observations:	Wide and vast flooded area (~180m) with poorly defined banks. Floodplain has much submergent vegetation.		
Substrate:	Left Downstream Bank:	90% organics, 10% silt		
	Bed:	90% organics, 10% silt		
	Right Downstream Bank:	90% organics, 10% silt		
Water Chemistry:	Time measured:	15:20		Additional Comments:
	Temperature	15.52	°C	I.e., Fully vegetated, low stability (poorly defined banks), low embededness, low compaction
	Conductivity:	86	mS/cm	
	pH:	6.54		
	Turbidity:	6	NTU	
	DO:	5.45	mg/L	
		52.4	%	

Project:	21455151	Date Surveyed:	09/18/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-21

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Not completed

Flow Rate (m^3/s):	-
Notes:	Too deep to wade. Cross-sectional survey and manual flow measurements not completed.

Project:	21455151	Date Surveyed:	09/18/2021

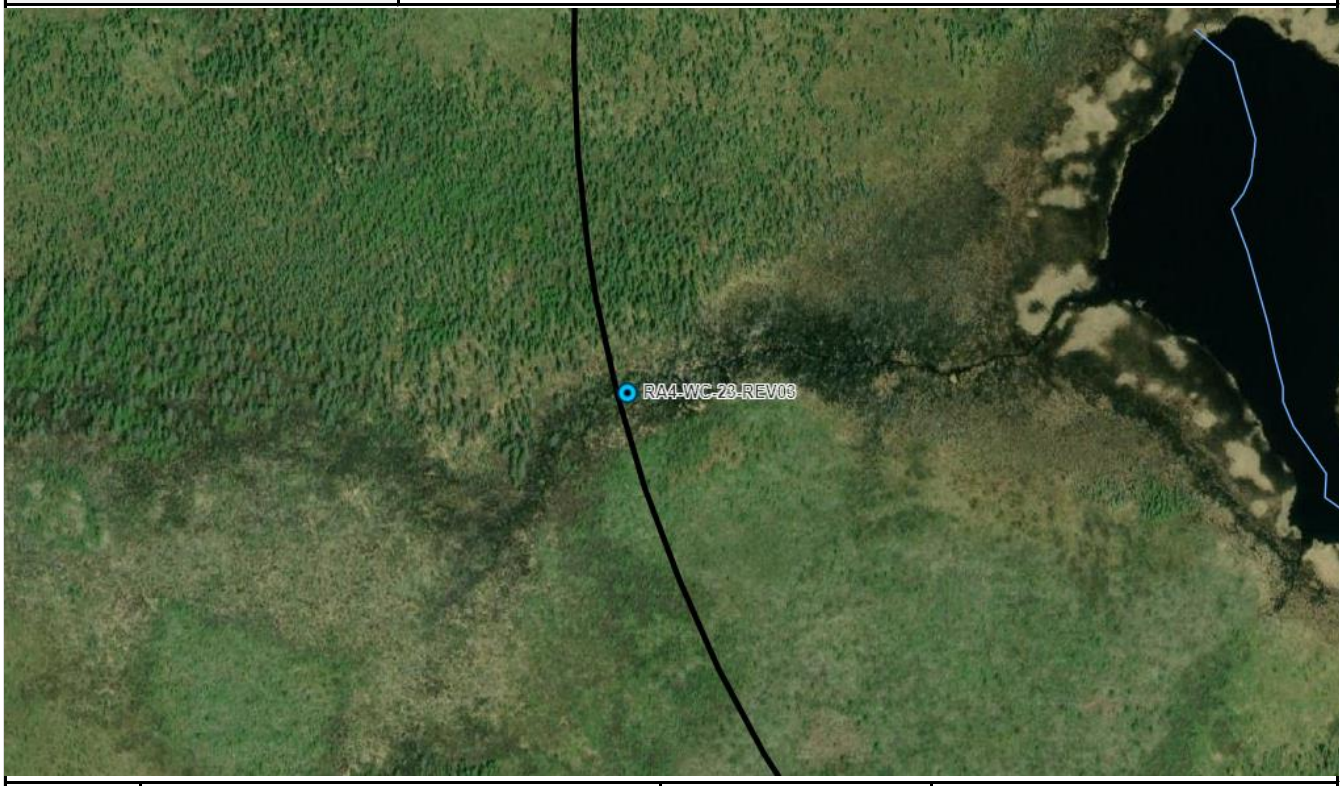
2021
Water Crossing Surveys

RA4-WC-23

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-23

Photograph A: Aerial view near crossing location.

Inspection Date (mm/dd/yyyy):	09/13/2021				
Location Description:	No landing zone near crossing. Watercourse is impounded with water flooding (No defined channel at crossing). There is a defined channel downstream of the crossing which flows into a small lake.				
Coordinates of Crossing:	Zone 16	Easting:	519751	Northing:	5658577
Coordinates of Cross Section:	Zone 16	Easting:	-	Northing:	-
Personnel Present:	JW, MH				
Weather Conditions:					



Project:	21455151	Date Surveyed:	09/13/2021

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA4-WC-23
Current Metering Section:	Surface Geology:	Primarily organics and silt		
	General Description:	Large-sized permanent watercourse with poorly defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Low sinuosity		
	Bed Slope:	0%		
	Relative Entrenchment:	N/A		
	Fluvial Geomorphology:	In Adjustment Stability Index: N/A		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	~60m		
	Wetted Width (m):	N/A		
	Bankfull Depth (m):	N/A		
	Bankfull Width (m):	3.5		
	Floodplain Observations:	Vast flooding. Floodplain is relatively flat with shrubs and standing snags.		
Substrate:	Left Downstream Bank:	N/A		
	Bed:	N/A		
	Right Downstream Bank:	N/A		

Water Chemistry:	Time measured:	-		Additional Comments:
	Temperature	-	°C	N/A
	Conductivity:	-	mS/cm	
	pH:	-		
	Turbidity:	-	NTU	
	DO:	-	mg/L	
		-	%	

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Fluvial Geomorphology:	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Not completed

Flow Rate (m^3/s):	-
Notes:	Only rapid assessment completed due to inability to land. Water quality, cross-sectional survey, and manual flow measurements not completed.

Project:	21455151	Date Surveyed:	09/13/2021

2021
Water Crossing Surveys

RA4-WC-26

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-26

Photograph A: Near crossing location. View looking downward.

Photograph B: Near crossing location; view looking downstream. North channel.

Photograph C: Near crossing location: view looking upstream. South channel.

Photograph D: Approx. 75 m upstream of crossing; view looking downstream.

Photograph E: Approx. 30m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/13/2021				
Location Description:	Small meandering channels that intersects branch within a fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	519974	Northing:	5663183
Coordinates of Cross Section:	Zone 16	Easting:	519977	Northing:	5663181
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 10°C				
Project:	21455151		Date Surveyed:		09/13/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-26

Current Metering Section:	Surface Geology:	Mostly boulders and cobble		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentationsuch as undercut banks).		
	Hydraulic Control:	Beaver dam just upstream from crossing, creating two channels. Large impoundment downstream of crossing (flooded).		
	Sinuosity:	High sinuosity		
	Bed Slope:	Relativel flat		
	Relative Entrenchment:	Un-confined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.34		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A		
	Wetted Width (m):	N/A		
	Bankfull Depth (m):	N/A		
	Bankfull Width (m):	N/A		
	Floodplain Observations:	Flooded banks. Floodplain is flat and heavily vegetated with a lot of submereged vegetation, grasses and shrubs, and floating vegetation.		
Substrate:	Left Downstream Bank:	100% silt		
	Bed:	50% boulders, 30% cobble, 10% coarse sand, 5% medium gravel,m 5% coarse gravel		
	Right Downstream Bank:	100% silt		
Water Chemistry:	Time measured:	11:20		Additional Comments:
	Temperature	12.82	°C	Fully vegetated, low stability, medium embedded, highly compacted banks
	Conductivity:	112	mS/cm	
	pH:	6.62		
	Turbidity:	0	NTU	
	DO:	10.49	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/13/2021

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA4-WC-26
Cross Section Survey				
Distance (m)	**Rod**	**Elevation**	**Comments**	
-	-	-	Not completed	

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.80	-	-		RDB EOW
1.00	0.22	0.157		
1.25	0.28	0.216		
1.50	0.29	0.147		
1.75	0.21	0.334		
2.00	0.35	0.33		
2.25	0.39	0.221		
2.50	0.34	0.302		
2.75	0.32	0.208		
3.00	0.37	0.171		
3.25	0.40	0.107		
3.50	0.41	0.113		
3.75	0.29	0.112		
4.00	0.29	0.153		
4.25	0.37	0.186		
4.50	0.42	0.072		
4.75	0.34	0.012		
5.00	0.28	0.118		
5.25	0.31	0.077		
5.40	-	-		LDB EOW

Flow Rate (m^3/s):	**0.242**
Notes:	North Channel

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.60	-	-		RDB EOW
0.70	0.53	0.185		
0.80	0.52	0.11		
0.90	0.46	0.12		
1.00	0.51	0.279		
1.10	0.49	0.35		
1.20	0.51	0.315		
1.30	0.52	0.12		
1.40	0.58	0.145		
1.50	0.50	0.106		
1.60	0.54	0.115		
1.70	0.54	0.117		
1.80	0.52	0.108		
1.90	0.60	0.136		
2.00	0.54	0.119		
2.10	0.54	0.176		
2.20	0.52	0.057		
2.30	0.53	0.011		
2.40	0.48	0.029		
2.50	-	-		LDB EOW

Flow Rate (m^3/s):	**0.138**		
Notes:	South Channel		
Project:	21455151	Date Surveyed:	09/13/2021

2021
Water Crossing Surveys

RA4-WC-27

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-27

Photograph A: Near crossing location. View looking north.

Photograph B: Near crossing location; view looking upstream.	Photograph C: Near crossing location; view looking downstream.

Inspection Date (mm/dd/yyyy):	09/15/2021				
Location Description:	Crossing is located on a straight, large, permanent, well defined, open and confined watercourse. Crossing is located on same watercourse as RA1-WC-23				
Coordinates of Crossing:	Zone 16	Easting:	522053	Northing:	5691380
Coordinates of Cross Section:	Zone 16	Easting:	521997	Northing:	5691374
Personnel Present:	JW, MH				
Weather Conditions:	Sunny, 10°C				

Project:	21455151	Date Surveyed:	09/15/2021

Marten Falls CAR Water Crossing Survey

Crossing Location: RA4-WC-27

Current Metering Section:	Surface Geology:	Silt
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	None observed.
	Sinuosity:	Low sinuosity
	Fluvial	Relatively flat
	Relative Entrenchment:	Confined
	Fluvial Geomorphology:	In Regime Stability Index: 0.2
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A
	Wetted Width (m):	N/A
	Floodplain	N/A
	Bankfull Width (m):	N/A
	Floodplain Observations:	Floodplain dominated by shrubs and submerged vegetation.
Substrate:	Left Downstream Bank:	100% silt
	Bed:	100% silt, assumed from visual and LDB (could not wade)
	Right Downstream Bank:	100%silt, assumed from visual and LDB (could not wade)

Water Chemistry:	Time measured:	13:34		Additional Comments:
	Temperature	12.34	°C	
	Conductivity:	87	mS/cm	
	pH:	6.23		
	Turbidity:	0	NTU	
	DO:	7.75	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/15/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-27

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Not completed

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade. Cross-sectional survey and manual flow measurements not completed

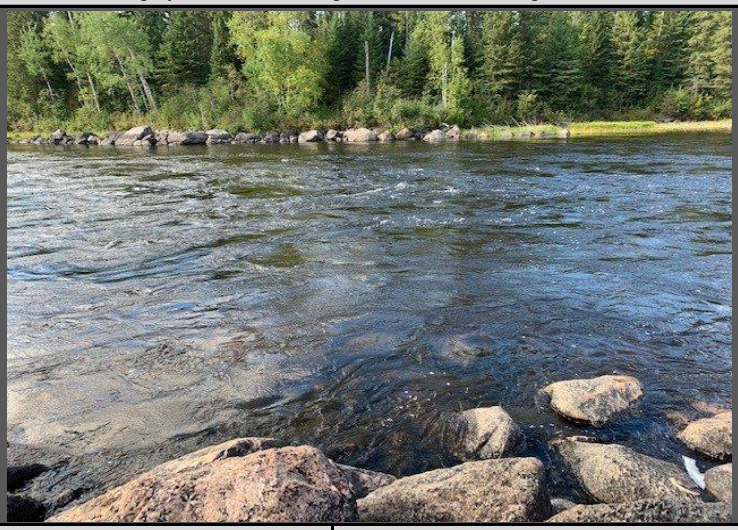
Project:	21455151	Date Surveyed:	09/15/2021

2021
Water Crossing Surveys

RA4-WC-34

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Photograph A: Near crossing location. View looking north.

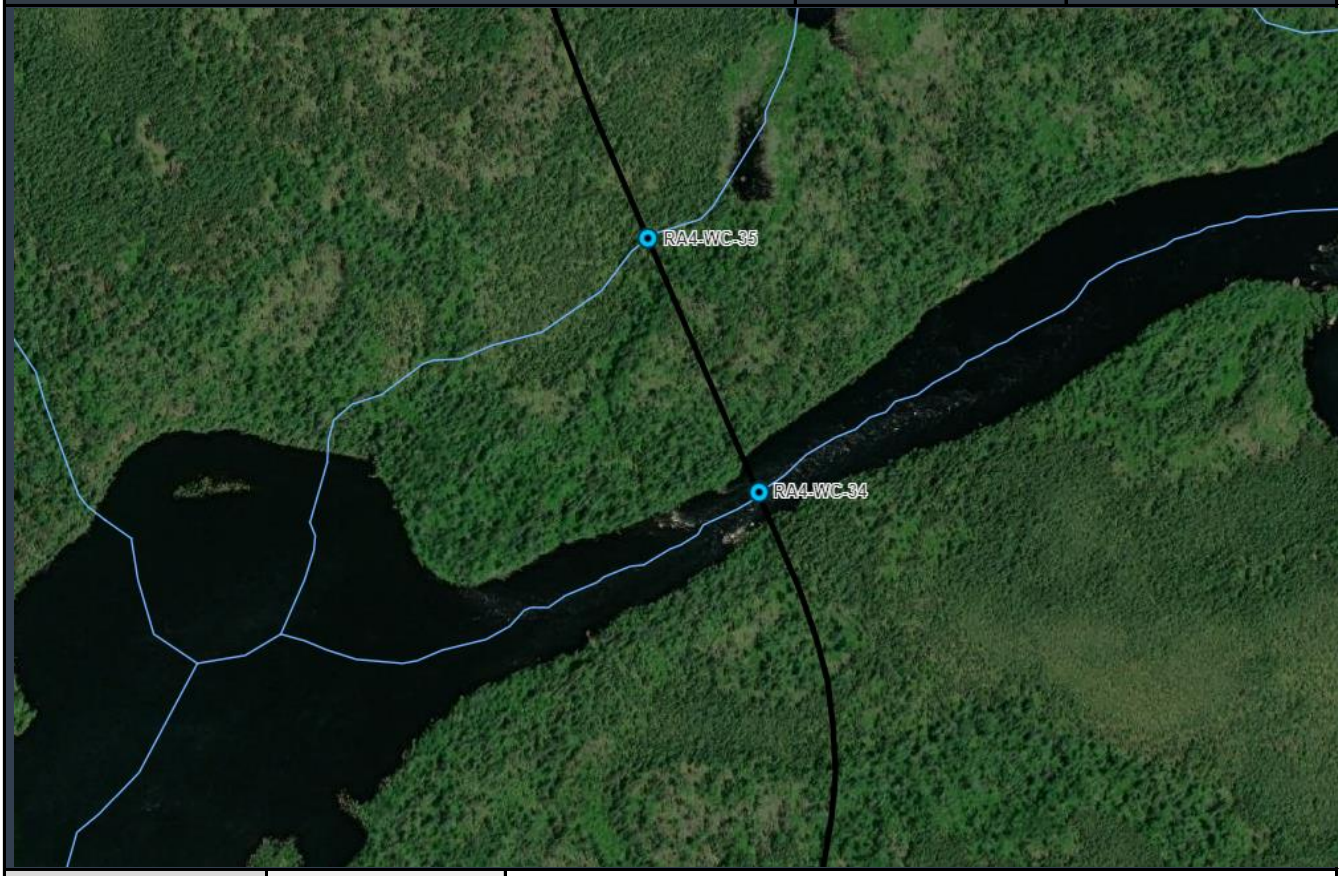


Photograph B: Near crossing location; view looking downstream.	Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 120m upstream of crossing; view looking downstream.

Inspection Date (mm/dd/yyyy):	09/15/2021				
Location Description:	Albany River				
Coordinates of Crossing:	Zone 16	Easting:	525100	Northing:	5705282
Coordinates of Cross Section:	Zone 16	Easting:	525111	Northing:	5705262
Personnel Present:	JW, MH				
Weather Conditions:	Sunny, 16°C				
Project:	21455151		Date Surveyed:		09/15/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34



Current Metering Section:	Surface Geology:	Boulders and cobble
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	None observed
	Sinuosity:	Low sinuosity
	Fluvial	Relatively flat
	Relative Entrenchment:	Confined
	Fluvial Geomorphology:	In Regime Stability Index: 0.12
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A
	Wetted Width (m):	N/A
	Floodplain	N/A
	Bankfull Width (m):	N/A
	Floodplain Observations:	N/A
Substrate:	Left Downstream Bank:	80% boulders, 10% cobble, 10% coarse gravel
	Bed:	Too deep and swift to wade
	Right Downstream Bank:	100% boulders

Water Chemistry:	Time measured:	4:48		Additional Comments:
	Temperature	14.38	°C	High bank stability, medium embededness, and high compaction.
	Conductivity:	115	mS/cm	
	pH:	7.19		
	Turbidity:	0	NTU	
	DO:	11.11	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/15/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-34

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep and swift to wade. Cross-sectional survey and manual flow measurements not completed.

Project:	21455151	Date Surveyed:	09/15/2021

2021
Water Crossing Surveys

RA4-WC-37

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-37

Photograph A: Right downstream bank near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 120m upstream of crossing; view looking downstream.

Photograph E: Approx. 120m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/12/2021				
Location Description:	Crossing is located on a large permanent, well defined channel. The channel was too deep to wade.				
Coordinates of Crossing:	Zone 16	Easting:	524697	Northing:	5708581
Coordinates of Cross Section:	Zone 16	Easting:	524697	Northing:	5708581
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 12°C				
Project:	21455151		Date Surveyed:		09/12/2021

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA4-WC-37

Current Metering Section:	Surface Geology:	Soft organic substrate		
	General Description:	Large-sized permanent watercourse with poorly defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	Beaver dam ~90m upstream of crossing. Beaver dam ~70m downstream from crossing.		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Un-confined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.24		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5		
	Wetted Width (m):	6.0		
	Floodplain	>1.5		
	Bankfull Width (m):	6.0		
	Floodplain Observations:	Vast, flat floodplain dominated by grasses. Flooded banks, grasses on riparian submereged.		
Substrate:	Left Downstream Bank:	80% organics, 20% silt		
	Bed:	80% organics, 20% silt		
	Right Downstream Bank:	80% organics, 20% silt		
Water Chemistry:	Time measured:	14:00		Additional Comments:
	Temperature	12.21	°C	Fully vegetated, low bank stability, low embededness, and low compaction.
	Conductivity:	55	mS/cm	
	pH:	5.86		
	Turbidity:	0	NTU	
	DO:	6.4	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	09/12/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-37

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
3.00	-	-		LDB EOW
3.50	0.48	0.06		
4.00	0.46	0.11		
4.50	0.44	0.10		
5.00	0.36	0.14		
5.50	0.28	0.13		
6.00	0.31	0.14		
6.50	0.29	0.14		
7.00	0.34	0.14		
7.50	0.35	0.14		
8.00	0.33	0.09		
8.50	0.38	0.08		
9.00	0.42	0.07		
9.50	0.54	0.06		
10.00	0.52	0.05		
10.50	0.62	0		No flow
11.00	0.64	0		No flow
11.50	0.60	0		No flow
12.00	0.42	0		No flow
12.50	-	-		RDB EOW

Flow Rate (m^3/s):	**0.273**
Notes:	Flow meter not working. Flow rate taken using the manual method (seconds for 1m distance). Too deep to wade at crossing - discharge completed at ~90m upstream of crossing (along beaverdam).

Project:	21455151	Date Surveyed:	09/12/2021

2021
Water Crossing Surveys

RA4-WC-55

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Photograph A: View of right downstream bank near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	09/16/2021				
Location Description:	Wabassi River				
Coordinates of Crossing:	Zone 16	Easting:	539004	Northing:	5735928
Coordinates of Cross Section:	Zone 16	Easting:	539024	Northing:	5735944
Personnel Present:	JW, MH				
Weather Conditions:	Mostly cloudy, 16°C				

Project:	21455151	Date Surveyed:	09/16/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Current Metering Section:	Surface Geology:	Mostly boulders and cobble covered in silt.	
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed.	
	Sinuosity:	High sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Confined	
	Fluvial Geomorphology:	In Regime Stability Index: 0.13	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A	
	Wetted Width (m):	N/A	
	Floodplain	N/A	
	Bankfull Width (m):	N/A	
	Floodplain Observations:	Grasses and shrubs with mature mixed forest	
Substrate:	Left Downstream Bank:	90% silt, 10% fine sand	
	Bed:	50% cobble, 25% silt, 20% boulders, 5% medium gravel	
	Right Downstream Bank:	90% silt, 10% fine sand	
Water Chemistry:	Time measured:	11:47	Additional Comments:
	Temperature	11.97 °C	Fully vegetated, stable, highly compacted banks, low embededness.
	Conductivity:	72 mS/cm	
	pH:	6.77	
	Turbidity:	0 NTU	
	DO:	11.25 mg/L	
		N/A %	

Project:	21455151	Date Surveyed:	09/16/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade. Cross-section survey and manual flow measurements not completed.

Project:	21455151	Date Surveyed:	09/16/2021

2021
Water Crossing Surveys

RA4-WC-57

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-57

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 60 m upstream of crossing; view looking downstream.

Photograph D: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	09/16/2021				
Location Description:	Small unnamed watercourse with shrubs along banks and overhanging, flooded banks with flooded areas extending beyond banks into the treeline.				
Coordinates of Crossing:	Zone 16	Easting:	539258	Northing:	573888
Coordinates of Cross Section:	Zone 16	Easting:	539254	Northing:	573883
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 20°C				
Project:	21455151		Date Surveyed:		09/16/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-57

Current Metering Section:	Surface Geology:	Predominantly organics.		
	General Description:	Small permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentationsuch as undercut banks).		
	Hydraulic Control:	None observed.		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Occasionally Confined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.3		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.5		
	Wetted Width (m):	2.0		
	Floodplain	1.0		
	Bankfull Width (m):	3.0		
	Floodplain Observations:	Wide and flat floodplain, dominated by shrubs. Banks are flooded and water braids/floods into low lying areas of floodplain to treeline.		
Substrate:	Left Downstream Bank:	80% organics, 20% silt		
	Bed:	80% organics, 20% silt		
	Right Downstream Bank:	80% organics, 20% silt		
Water Chemistry:	Time measured:	14:12		Additional Comments:
	Temperature	12.23	°C	Fully vegetated, low stability, lowly embedded, lowly compacted banks
	Conductivity:	43	mS/cm	
	pH:	6		
	Turbidity:	0	NTU	
	DO:	7.07	mg/L	
		64.6	%	

Project:	21455151	Date Surveyed:	09/16/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-57

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.00	-	-		RDB TOB
0.20	-	-		RDB EOW
0.30	0.18	0.019		
0.40	0.19	0.026		
0.50	0.20	0.022		
0.60	0.20	0.018		
0.70	0.24	0.028		
0.80	0.36	0.11		
0.90	0.46	0.218		
1.00	0.48	0.178		
1.10	0.48	0.225		
1.20	0.48	0.207		
1.30	0.50	0.194		
1.40	0.46	0.121		
1.50	0.49	0.101		
1.60	0.28	0.079		
1.70	0.15	0.001		
1.80	0.12	0.001		
1.90	0.06	0		Weeds/ grass preventing flow
2.00	-	-		LDB EOW
2.15	-	-		LDB TOB

Flow Rate (m^3/s):	**0.068**
Notes:	Discharge completed 9 m downstream from crossing.

Project:	21455151	Date Surveyed:	09/16/2021

2022
Water Crossing Surveys
RA1-4-WC-10

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-10

Photograph A: Near crossing location; view looking downstream.

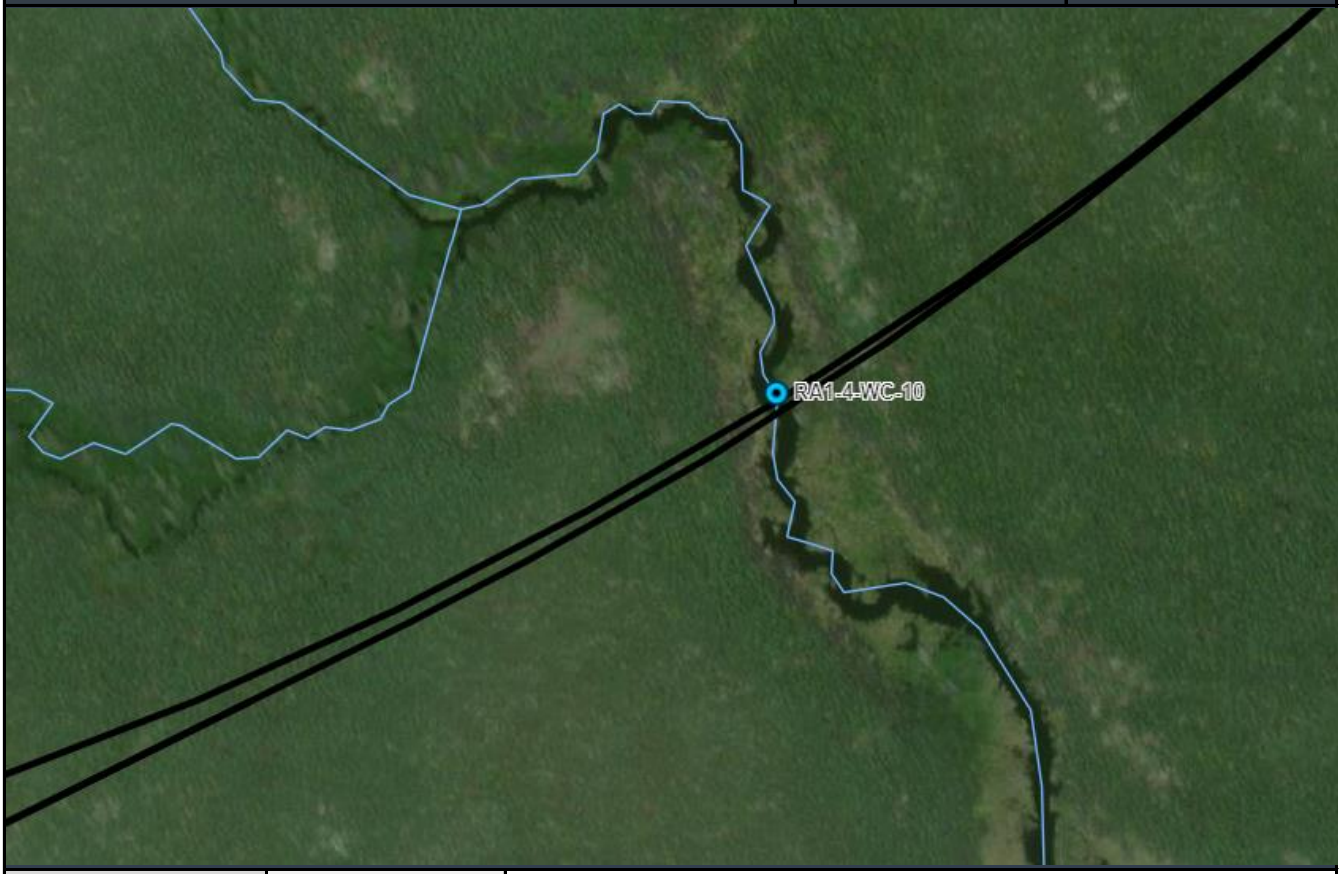
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 50 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/18/2022				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	540829	Northing:	5740602
Coordinates of Cross Section:	Zone 16	Easting:	540827	Northing:	5740605
Personnel Present:	JW, MH				
Weather Conditions:	Mostly cloudy, 18°C, light wind				
Project:	21455151		Date Surveyed:		08/18/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-10



Current Metering Section:	Surface Geology:	Predominantly organic materials.		
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, unconfined and moderately stable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation such as slumping and undercut banks).		
	Hydraulic Control:	None observe, active beaver dam observed downstream.		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat.		
	Relative Entrenchment:	Slightly entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5		
	Wetted Width (m):	12.0		
	Floodplain	>1.5		
	Bankfull Width (m):	12.0		
	Floodplain Observations:	Broad and flat topography with heavy cover of grasses and shrubs.		
Substrate:	Left Downstream Bank:	Predominantly organics		
	Bed:	Predominantly organics with some silt		
	Right Downstream Bank:	Predominantly organics		
Water Chemistry:	Time measured:	11:58:00 AM		Additional Comments:
	Temperature	17.59	°C	Too deep to wade, flooded conditions observed
	Conductivity:	61	mS/cm	
	pH:	6.45		
	Turbidity:	87.6	NTU	
	DO:	10.73	mg/L	
		63.5	%	

Project:	21455151	Date Surveyed:	08/18/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-10

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade.

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade.

Flow Rate (m^3/s):	-
Notes:	Crossing location and assessed reach too deep to wade and cross-sectional survey and flow measurements not completed.

Project:	21455151	Date Surveyed:	08/18/2022

2022
Water Crossing Surveys

RA1-4-WC-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-19

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 50 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	18-08-2022				
Location Description:	Medium-sized unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	546802	Northing:	5742739
Coordinates of Cross Section:	Zone 16	Easting:	546812	Northing:	5742742
Personnel Present:	JW, MH				
Weather Conditions:	Mostly cloudy, 20°C, light wind				
Project:	21455151		Date Surveyed:		2022-08-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-19

Current Metering Section:	Surface Geology:	Predominantly organic materials.		
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, unconfined and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat.		
	Relative Entrenchment:	Slightly entrenched		
	Fluvial Geomorphology:	In Regime Stability Index: 0		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5		
	Wetted Width (m):	30.0		
	Floodplain	>1.5		
	Bankfull Width (m):	40.0		
	Floodplain Observations:	Broad and flat topography with heavy cover of grasses and shrubs, with standing snags and coniferous forest.		
Substrate:	Left Downstream Bank:	Predominantly organics		
	Bed:	Predominantly organics		
	Right Downstream Bank:	Predominantly organics		
Water Chemistry:	Time measured:	2:39:00 PM		Additional Comments:
	Temperature	21.87	°C	Too deep to wade, flooded conditions observed
	Conductivity:	68	mS/cm	
	pH:	6.3		
	Turbidity:	1.9	NTU	
	DO:	5.68	mg/L	
		64.7	%	

Project:	21455151	Date Surveyed:	2022-08-18

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-19

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade.

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade.

Flow Rate (m^3/s):	-
Notes:	Crossing location and assessed reach too deep to wade and cross-sectional survey and flow measurements not completed.

Project:	21455151	Date Surveyed:	2022-08-18

2022
Water Crossing Surveys
RA1-4-WC-21

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-21

Photograph A: Near crossing location; view looking downstream.

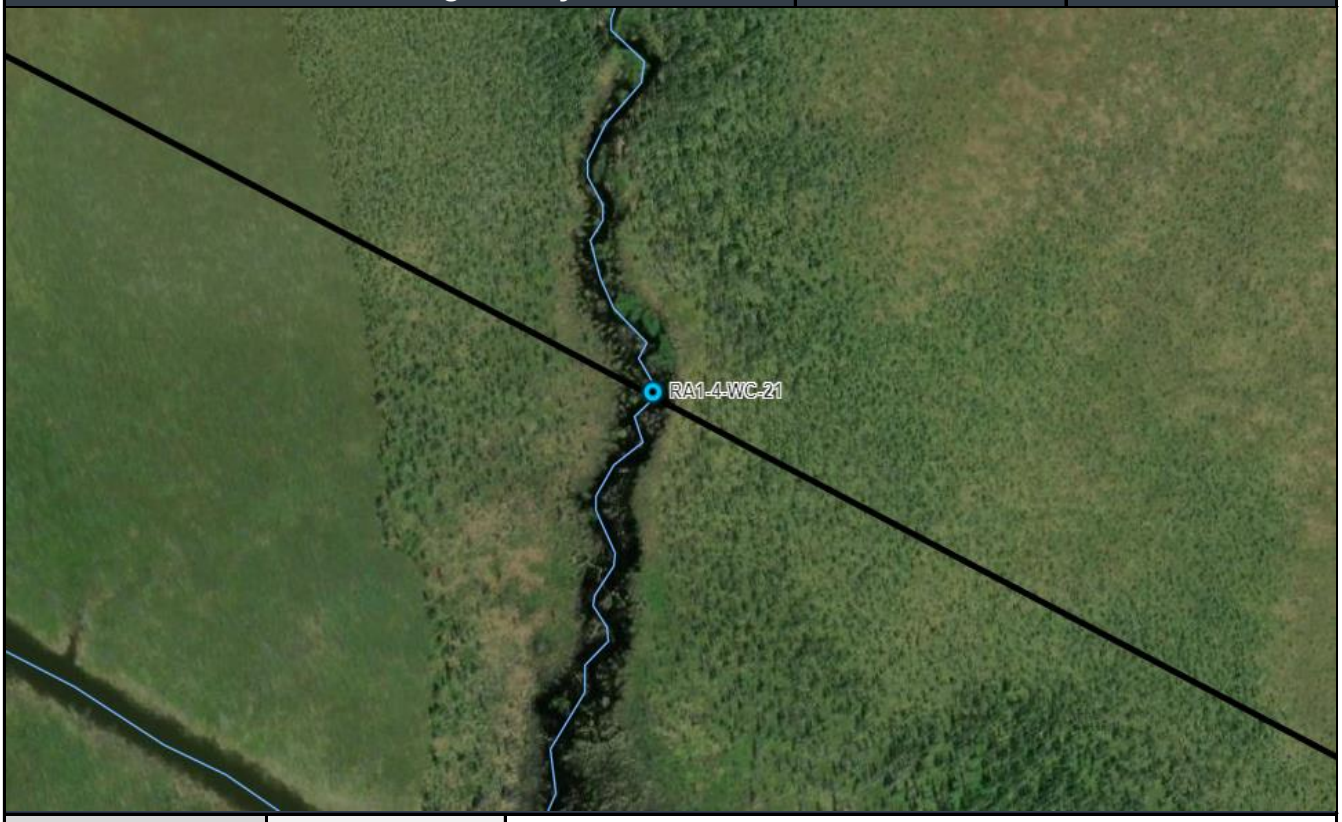
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 60 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	16-08-2022				
Location Description:	Small unnamed watercourse that intersects fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	551025	Northing:	5740733
Coordinates of Cross Section:	Zone 16	Easting:	551024	Northing:	5740735
Personnel Present:	JC, KE				
Weather Conditions:	Sunny, 22°C				
Project:	21455151		Date Surveyed:		2022-08-16

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-4-WC-21



Current Metering Section:	Surface Geology:	Predominantly organic materials.		
	General Description:	Small permanent watercourse with moderately defined bed and banks, and unstable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Bed Slope:	Relatively flat.		
	Relative Entrenchment:	Moderately entrenched		
	Floodplain Observations:	In Regime Stability Index: 0.09		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.2		
	Wetted Width (m):	5.5		
	Bankfull Depth (m):	>1.5		
	Bankfull Width (m):	6.0		
	Floodplain Observations:	Broad and flat topography with heavy cover of grasses and shrubs, and flooded in some areas.		
Substrate:	Left Downstream Bank:	Predominantly organics		
	Bed:	Predominantly organics		
	Right Downstream Bank:	Predominantly organics		
Water Chemistry:	Time measured:	10:22:00 AM		Additional Comments:
	Temperature	16.5	°C	Too deep to wade, flooded conditions observed
	Conductivity:	31	mS/cm	
	pH:	7.35		
	Turbidity:	7.3	NTU	
	DO:	7.45	mg/L	
		N/A	%	
Project:	21455151		Date Surveyed:	2022-08-16

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-21

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade.

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade.

Flow Rate (m^3/s):	-
Notes:	Crossing location and assessed reach too deep to wade and cross-sectional survey and flow measurements not completed.

Project:	21455151	Date Surveyed:	2022-08-16

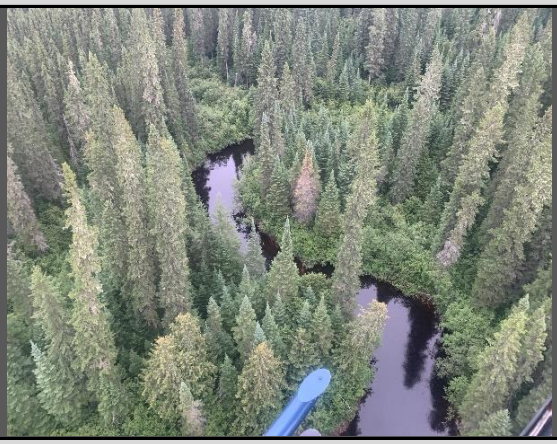
2022
Water Crossing Surveys
RA1-4-WC-31

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-31

Photograph A: Aerial view near crossing location. View looking downward.

Photograph B: Aerial view near crossing location. View looking downward.

Photograph C: Aerial view near crossing location. View looking downward.



Photograph D: Aerial view near crossing location. View looking downward.

Inspection Date (mm/dd/yyyy):	19-08-2022				
Location Description:	Buffaloskin River				
Coordinates of Crossing:	Zone 16	Easting:	566883	Northing:	5731970
Coordinates of Cross Section:	Zone 16	Easting:	N/A	Northing:	N/A
Personnel Present:	JC, KE				
Weather Conditions:	N/A				
Project:	21455151		Date Surveyed:		2022-08-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-31

Current Metering Section:	Surface Geology:	Predominantly organic materials.		
	General Description:	Small permanent watercourse with moderately defined bed and banks, and unstable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentation).		
	Hydraulic Control:	Several piles od large woody debris observed.		
	Sinuosity:	High sinuosity		
	Bed Slope:	Relatively flat.		
	Relative Entrenchment:	Moderately entrenched		
	Floodplain Observations:	Stability Index: N/A		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	~0.75		
	Wetted Width (m):	7.0		
	Bankfull Depth (m):	-		
	Bankfull Width (m):	8.0		
	Floodplain Observations:	Broad and flat topography with shrubs and mature spruce trees close to riparian.		
Substrate:	Left Downstream Bank:	Predominantly organics with some silt.		
	Bed:	Predominantly organics and silt (assumed based on channel unit).		
	Right Downstream Bank:	Predominantly organics with some silt.		
Water Chemistry:	Time measured:	-		Additional Comments:
	Temperature	N/A	°C	Rapid assessment completed (no water quality, cross-sectional survey, or flow measurements completed).
	Conductivity:	N/A	mS/cm	
	pH:	N/A		
	Turbidity:	N/A	NTU	
	DO:	N/A	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	2022-08-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-31

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed.

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Not completed

Flow Rate (m^3/s):	-
Notes:	Rapid assessment completed (no water quality, cross-sectional survey, or flow measurements completed).

Project:	21455151	Date Surveyed:	2022-08-19

2022
Water Crossing Surveys
RA1-4-WC-33

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 50 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	19-08-2022				
Location Description:	Small unnamed watercourse that intersects dense alders.				
Coordinates of Crossing:	Zone 16	Easting:	569502	Northing:	5733028
Coordinates of Cross Section:	Zone 16	Easting:	569514	Northing:	5733025
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 18°C, light wind				
Project:	21455151		Date Surveyed:		2022-08-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Current Metering Section:	Surface Geology:	Predominantly organic materials.		
	General Description:	Small permanent watercourse with moderately defined bed and banks, unconfined and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed.		
	Sinuosity:	Low sinuosity		
	Bed Slope:	Relatively flat.		
	Relative Entrenchment:	Moderately entrenched		
	Floodplain Observations:	N/A Stability Index: N/A		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.9		
	Wetted Width (m):	7.0		
	Bankfull Depth (m):	1.0		
	Bankfull Width (m):	9.0		
	Floodplain Observations:	Flat topography with heavy cover of shrubs.		
Substrate:	Left Downstream Bank:	Predominantly organics		
	Bed:	Predominantly organics		
	Right Downstream Bank:	Predominantly organics		
Water Chemistry:	Time measured:	10:00:00 AM		Additional Comments:
	Temperature	20.5	°C	
	Conductivity:	25	mS/cm	
	pH:	5.54		
	Turbidity:	0	NTU	
	DO:	4.18	mg/L	
		46.3	%	

Project:	21455151	Date Surveyed:	2022-08-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not surveyed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.10	0.00	0		RDB ToB
1.35	0.00	0		RDB EOW
1.45	0.04	0.007		
1.55	0.05	0.007		
1.65	0.08	0.015		
1.75	0.46	0.56		
1.85	0.50	0.073		
1.95	0.51	0.083		
2.05	0.51	0.025		
2.15	0.54	0.055		
2.25	0.30	0.066		
2.35	0.38	0.045		
2.45	0.34	0.065		
2.55	0.22	0.009		
2.65	0.20	0.005		
2.75	0.19	0.002		
2.85	0.18	0.009		
2.95	0.08	0.006		
3.05	<0.01	0		
3.15	<0.01	0		
3.25	<0.01	0		
3.35	<0.01	0		
3.45	<0.01	0		
3.47	0.00	0		LDB EOW
3.52	0.00	0		LDB ToB

Flow Rate (m^3/s):	**0.042**
Notes:	Densely overhung by alders. Cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	2022-08-19

2022
Water Crossing Surveys
RA1-4-WC-35

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35

Photograph A: Near crossing location; view looking downstream.

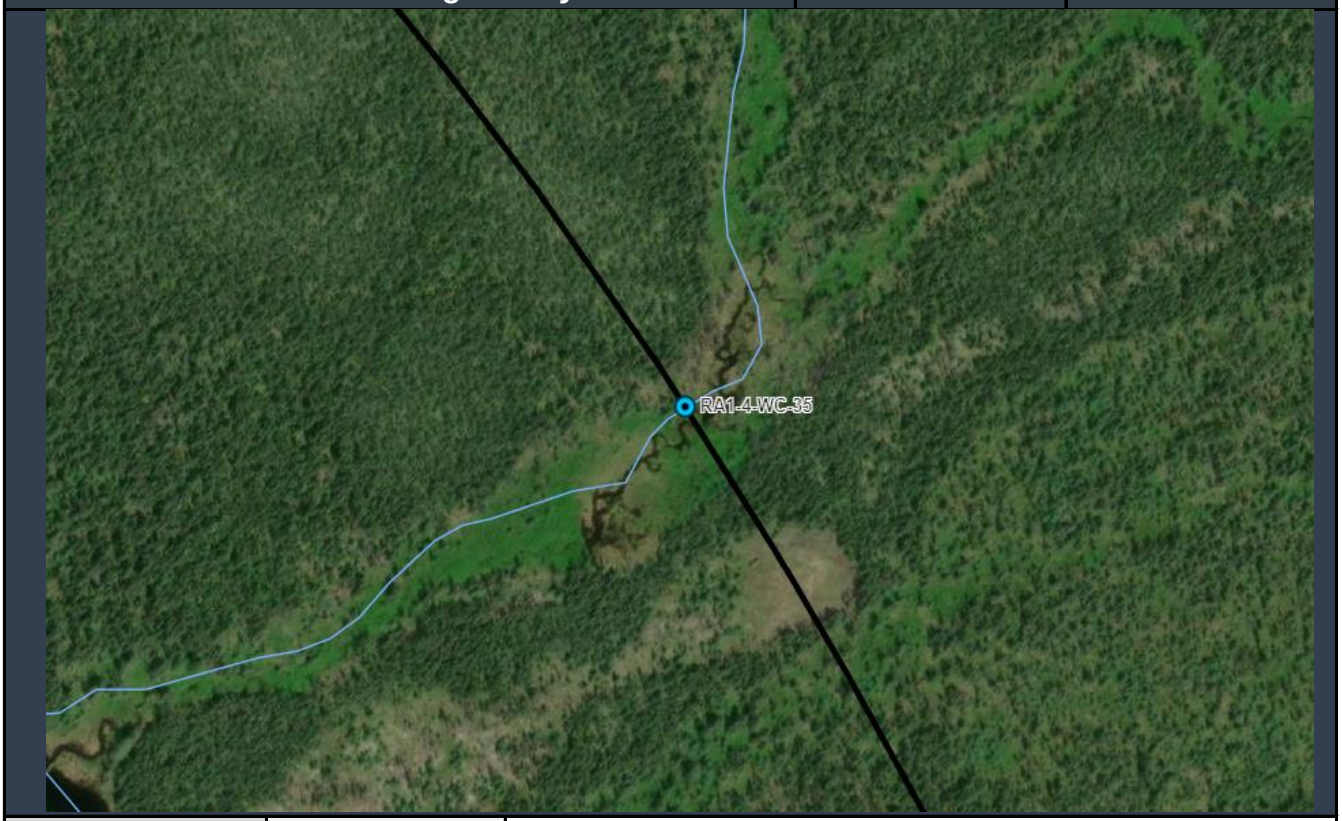
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 90 m upstream of crossing; view looking downstream.

Photograph D: Approx. 120 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	19-08-2022				
Location Description:	Small unnamed watercourse that intersects dense alders.				
Coordinates of Crossing:	Zone 16	Easting:	573750	Northing:	5732816
Coordinates of Cross Section:	Zone 16	Easting:	573747	Northing:	5732807
Personnel Present:	JW, MH				
Weather Conditions:	Overcast, 18°C, light wind				
Project:	21455151		Date Surveyed:		2022-08-19

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-4-WC-35



Current Metering Section:	Surface Geology:	Predominantly organic materials.	
	General Description:	Small permanent watercourse with moderately defined bed and banks, unconfined and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation).	
	Hydraulic Control:	Beaver dam observed upstream causing an impoundment in the upstream reach. Second beaver dam observed downstream of the crossing.	
	Sinuosity:	Low sinuosity	
	Bed Slope:	Relatively flat.	
	Relative Entrenchment:	Moderately entrenched	
	Floodplain Observations:	N/A Stability Index: N/A	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.1	
	Wetted Width (m):	3.5	
	Bankfull Depth (m):	1.2	
	Bankfull Width (m):	3.5	
	Floodplain Observations:	Flat topography with heavy cover of shrubs and alders with coniferous forest established on the RDB.	
Substrate:	Left Downstream Bank:	Predominantly organics	
	Bed:	Predominantly organics	
	Right Downstream Bank:	Predominantly organics	
Water Chemistry:	Time measured:	1:45:00 PM	Additional Comments:
	Temperature	16.48 °C	Impoundments causing flooded conditions and low flow velocity.
	Conductivity:	49 mS/cm	
	pH:	5.4	
	Turbidity:	2.3 NTU	
	DO:	3.53 mg/L	
		36.3 %	

Project:	21455151	Date Surveyed:	2022-08-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not surveyed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.15	0.00	0		RDB ToB
1.20	0.00	0		RDB EOW
1.40	0.25	-0.003		
1.60	0.36	0.001		
1.80	0.37	0.004		
2.00	0.48	0.004		
2.20	0.54	0.003		
2.40	0.57	0.003		
2.60	0.54	0.004		
2.80	0.47	0.015		
3.00	0.49	0.01		
3.20	0.48	0.002		
3.40	0.52	0.001		
3.60	0.54	0.012		
3.80	0.58	0.001		
4.00	0.62	-0.002		
4.20	0.63	-0.002		
4.40	0.15	0.006		
4.60	0.50	0.001		
4.80	0.48	0.003		
5.00	0.38	0		
5.20	0.40	-0.001		
5.40	0.34	0		
5.48	0.00	0		LDB EOW
5.62	0.00	0		LDB ToB

Flow Rate (m^3/s):	**0.006**
Notes:	Densely overhung by alders. Cross-sectional survey not completed. Weeds, sticks, fallen trees and other organics throughout the channel that potentially affected velocity measurements.

Project:	21455151	Date Surveyed:	2022-08-19

2022
Water Crossing Surveys
RA1-4-WC-36

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-36

Photograph A: Near crossing location; view looking downstream.

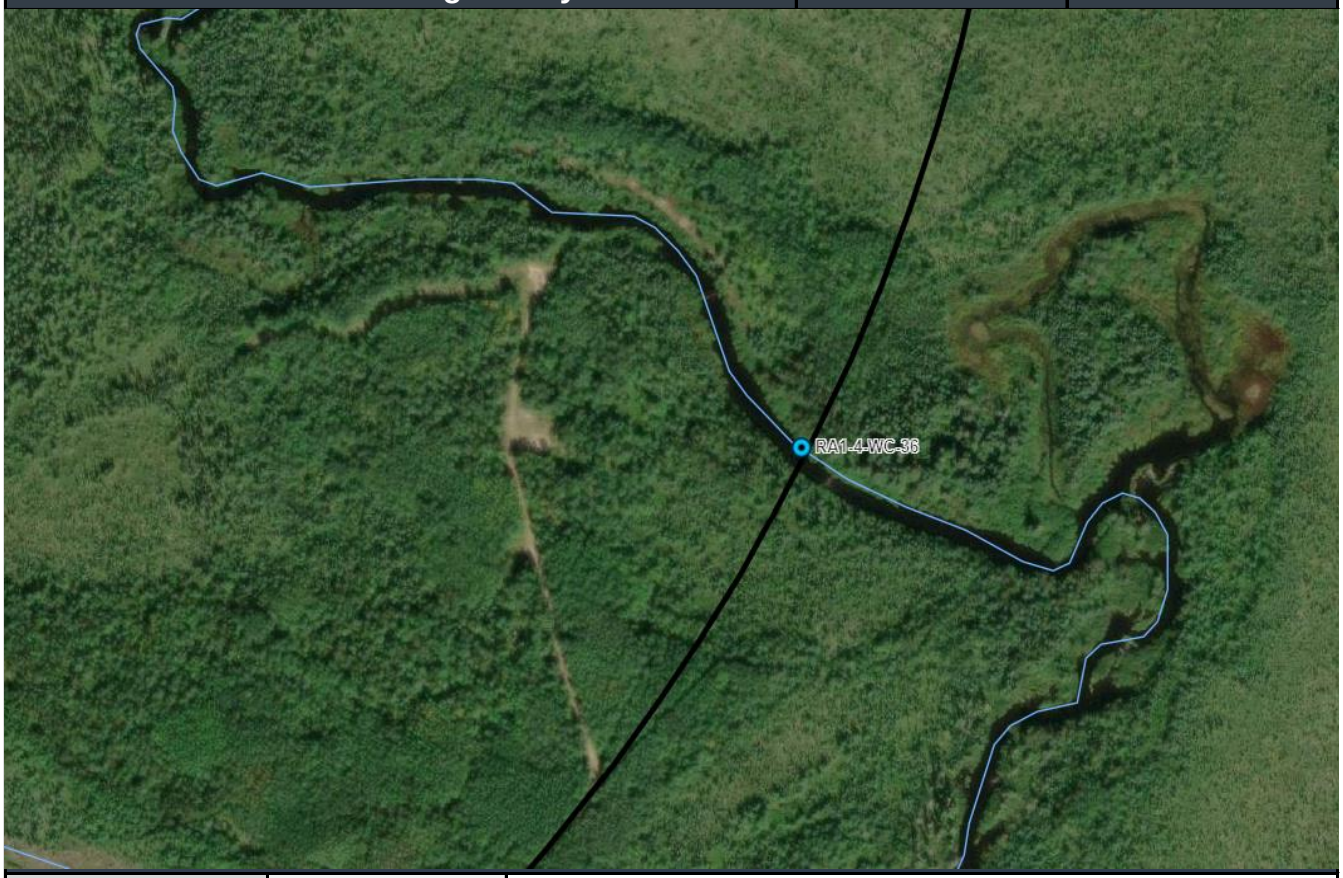
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 60m upstream of crossing; view looking downstream.

Photograph D: Approx. 60m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/22/2021				
Location Description:	Crossing is located on a large permanent watercourse. Watercourse is winding, and neutral with steep drops offs from banks.				
Coordinates of Crossing:	Zone 16	Easting:	577681	Northing:	5726015
Coordinates of Cross Section:	Zone 16	Easting:	577674	Northing:	5726014
Personnel Present:	JW, MH, WB				
Weather Conditions:	Overcast, 16°C				
Project:	21455151		Date Surveyed:		08/22/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-36



Current Metering Section:	Surface Geology:	Predominantly silt with some organics		
	General Description:	Large-sized permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed.		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Un-Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.15		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5		
	Wetted Width (m):	10.0		
	Floodplain	N/A		
	Bankfull Width (m):	10.8		
	Floodplain Observations:	Grasses, shrubs, and coniferous forest		
Substrate:	Left Downstream Bank:	80% silt, 20% organics		
	Bed:	Too deep to wade.		
	Right Downstream Bank:	80% silt, 20% organics		
Water Chemistry:	Time measured:	12:04		Additional Comments:
	Temperature	15.14	°C	Fully vegetated, moderate bank stability, low embededness, and low bank compaction.
	Conductivity:	68	mS/cm	
	pH:	6.52		
	Turbidity:	1.8	NTU	
	DO:	6.75	mg/L	
		66.9	%	

Project:	21455151	Date Surveyed:	08/22/2021

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-36

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Crossing location and assessed reach too deep to wade and cross-sectional survey and flow measurements not completed.

Project:	21455151	Date Surveyed:	08/22/2021

2022
Water Crossing Surveys
RA1-4-WC-37

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-37

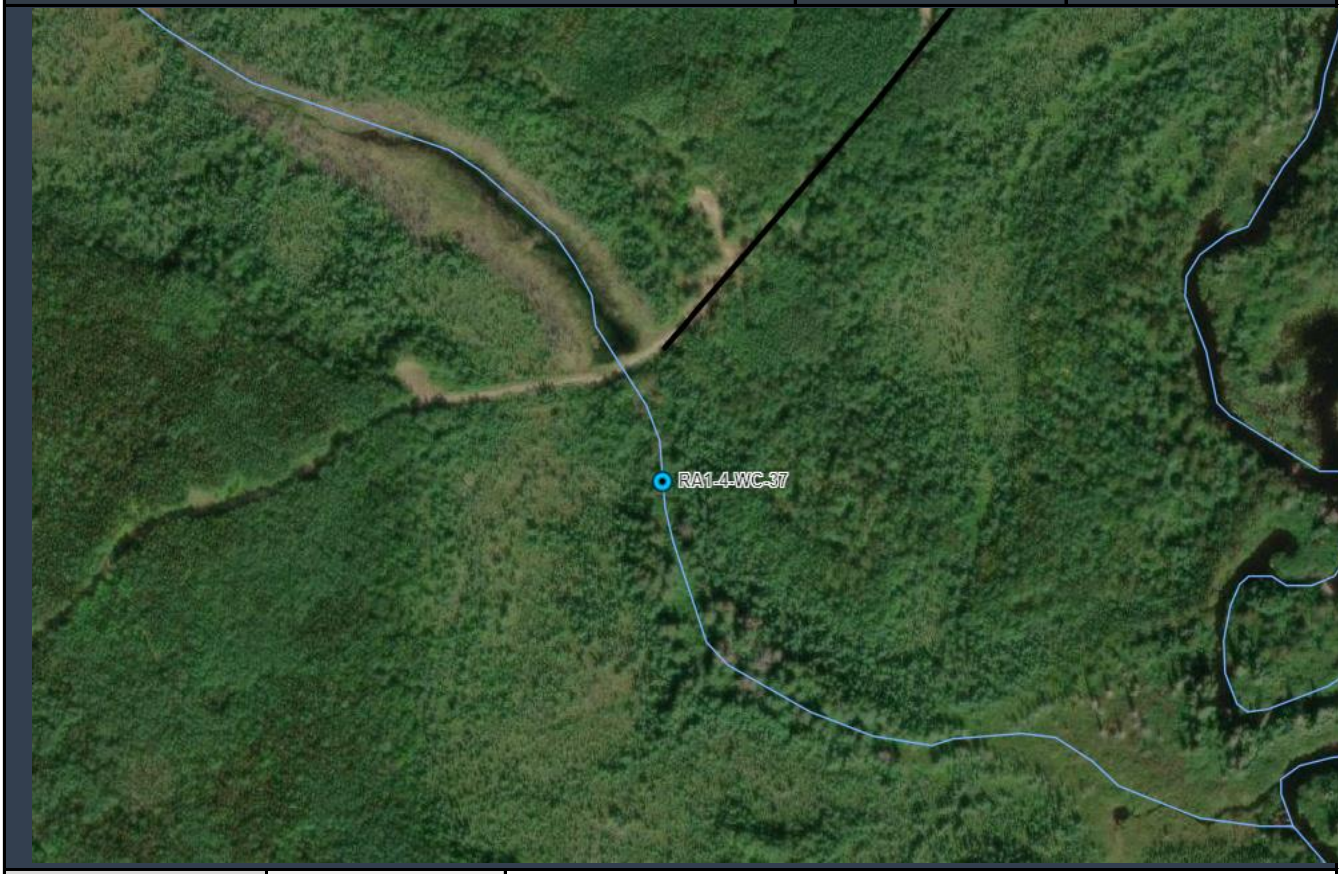
Photograph A: Near crossing location. View looking downward.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	08/16/2022				
Location Description:	Crossing is located on a narrow and shallow channel through conifer forest and dense alders. Steep banks and minimal water.				
Coordinates of Crossing:	Zone 16	Easting:	577418	Northing:	5725568
Coordinates of Cross Section:	Zone 16	Easting:	577418	Northing:	5725570
Personnel Present:	JC, KE				
Weather Conditions:	Sunny, 28°C				
Project:	21455151		Date Surveyed:		08/16/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-37



Current Metering Section:	Surface Geology:	Mostly organics and silt.	
	General Description:	Small intermittent watercourse with poorly defined bed and banks, and unstable channel conditions (i.e., well vegetated with some evidence of erosion and sedimentationsuch as undercut banks).	
	Hydraulic Control:	None observed.	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Frequently Confined	
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.385	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.2	
	Wetted Width (m):	0.3	
	Floodplain	N/A	
	Bankfull Width (m):	0.3	
	Floodplain Observations:	Relatively flat with dense alders.	
Substrate:	Left Downstream Bank:	50% organics and 50% silt	
	Bed:	50% organics and 50% silt	
	Right Downstream Bank:	50% organics and 50% silt	
Water Chemistry:	Time measured:	14:22	Additional Comments:
	Temperature	9.4 °C	Some bank undercutting, partially vegetated banks, low bank stability, low embededness, and low bank compaction.
	Conductivity:	26.4 mS/cm	
	pH:	7.01	
	Turbidity:	5.4 NTU	
	DO:	4.84 mg/L	
		N/A %	

Project:	21455151	Date Surveyed:	08/16/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-37

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.37	0.01	0		
0.40	0.03	0.03		
0.50	0.04	0.08		
0.60	0.04	0.05		
0.68	0.00	0		

Flow Rate (m^3/s):	**0.001**
Notes:	

Project:	21455151	Date Surveyed:	08/16/2022

2022
Water Crossing Surveys
RA1-WC-01

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-01

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 40m upstream of crossing; view looking downstream.

Photograph D: Approx. 40m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/20/2022				
Location Description:	Crossing is located on a small permanent watercourse intersecting forested terrain.				
Coordinates of Crossing:	Zone 16	Easting:	530918	Northing:	562153
Coordinates of Cross Section:	Zone 16	Easting:	530917	Northing:	562155
Personnel Present:	JW, MH, WB				
Weather Conditions:	Mostly cloudy, 23°C				
Project:	21455151		Date Surveyed:		08/20/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-01

Current Metering Section:	Surface Geology:	Predominantly boulders with some cobble		
	General Description:	Small permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	Beaver dam ~40m upstream from crossing, lots of woody debris		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Occasionally Confined		
	Fluvial Geomorphology:	N/A Stability Index: N/A		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.25		
	Wetted Width (m):	8.0		
	Floodplain	N/A		
	Bankfull Width (m):	8.8		
	Floodplain Observations:	N/A		
Substrate:	Left Downstream Bank:	95% organics, 5% boulders		
	Bed:	70% boulders, 30% cobble		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	13:10		Additional Comments:
	Temperature	17.97	°C	Fully vegetated banks, moderate bank stability, moderate embededness, and high bank compaction.
	Conductivity:	85	mS/cm	
	pH:	6.55		
	Turbidity:	0.1	NTU	
	DO:	6.89	mg/L	
		71.9	%	

Project:	21455151	Date Surveyed:	08/20/2022

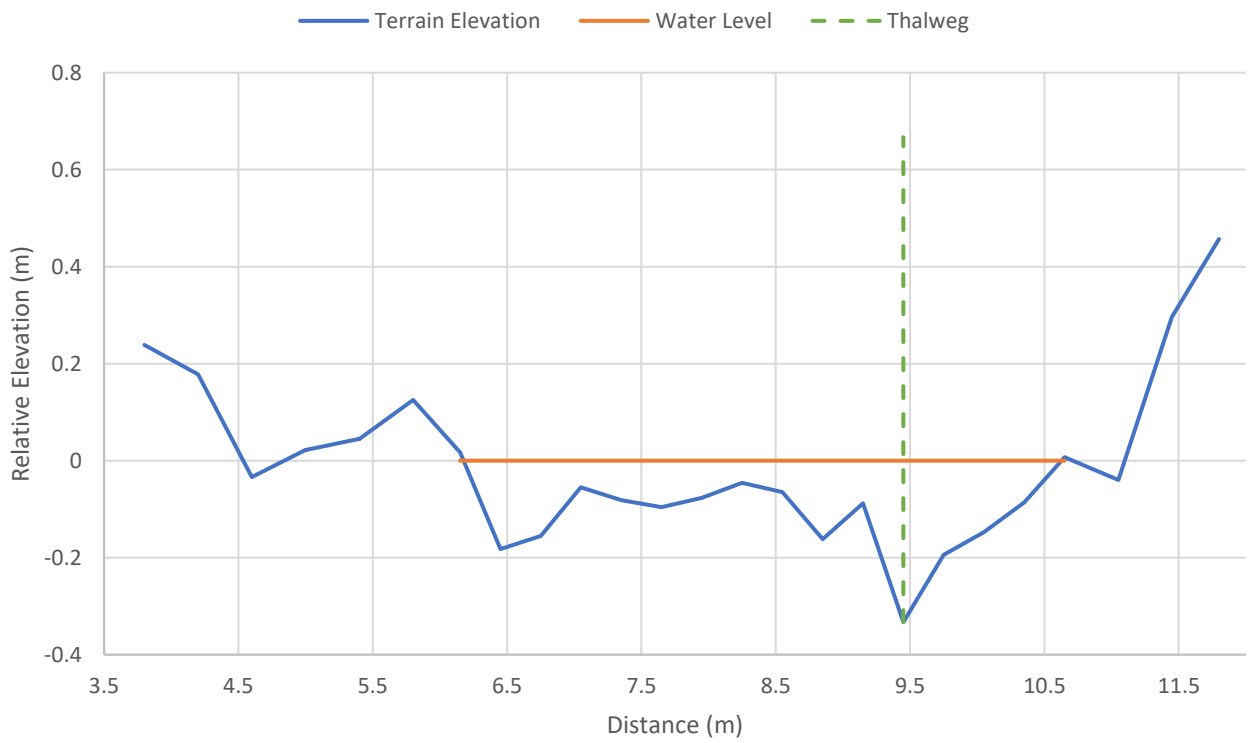
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-01

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
3.8	1.874	0.239	RDB TOB
4.2	1.935	0.178	
4.6	2.147	-0.034	
5	2.091	0.022	
5.4	2.068	0.045	
5.8	1.988	0.125	
6.15	2.096	0.017	RDB EOW
6.45	2.295	-0.182	
6.75	2.268	-0.155	
7.05	2.168	-0.055	
7.35	2.194	-0.081	
7.65	2.209	-0.096	
7.95	2.19	-0.077	
8.25	2.159	-0.046	
8.55	2.178	-0.065	
8.85	2.275	-0.162	
9.15	2.201	-0.088	
9.45	2.446	-0.333	
9.75	2.307	-0.194	
10.05	2.26	-0.147	
10.35	2.199	-0.086	
10.65	2.106	0.007	LDB EOW
11.05	2.153	-0.04	
11.45	1.817	0.296	
11.8	1.656	0.457	LDB TOB

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Water Crossing RA1-WC-01 Cross Sectional Profile



Project:	21455151	Date Surveyed:	08/20/2022

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-WC-01
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.00	-	-		RDB TOB
1.40	0.00	0		RDB EOW
1.50	0.10	0.199		
1.60	0.09	0.21		
1.70	0.08	0.296		
1.80	0.09	0.616		
1.90	0.10	0.455		
2.00	0.07	0.556		
2.10	0.06	0.558		
2.20	0.13	0.263		
2.30	0.07	0.499		
2.40	0.10	0.338		
2.50	0.08	0.406		
2.60	0.12	0.438		
2.70	0.12	0.49		
2.80	0.05	0.119		
2.90	0.05	0.152		
3.00	0.04	0.04		
3.10	0.04	0.137		
3.20	0.03	0.121		
3.25	0.00	0		LDB EOW
4.20	-	-		LDB TOB

Flow Rate (m^3/s):	**0.051**
Notes:	

Project:	21455151	Date Surveyed:	08/20/2022

2022
Water Crossing Surveys
RA1-WC-09

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09

Photograph A: Near crossing location. View of right downstream bank.

Photograph B: Near crossing location; view looking downstream.

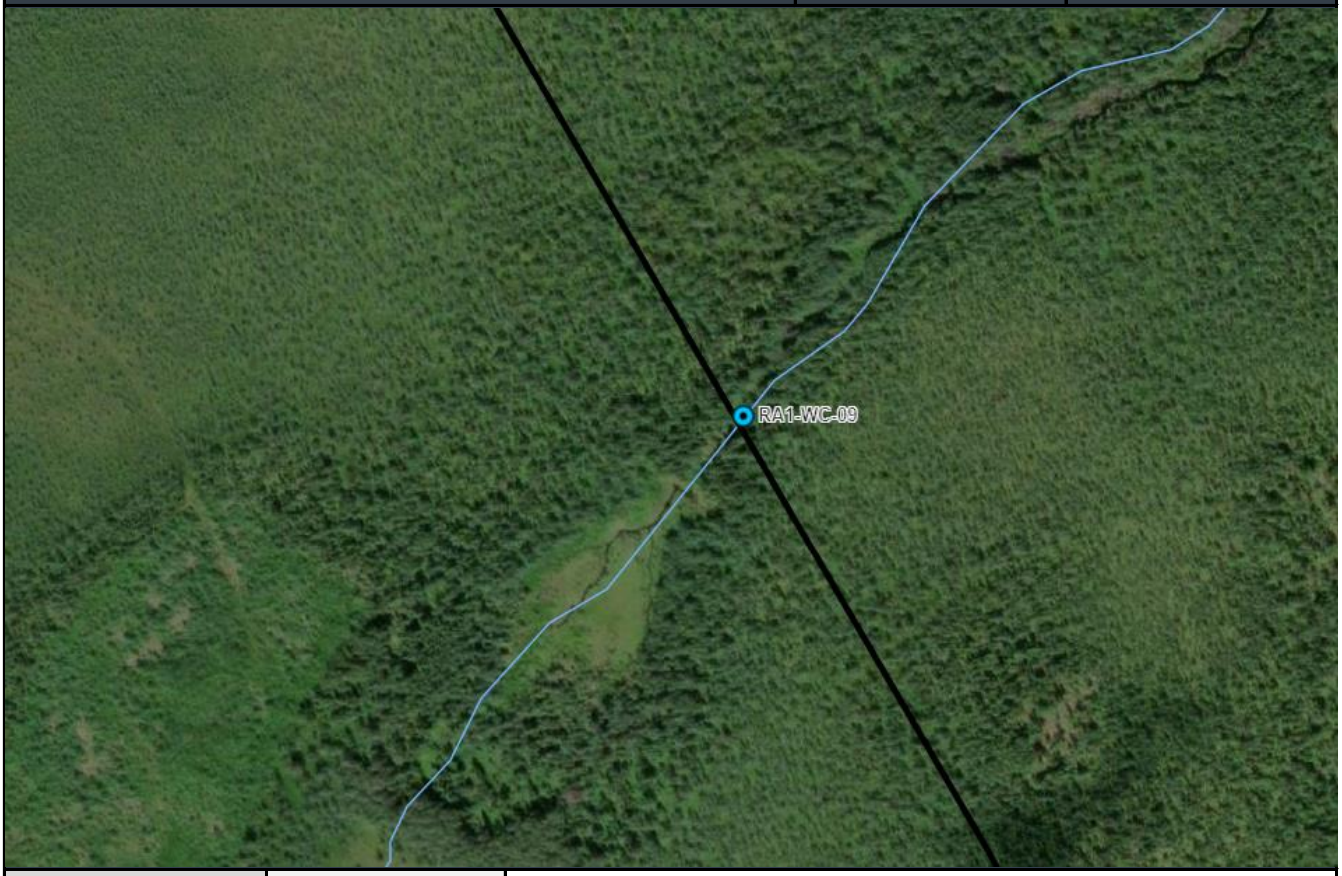
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 100m upstream of crossing; view looking downstream.

Photograph E: Approx. 100m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/17/2022				
Location Description:	Crossing is located on a small permanent and broad watercourse. Crossing located on a flat that is slightly impounded due to woody and organic debris.				
Coordinates of Crossing:	Zone 16	Easting:	532606	Northing:	5644605
Coordinates of Cross Section:	Zone 16	Easting:	532601	Northing:	5644610
Personnel Present:	JW, MH, WB				
Weather Conditions:	Mostly cloudy, 25°C				
Project:	21455151		Date Surveyed:		08/17/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09



Current Metering Section:	Surface Geology:	Predominantly organics - detritus substrate.	
	General Description:	Small permanent watercourse with well-defined bed and banks, and unstable channel conditions (i.e., fully vegetated banks with some evidence of erosion and sedimentationsuch as undercut banks and slumping).	
	Hydraulic Control:	Lots of organics, woody debris, and detritus substrate.	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Un-Confined	
	Fluvial Geomorphology:	In Regime Stability Index:	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.5	
	Wetted Width (m):	3.0	
	Floodplain	N/A	
	Bankfull Width (m):	4.0	
	Floodplain Observations:	Shrubs and mature mixed forest	
Substrate:	Left Downstream Bank:	100% organics	
	Bed:	100% organics	
	Right Downstream Bank:	100% organics	
Water Chemistry:	Time measured:	14:00	Additional Comments:
	Temperature	16.44 °C	Slumping, undercut banks, fully vegetated, low bank stability, low embededness, low bank compaction. Some subsurface flow. Channel is braided 110m upstream from crossing.
	Conductivity:	0.078 mS/cm	
	pH:	6.15	
	Turbidity:	0 NTU	
	DO:	10.51 mg/L	
		N/A %	

Project:	21455151	Date Surveyed:	08/17/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-09

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.10	-	-		RDB TOB
1.30	0.67	0.023		RDB EOW (undercut bank)
1.40	0.67	0.029		
1.50	0.64	0.025		
1.60	0.63	0.019		
1.70	0.60	0.023		
1.80	0.56	0.015		
1.90	0.54	0.017		
2.00	0.51	0.018		
2.10	0.49	0.027		
2.20	0.45	0.023		
2.30	0.47	0.036		
2.40	0.49	0.049		
2.50	0.50	0.047		
2.60	0.47	0.047		
2.70	0.42	0.041		
2.80	0.41	0.032		
2.90	0.42	0.028		
3.00	0.43	0.011		
3.04	0.44	-		LDB EOW (undercut bank)
3.18	-	-		LDB TOB

Flow Rate (m^3/s):	**0.027**
Notes:	

Project:	21455151	Date Surveyed:	08/17/2022

2022
Water Crossing Surveys
RA1-WC-11

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-11

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Upstream of crossing; view looking downstream.

Photograph D: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/21/2022				
Location Description:	Crossing is located on the Ogoki River.				
Coordinates of Crossing:	Zone 16	Easting:	534983	Northing:	5649288
Coordinates of Cross Section:	Zone 16	Easting:	534519	Northing:	5649039
Personnel Present:	JC, KE				
Weather Conditions:	Sunny, 28°C				
Project:	21455151		Date Surveyed:		08/21/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-11

Current Metering Section:	Surface Geology:	Too deep to wade - likely bedrock, boulders, or cobble.
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).
	Hydraulic Control:	None observed.
	Sinuosity:	Low sinuosity
	Fluvial	Relatively flat
	Relative Entrenchment:	Frequently Confined
	Fluvial Geomorphology:	In Regime Stability Index: 0.07125
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>3
	Wetted Width (m):	32.0
	Floodplain	>3
	Bankfull Width (m):	75.0
	Floodplain Observations:	Large boulders and exposed bedrock outcroppings. Mature coniferous forest.
Substrate:	Left Downstream Bank:	100% bedrock
	Bed:	100% bedrock
	Right Downstream Bank:	100% bedrock

Water Chemistry:	Time measured:	13:51		Additional Comments:
	Temperature	21.5	°C	Partially vegetated, stable banks, low embededness and high compaction.
	Conductivity:	79	mS/cm	
	pH:	7.09		
	Turbidity:	0.6	NTU	
	DO:	9.45	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	08/21/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-11

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade. Cross-section survey and manual flow measurements not completed.

Project:	21455151	Date Surveyed:	08/21/2022

2022
Water Crossing Surveys
RA1-WC-14

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-14

Photograph A: Near crossing location; view looking downstream.

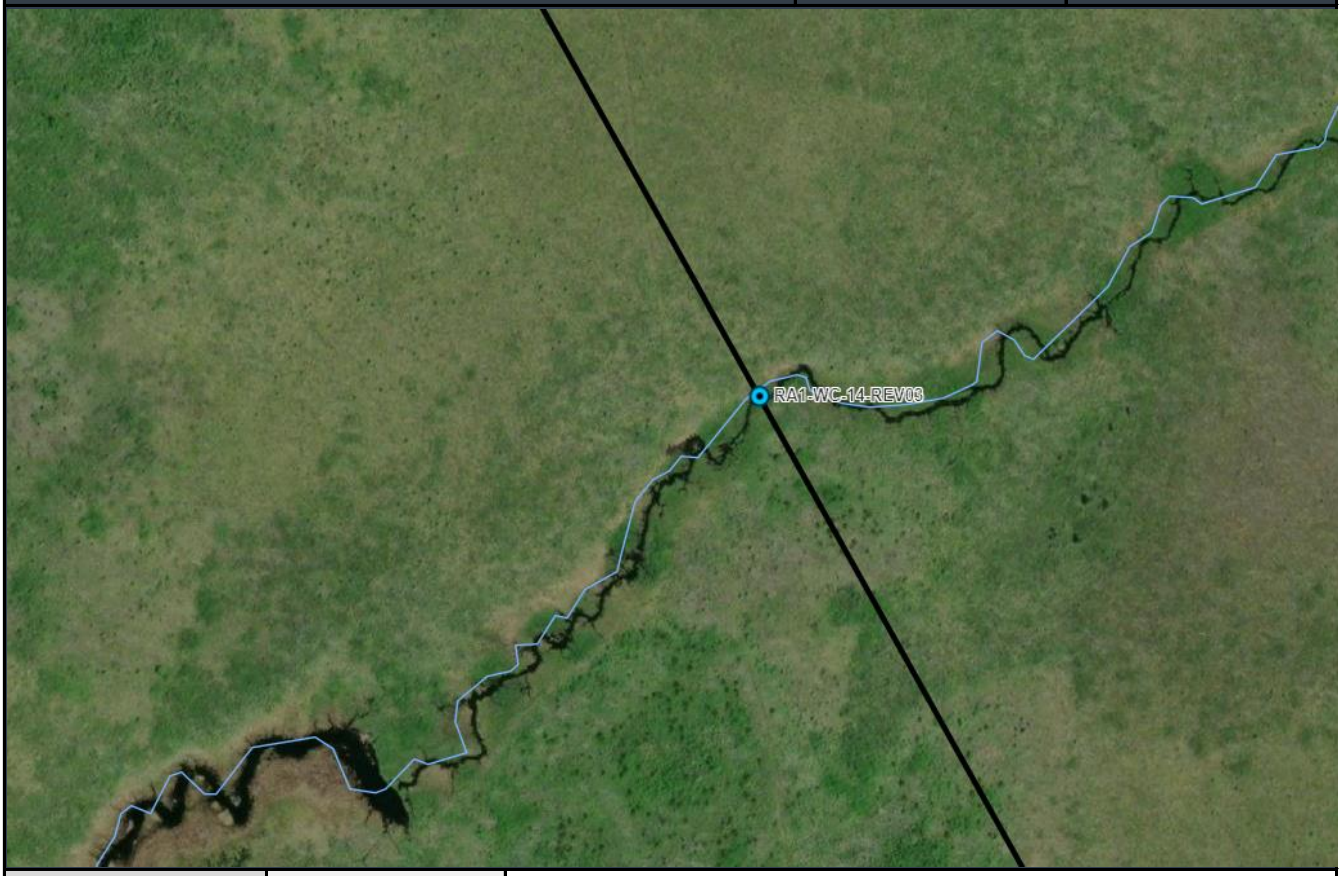
Photograph B: Near crossing location: view looking upstream.

Photograph C: Upstream of crossing; view looking downstream.

Photograph D: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/22/2022				
Location Description:	Small unnamed watercourse intersecting flooded grassy terrain				
Coordinates of Crossing:	Zone 16	Easting:	529515	Northing:	5656013
Coordinates of Cross Section:	Zone 16	Easting:	529624	Northing:	5656141
Personnel Present:	JC, KE				
Weather Conditions:	Light rain				
Project:	21455151		Date Surveyed:		08/22/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-14



Current Metering Section:	Surface Geology:	Predominantly organics.		
	General Description:	Small permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed.		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Frequently Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.18575		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.7		
	Wetted Width (m):	3.0		
	Floodplain	0.8		
	Bankfull Width (m):	3.0		
	Floodplain Observations:	Relatively flat with grasses, forbes and thick alders.		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	100% organics		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	13:43		Additional Comments:
	Temperature	19.1	°C	Fully vegetated, low bank stability, low embededness, low bank compaction. Creek is incised with an irregular meander.
	Conductivity:	34	mS/cm	
	pH:	6.78		
	Turbidity:	5.2	NTU	
	DO:	4.01	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	08/22/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-14

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.15	0.42	0		
1.20	0.42	0.009		
1.40	0.44	0.008		
1.60	0.50	0.015		
1.80	0.54	0.006		
2.00	0.62	0.013		
2.20	0.64	0.024		
2.40	0.66	0.033		
2.60	0.66	0.045		
2.80	0.64	0.029		
3.00	0.56	0.039		
3.20	0.50	0.041		
3.40	0.46	0.036		
3.60	0.42	0.044		
3.80	0.32	0.037		
4.00	0.30	0.031		
4.20	0.20	0.006		
4.30	0.00	0		

Flow Rate (m^3/s):	**0.042**
Notes:	

Project:	21455151	Date Surveyed:	08/22/2022

2022
Water Crossing Surveys
RA1-WC-16

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-16

Photograph A: Near crossing location; view looking downstream.

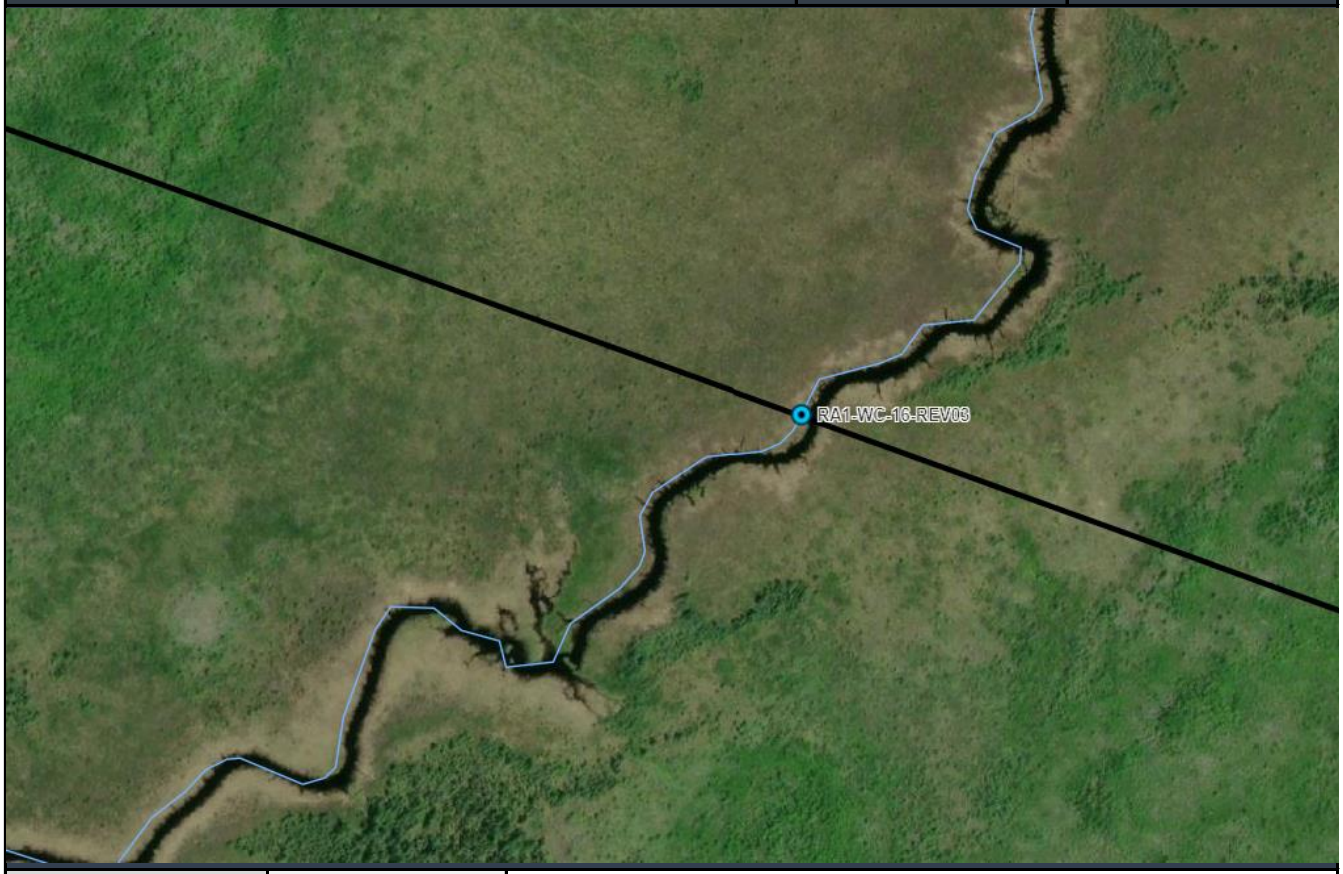
Photograph B: Near crossing location: view looking upstream.

Photograph C: Upstream of crossing; view looking downstream.

Photograph D: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/19/2022				
Location Description:	Crossing is located on an unnamed creek.				
Coordinates of Crossing:	Zone 16	Easting:	526864	Northing:	5658007
Coordinates of Cross Section:	Zone 16	Easting:	526927	Northing:	5658038
Personnel Present:	JC, KE				
Weather Conditions:	Overcast, 20°C				
Project:	21455151		Date Surveyed:		08/19/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-16



Current Metering Section:	Surface Geology:	Organics	
	General Description:	Medium-sized permanent watercourse with poorly defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed	
	Sinuosity:	Moderate sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Un-Confined	
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.357	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	2.2	
	Wetted Width (m):	9.0	
	Floodplain	2.5	
	Bankfull Width (m):	10.0	
	Floodplain Observations:	Large and vast wetland.	
Substrate:	Left Downstream Bank:	100% organics	
	Bed:	100% organics	
	Right Downstream Bank:	100% organics	
Water Chemistry:	Time measured:	14:45	Additional Comments:
	Temperature	19.4 °C	Fully vegetated, low bank stability, low embededness, and low bank compaction. Very unstable and flooded banks. Sharp drop from edge of banks. Banks lined with long submereged grass in 0.5-1m of water.
	Conductivity:	68 mS/cm	
	pH:	6.23	
	Turbidity:	2.9 NTU	
	DO:	3.24 mg/L	
		N/A %	

Project:	21455151	Date Surveyed:	08/19/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-16

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep and unstable to safely wade. Cross-section survey and manual flow measurements not completed.

Project:	21455151	Date Surveyed:	08/19/2022

2022
Water Crossing Surveys
RA1-WC-17

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-17

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	08/19/2022				
Location Description:	Medium sized unnamed watercourse intersecting fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	525296	Northing:	5659102
Coordinates of Cross Section:	Zone 16	Easting:	525210	Northing:	5658953
Personnel Present:	JC, KE				
Weather Conditions:	Overcast, 20°C				
Project:	21455151		Date Surveyed:		08/19/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-17

Current Metering Section:	Surface Geology:	Predominantly a mix of sand and gravel.		
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentationsuch as undercut banks).		
	Hydraulic Control:	None observed.		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.18		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.7		
	Wetted Width (m):	10.0		
	Floodplain	1.0		
	Bankfull Width (m):	15.0		
	Floodplain Observations:	Predominantly shrubs and willows with coniferous forest.		
Substrate:	Left Downstream Bank:	N/A		
	Bed:	25% coarse sand, 25% medium gravel, 20% silt, 15% sobble, 15% organics		
	Right Downstream Bank:	N/A		
Water Chemistry:	Time measured:	12:22		Additional Comments:
	Temperature	18.2	°C	Fully vegetated, slightly undercut banks, stable banks, low embededness, moderate compaction.
	Conductivity:	101	mS/cm	
	pH:	7.43		
	Turbidity:	5.8	NTU	
	DO:	6.5	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	08/19/2022

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-WC-17

Cross Section Survey

	Distance (m)	Rod	Elevation	Comments	
	-	-	-	Not completed	

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.20	0.22	0		
1.30	0.25	0.11		
1.80	0.32	0.17		
2.30	0.30	0.19		
2.80	0.42	0.12		
3.30	0.40	0.23		
3.80	0.44	0.25		
4.30	0.44	0.23		
4.80	0.48	0.22		
5.30	0.52	0.2		
5.80	0.48	0.23		
6.30	0.56	0.2		
6.80	0.58	0.15		
7.30	0.58	0.17		
7.80	0.62	0.12		
8.30	0.58	0.1		
8.80	0.54	0.13		
9.30	0.52	0.12		
9.35	0.50	0		

Flow Rate (m^3/s):	**0.670**
Notes:	

Project:	21455151	Date Surveyed:	08/19/2022

2022
Water Crossing Surveys
RA1-WC-22

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-22

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/20/2022				
Location Description:	Medium-sized unnamed watercourse intersecting grassy terrain.				
Coordinates of Crossing:	Zone 16	Easting:	521713	Northing:	5663417
Coordinates of Cross Section:	Zone 16	Easting:	521710	Northing:	5663409
Personnel Present:	JC, KE				
Weather Conditions:	Sunny, 22°C				
Project:	21455151		Date Surveyed:		08/20/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-22

Current Metering Section:	Surface Geology:	Predominantly organics.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and unstable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	Beaver dam with impoundment upstream		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Realitvely flat.		
	Relative Entrenchment:	Un-Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.0857		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1		
	Wetted Width (m):	~15		
	Floodplain	1		
	Bankfull Width (m):	~15		
	Floodplain Observations:	Predominantly grasses with some shrubs.		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	100% organics		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	15:50		Additional Comments:
	Temperature	19.5	°C	Fully vegetated, low bank stability, low embededness, low bank compaction. Banks are flooded into adjacent grass hummocks.
	Conductivity:	114	mS/cm	
	pH:	6.28		
	Turbidity:	4.3	NTU	
	DO:	4.15	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	08/20/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-22

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade

Flow Rate (m^3/s):	-
Notes:	Too deep and unstable to wade.

Project:	21455151	Date Surveyed:	08/20/2022

2022
Water Crossing Surveys
RA1-WC-25

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-25

Photograph A: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	08/21/2022				
Location Description:	Crossing is located on unnamed watercourse. This crossing was previously done. Only water quality and discharge measurements completed.				
Coordinates of Crossing:	Zone 16	Easting:	/	Northing:	/
Coordinates of Cross Section:	Zone 16	Easting:		Northing:	
Personnel Present:	JW, MH, WB				
Weather Conditions:	Sunny, 27°C				

Project:	21455151	Date Surveyed:	08/21/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-25

Current Metering Section:	Surface Geology:	N/A		
	General Description:	N/A		
	Hydraulic Control:	N/A		
	Sinuosity:	N/A		
	Fluvial	N/A		
	Relative Entrenchment:	N/A		
	Fluvial Geomorphology:	In Adjustment Stability Index: N/A		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A		
	Wetted Width (m):	N/A		
	Floodplain	N/A		
	Bankfull Width (m):	N/A		
	Floodplain Observations:	N/A		
Substrate:	Left Downstream Bank:	N/A		
	Bed:	N/A		
	Right Downstream Bank:	N/A		
Water Chemistry:	Time measured:	14:55		Additional Comments:
	Temperature	13.77	°C	I.e., Slumping, partially vegetated, moderately stable, highly embedded, moderately compacted banks
	Conductivity:	54	mS/cm	
	pH:	5.5		
	Turbidity:	0	NTU	
	DO:	6.65	mg/L	
		64.1	%	

Project:	21455151	Date Surveyed:	08/21/2022

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-WC-25
Manual Flow Measurements				
Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.20	0.05	0.204		LDB EOD (undercut bank)
1.30	0.08	0.255		
1.40	0.14	0.267		
1.50	0.17	0.123		
1.60	0.18	0.102		
1.70	0.00	0		RDB EOW
1.82	0.00	0		RDB TOB

Flow Rate (m^3/s):	**0.010**
Notes:	

Project:	21455151	Date Surveyed:	08/21/2022

2022
Water Crossing Surveys
RA1-WC-30

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-30

Photograph A: Near crossing location. View looking downward.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 95m upstream of crossing; view looking downstream.

Photograph E: Approx. 85m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/22/2022				
Location Description:	Small unnamed watercourse intersected wooded terrain.				
Coordinates of Crossing:	Zone 16	Easting:	520534	Northing:	5709379
Coordinates of Cross Section:	Zone 16	Easting:	520532	Northing:	5709373
Personnel Present:	JW, MH, WB				
Weather Conditions:	Overcast, 17°C				
Project:	21455151		Date Surveyed:		08/22/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-30

Current Metering Section:	Surface Geology:	Predominantly organics and sand.	
	General Description:	Small permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	Beaver dam 100m downstream from crossing (under construction - could be a future control).	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Un-Confined	
	Fluvial Geomorphology:	In Regime Stability Index:	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.25	
	Wetted Width (m):	35.0	
	Floodplain	0.8	
	Bankfull Width (m):	3.2	
	Floodplain Observations:	Primarily grasses with shrubs and coniferous forest.	
Substrate:	Left Downstream Bank:	100% organics	
	Bed:	50% organics, 40% fine sand, 10% coarse sand	
	Right Downstream Bank:	100% organics	
Water Chemistry:	Time measured:	11:35	Additional Comments:
	Temperature	17.86 °C	Fully vegetated, low bank stability, low embededness, low bank compaction. Watercourse has a regular meander, and is incised. Flooded banks with hummocks. Flooded grasses and shrubs on riparian. Submergent vegetation present.
	Conductivity:	40 mS/cm	
	pH:	5.24	
	Turbidity:	0 NTU	
	DO:	9.89 mg/L	
		104.3 %	

Project:	21455151	Date Surveyed:	08/22/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-30

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)			Comments
		60% Depth	80% / 20% Depth		
1.20	0.17	0			Edge of flooded grass
1.35	0.32	0.009			LDB (not defined)
1.50	0.86		0.016	0.016	
1.65	0.87		0.015	0.025	
1.80	0.89		0.02	0.045	
1.95	0.94		0.04	0.096	
2.10	0.92		0.049	0.087	
2.25	0.96		0.051	0.066	
2.40	0.94		0.079	0.059	
2.55	0.94		0.058	0.069	
2.70	0.95		0.054	0.061	
2.85	0.88		0.042	0.061	
3.00	0.83		0.045	0.051	
3.15	0.85		0.04	0.06	
3.3.	0.72	0.045			
3.45	0.64	0.018			
3.60	0.58	0.013			
3.75	0.58	0.006			
3.90	0.50	0.005			
4.05	0.49	0.002			
4.20	0.32	0.002			grass - no well defined banks)
4.30	0.21	0			

Flow Rate (m^3/s):	**0.089**
Notes:	Vast weeds/grass in channel could have potential affects on flow readings.

Project:	21455151	Date Surveyed:	08/22/2022

2022
Water Crossing Surveys
RA1-WC-32

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-32

Photograph A: Near crossing location; view looking downstream.

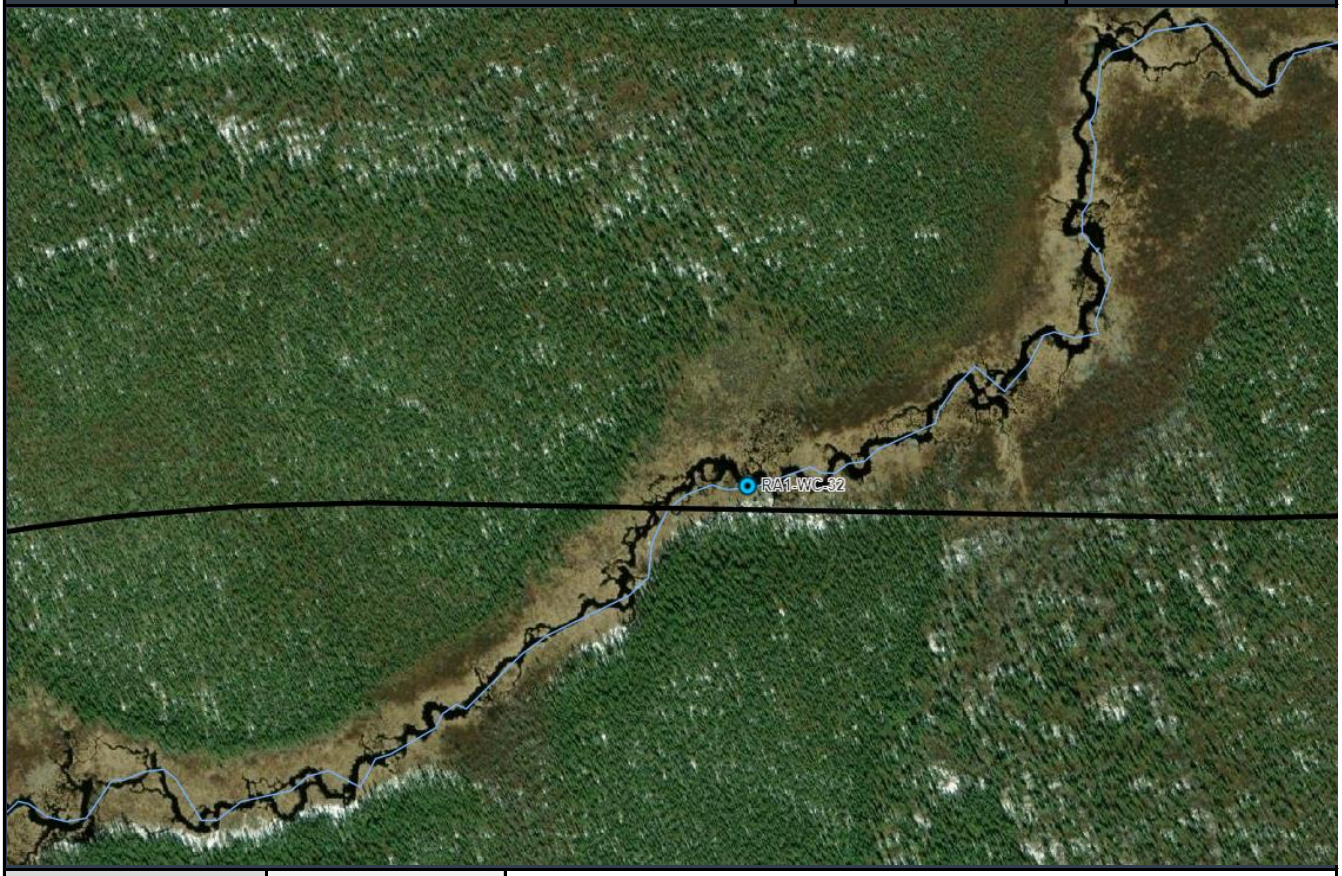
Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 25 m upstream of crossing; view looking downstream.

Photograph D: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/21/2022				
Location Description:	Unnamed watercourse intersecting fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	522111	Northing:	5711797
Coordinates of Cross Section:	Zone 16	Easting:	522108	Northing:	5711800
Personnel Present:	JW, MH, WB				
Weather Conditions:	Sunny, 25°C				
Project:	21455151		Date Surveyed:		08/21/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-32



Current Metering Section:	Surface Geology:	Too deep to wade - most likely organics	
	General Description:	Medium-sized permanent watercourse with moderately defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed.	
	Sinuosity:	Moderate sinuosity	
	Fluvial	Relatively flat.	
	Relative Entrenchment:	Un-Confined	
	Fluvial Geomorphology:	N/A Stability Index: -	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.4	
	Wetted Width (m):	~80	
	Floodplain	N/A	
	Bankfull Width (m):	9.0	
	Floodplain Observations:	Relatively flat. Predominantly flooded grasses and hummocks.	
Substrate:	Left Downstream Bank:	100% organics	
	Bed:	100% organics	
	Right Downstream Bank:	100% organics	
Water Chemistry:	Time measured:	10:52	Additional Comments:
	Temperature	17.08 °C	Fully vegetated, low bank stability, low embededness, low bank compaction. Flooded banks all the way to treeline. Not wadable at crossing. Watercourse is incised with a regular meander.
	Conductivity:	49 mS/cm	
	pH:	5.68	
	Turbidity:	5.7 NTU	
	DO:	4.55 mg/L	
		47.4 %	

Project:	21455151	Date Surveyed:	08/21/2022

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-WC-32

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)			Comments
		60% Depth	80% / 20% Depth		
2.75	0.61	0.005			Edge of flooded grass bank LDB (no defined banks)
2.90	0.72	0.005			
3.10	0.75	0.006			
3.30	0.80		0.015	0.004	
3.50	0.82		0.014	0.005	
3.70	0.84		0.016	0.003	
3.90	0.87		0.014	0.004	
4.10	0.90		0.034	0.005	
4.30	0.92		0.033	0.002	
4.50	0.98		0.028	0.008	
4.70	1.00		0.043	0.007	
4.90	1.08		0.045	0.009	
5.10	1.10		0.052	0.02	
5.30	1.10		0.055	0.031	
5.50	1.10		0.046	0.029	
5.70	1.08		0.047	0.033	
5.90	1.04		0.048	0.021	
6.10	0.90		0.035	0.022	
6.30	0.72	0.004			
6.50	0.69	0.004			Edge of flooded grass bank RDB (no defined banks)

Flow Rate (m^3/s):	**0.077**
Notes:	No defined banks

Project:	21455151	Date Surveyed:	08/21/2022

2022
Water Crossing Surveys
RA1-WC-41

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-41

Photograph A: Near crossing location. View looking downward.

Photograph B: Near crossing location; view looking downstream.

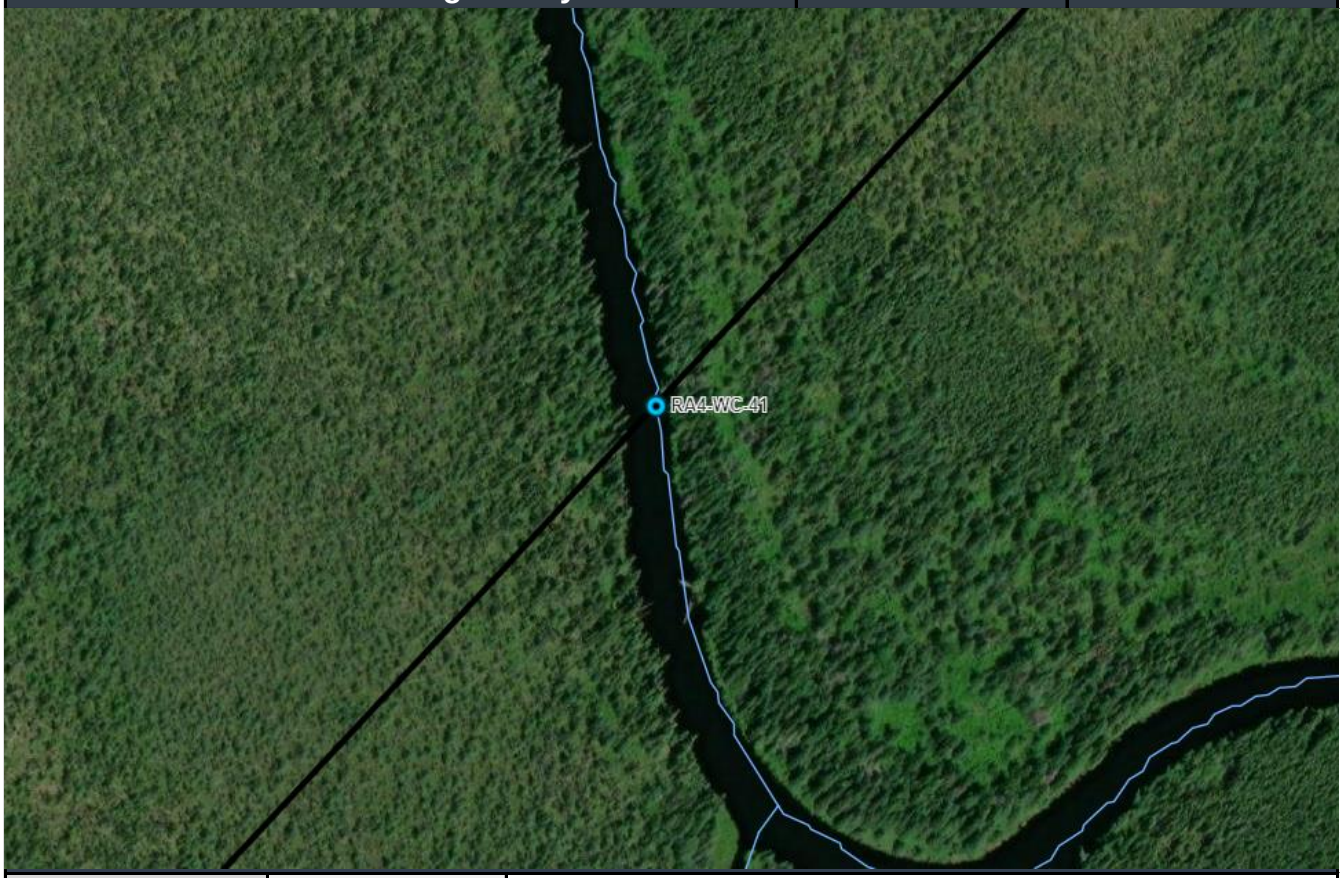
Photograph C: Near crossing location: view looking upstream.

Photograph D: Approx. 120m upstream of crossing; view looking downstream.

Photograph E: Approx. 90m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/23/2022				
Location Description:	Crossing is located on an unnamed watercourse.				
Coordinates of Crossing:	Zone 16	Easting:	524635	Northing:	5720108
Coordinates of Cross Section:	Zone 16	Easting:	524631	Northing:	5720102
Personnel Present:	JW, MH, WB				
Weather Conditions:	Overcast, 15°C				
Project:	21455151		Date Surveyed:		08/23/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-41



Current Metering Section:	Surface Geology:	Predominantly organics	
	General Description:	Small permanent watercourse with moderately-defined bed and banks, little to no entrenchment (some flooding), and unstable channel conditions (i.e., vegetated with ox bow channel forming and some evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Un-Confined	
	Fluvial Geomorphology:	N/A Stability Index: -	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.4	
	Wetted Width (m):	9.5	
	Floodplain	1.8	
	Bankfull Width (m):	9.8	
	Floodplain Observations:	Flat and dominated by grasses.	
Substrate:	Left Downstream Bank:	100% organics	
	Bed:	75% organics, 10% fine sand, 10% fine sand, 5% fine gravel	
	Right Downstream Bank:	100% organics	
Water Chemistry:	Time measured:	15:05	Additional Comments:
	Temperature	17.62 °C	Fully vegetated, moderately stable banks with low embededness and low compaction. There is a side channel (West) of main channel.
	Conductivity:	49 mS/cm	
	pH:	6.04	
	Turbidity:	0 NTU	
	DO:	8.17 mg/L	
		85.3 %	

Project:	21455151	Date Surveyed:	08/23/2022

Marten Falls CAR Water Crossing Survey			Crossing Location:	RA1-WC-41

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.15	0.00	0		LDB TOB
1.30	0.00	0		LDB EOW
1.55	0.17	0.003		
1.80	0.28	0.005		
2.05	0.50	0.01		
2.30	0.64	0.01		
2.55	0.89		0.006 0.074	
2.80	0.74	0.053		
3.05	0.92		0.004 0.084	
3.30	0.88		-0.014 0.08	
3.55	0.74	0.085		
3.80	1.05		-0.007 0.073	
4.05	1.05		0 0.052	
4.30	0.97		0.015 0.07	
4.55	0.96		0.029 0.071	
4.80	1.00		0.055 0.079	
5.05	1.09		0.067 0.088	
5.30	1.02		0.089 0.033	
5.55	1.00		0.066 0.017	
5.80	0.98		0.037 -0.002	
5.90	0.00	0		RDB EOW (where flooded grass begins - not well defined)

Flow Rate (m^3/s):	**0.160**
Notes:	Vast grass/organics in channel may have affected velocity measurements.

Project:	21455151	Date Surveyed:	08/23/2022

2022
Water Crossing Surveys
RA1-WC-51

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-51

Photograph A: Near crossing location; view looking downstream.

Photograph B: Near crossing location: view looking upstream.

Photograph C: Approx. 120m upstream of crossing; view looking downstream.

Photograph D: Approx. 120m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/26/2022				
Location Description:	Crossing is located on Wabassi River				
Coordinates of Crossing:	Zone 16	Easting:	510970	Northing:	5732829
Coordinates of Cross Section:	Zone 16	Easting:	510966	Northing:	5732848
Personnel Present:	JW, MH, WB				
Weather Conditions:	Overcast, 14°C				
Project:	21455151		Date Surveyed:		08/26/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-51

Current Metering Section:	Surface Geology:	Too deep to wade.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed.		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Un-Confined		
	Fluvial Geomorphology:	In Regime Stability Index:		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5		
	Wetted Width (m):	65.0		
	Floodplain	N/A		
	Bankfull Width (m):	70.0		
	Floodplain Observations:	Coniferous forest.		
Substrate:	Left Downstream Bank:	50% organics, 50% silt		
	Bed:	Too deep to wade.		
	Right Downstream Bank:	No access.		
Water Chemistry:	Time measured:	10:54		Additional Comments:
	Temperature	16.36	°C	Partially vegetated, stable watercourse, moderate bank stability, low embededness and low compaction.
	Conductivity:	123	mS/cm	
	pH:	6.09		
	Turbidity:	0	NTU	
	DO:	8.34	mg/L	
		85.3	%	

Project:	21455151	Date Surveyed:	08/26/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-51

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to safely wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to safely wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade.

Project:	21455151	Date Surveyed:	08/26/2022

2022
Water Crossing Surveys
RA4B-WC-02

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4B-WC-02

Photograph A: Near crossing location. View looking at right downstream bank.

Photograph B: Near crossing location; view looking downstream.

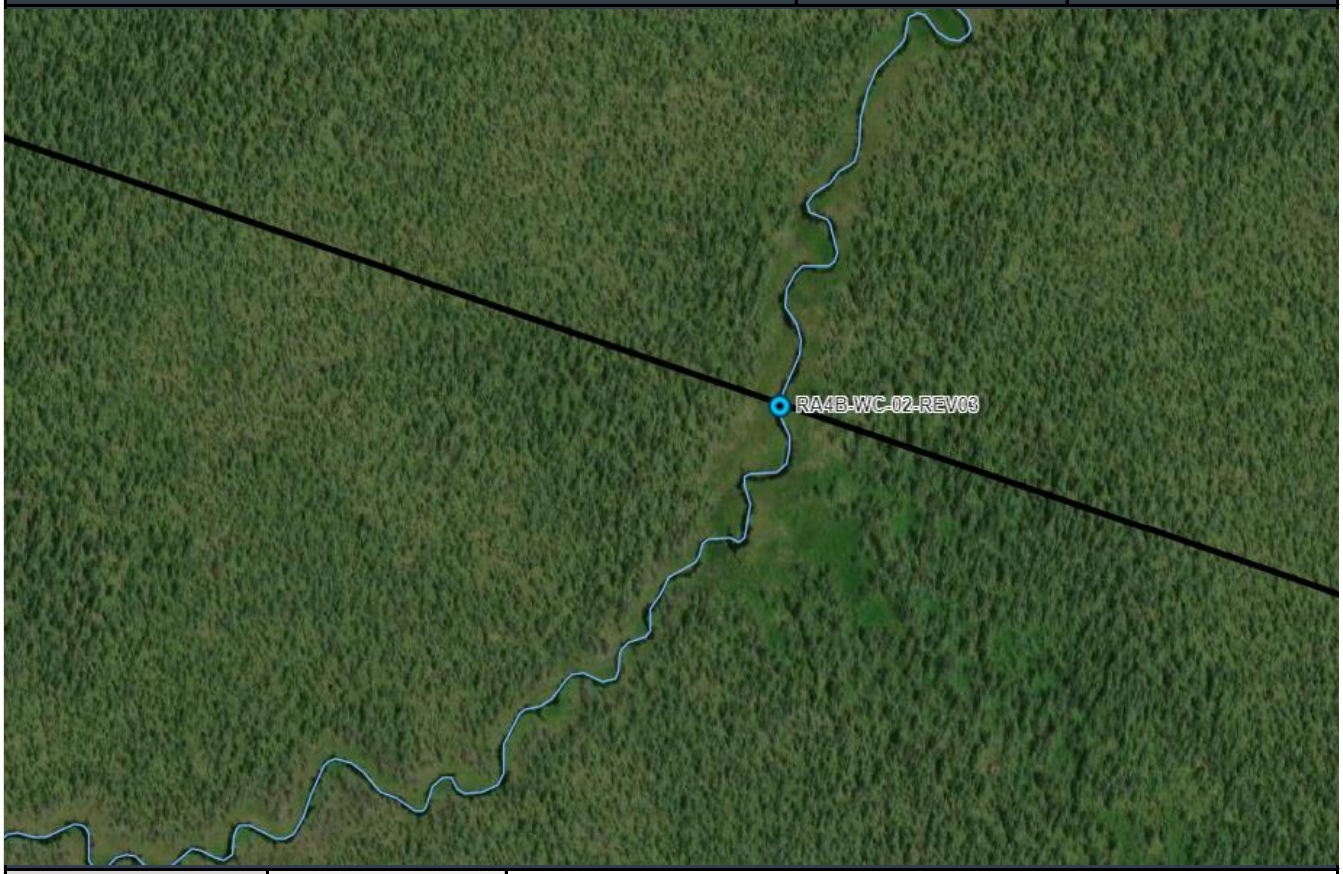
Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/23/2022				
Location Description:	Crossing is located on unnamed creek.				
Coordinates of Crossing:	Zone 16	Easting:	517166	Northing:	5631036
Coordinates of Cross Section:	Zone 16	Easting:	517166	Northing:	5631036
Personnel Present:	JC, KE				
Weather Conditions:	Overcast, 17°C				
Project:	21455151		Date Surveyed:		08/23/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4B-WC-02



Current Metering Section:	Surface Geology:	Organics		
	General Description:	Small permanent watercourse with moderately defined bed and banks, and unstable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentationsuch as undercut banks).		
	Hydraulic Control:	Small beaver dam downstream.		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Frequently Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.17		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.6		
	Wetted Width (m):	3.1		
	Floodplain	1.2		
	Bankfull Width (m):	3.4		
	Floodplain Observations:	Predominately grasses and shrubs with coniferous forest.		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	100% organics		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	13:31		Additional Comments:
	Temperature	17.1	°C	Undercut banks, fully vegetated banks, low bank stability, low embededness, and low bank compaction.
	Conductivity:	38	mS/cm	
	pH:	6.69		
	Turbidity:	2	NTU	
	DO:	8.58	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	08/23/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4B-WC-02

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
1.20	0.60	0		
1.30	0.50	0.135		
1.40	0.54	0.138		
1.50	0.50	0.121		
1.60	0.52	0		
1.70	0.52	0.119		
1.80	0.48	0.103		
1.90	0.50	0.118		
2.00	0.48	0.088		
2.10	0.44	0.061		
2.20	0.30	0.074		
2.30	0.24	0.059		
2.40	0.22	0.06		
2.50	0.18	0.031		
2.60	0.12	0.046		
2.70	0.14	0.039		
2.80	0.12	0		

Flow Rate (m^3/s):	**0.051**
Notes:	

Project:	21455151	Date Surveyed:	08/23/2022

2022
Water Crossing Surveys
RA4-WC-00

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-00

Photograph A: Near crossing location. View looking downward.

Photograph B: Near crossing location; view looking downstream.

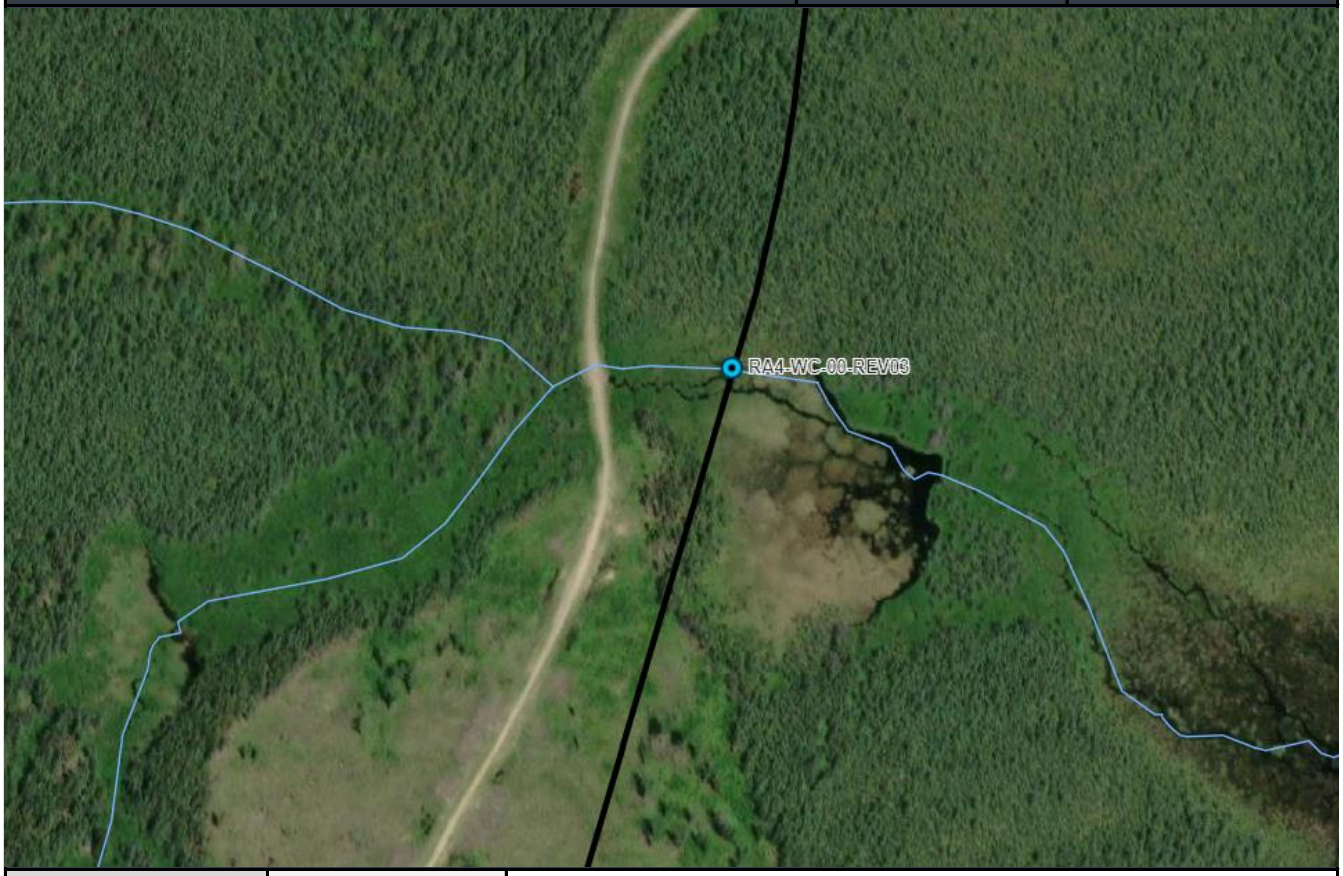
Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/25/2022				
Location Description:	Crossing located on unnamed creek.				
Coordinates of Crossing:	Zone 16	Easting:	5424202	Northing:	5620008
Coordinates of Cross Section:	Zone 16	Easting:	5424203	Northing:	5620008
Personnel Present:	JC, KE				
Weather Conditions:	N/A				
Project:	21455151		Date Surveyed:		08/25/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-00



Current Metering Section:	Surface Geology:	Predominantly silt	
	General Description:	Small permanent watercourse with moderately defined bed and banks, and moderately stable channel conditions (i.e., densely vegetated with some evidence of erosion and sedimentation).	
	Hydraulic Control:	Impoundment downstream.	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Occasionally Confined	
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.25	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.2	
	Wetted Width (m):	1.2	
	Floodplain	0.3	
	Bankfull Width (m):	1.7	
	Floodplain Observations:	Predominantly grasses and shrubs with coniferous forest	
Substrate:	Left Downstream Bank:	50% organics, 50% silt	
	Bed:	80% silt, 20% organics	
	Right Downstream Bank:	50% organics, 50% silt	
Water Chemistry:	Time measured:	11:29	Additional Comments:
	Temperature	12.1 °C	Fully vegetated banks, low bank stability, low embededness, low bank compaction. Winding and neutral channel form.
	Conductivity:	101 mS/cm	
	pH:	6.68	
	Turbidity:	2.1 NTU	
	DO:	8.21 mg/L	
		N/A %	

Project:	21455151	Date Surveyed:	08/25/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-00

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
2.30	0.00	0		LDB
2.40	0.06	0.02		
2.50	0.22	0.016		
2.60	0.30	0.017		
2.70	0.34	0.019		
2.80	0.38	0.019		
2.90	0.38	0.018		
3.00	0.40	0.021		
3.10	0.38	0.018		
3.20	0.38	0.021		
3.30	0.38	0.018		
3.40	0.36	0.016		
3.50	0.30	0.017		
3.60	0.28	0.016		
3.70	0.20	0.015		
3.80	0.80	0.005		
3.88	0.00	0		RDB

Flow Rate (m^3/s):	**0.008**
Notes:	

Project:	21455151	Date Surveyed:	08/25/2022

2022
Water Crossing Surveys
RA4-WC-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-19

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/22/2022				
Location Description:	Crossing located on unnamed creek.				
Coordinates of Crossing:	Zone 16	Easting:	523071	Northing:	5649798
Coordinates of Cross Section:	Zone 16	Easting:	523052	Northing:	5649781
Personnel Present:	JC, KE				
Weather Conditions:	Overcast				
Project:	21455151		Date Surveyed:		08/22/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-19

Current Metering Section:	Surface Geology:	Organics		
	General Description:	Small permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with some evidence of erosion and sedimentationsuch as undercut banks).		
	Hydraulic Control:	Beaver dam downstream.		
	Sinuosity:	High sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Un-Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.1		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.2		
	Wetted Width (m):	6.0		
	Floodplain	>1.5		
	Bankfull Width (m):	15.0		
	Floodplain Observations:	Predominantly grasses with shrubs and coniferous forest		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	100% organics		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	10:08		Additional Comments:
	Temperature	19.2	°C	Undercut banks, fully vegetated, low bank stability, low embededness, low compaction. Tortuous meander and neutral, channel form.
	Conductivity:	65	mS/cm	
	pH:	6.75		
	Turbidity:	4.5	NTU	
	DO:	3.96	mg/L	
		N/A	%	

Project:	21455151	Date Surveyed:	08/22/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-19

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.13	0.05	0		LDB
1.40	0.04	0.01		
1.50	0.06	0.003		
1.60	0.08	0.007		
1.70	0.08	0.117		
1.80	0.08	0.156		
1.90	0.08	0.314		
2.00	0.12	0.273		
2.10	0.22	0.231		
2.20	0.46	0.018		
2.30	0.40	0.192		
2.40	0.40	0.247		
2.50	0.47	0.146		
2.60	0.46	0.098		
2.70	0.46	0.211		
2.80	0.50	0.171		
2.90	0.50	0.213		
3.00	0.50	0.223		
3.10	0.50	0.137		
3.20	0.32	0.141		
3.30	0.00	0		RDB

Flow Rate (m^3/s):	**0.096**
Notes:	

Project:	21455151	Date Surveyed:	08/22/2022

2022
Water Crossing Surveys

RA4-WC-21

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-21

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	08/24/2022				
Location Description:	Unnamed crossing intersecting fen/bog terrain				
Coordinates of Crossing:	Zone 16	Easting:	521131	Northing:	5656047
Coordinates of Cross Section:	Zone 16	Easting:	521099	Northing:	5656084
Personnel Present:	JC, KE				
Weather Conditions:	Overcast, 20°C				
Project:	21455151		Date Surveyed:		08/24/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-21

Current Metering Section:	Surface Geology:	Predominantly organics		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat.		
	Relative Entrenchment:	Occassionally Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.09		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	N/A (flooded conditions)		
	Wetted Width (m):	N/A (flooded conditions)		
	Floodplain	1.4		
	Bankfull Width (m):	9.5		
	Floodplain Observations:	Flooded grassy floodplain with some shrubs		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	75% organics, 25% silt		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	13:33		Additional Comments:
	Temperature	16.8	°C	Fully vegetated banks, low bank stability, low embededness, and low compaction.
	Conductivity:	81	mS/cm	
	pH:	6.81		
	Turbidity:	6.1	NTU	
	DO:	6.59	mg/L	
		N/A	%	

Project:	21455151		08/24/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-21

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep and unstable to wade.

Project:	21455151	Date Surveyed:	08/24/2022

2022
Water Crossing Surveys
RA1-4-WC-33

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Photograph A: Near crossing location, view looking downstream.

Photograph B: Near crossing location; view looking upstream.

Inspection Date (mm/dd/yyyy):	06/24/2022				
Location Description:	Crossing is located on a small meandering permanent watercourse. There are no defined banks and mostly organics.				
Coordinates of Crossing:	Zone 16	Easting:	569502	Northing:	5733028
Coordinates of Cross Section:	Zone 16	Easting:	569514	Northing:	5733022
Personnel Present:	JF, MH				
Weather Conditions:	Sunny, 20°C				
Project:	21455151		Date Surveyed:		06/24/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Current Metering Section:	Surface Geology:	Predominantly organics		
	General Description:	Small permanent watercourse with poorly defined bed and banks, unconfined and moderately stable channel conditions (i.e., densely vegetated with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed.		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Un-confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.11		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	0.4		
	Wetted Width (m):	2.5		
	Floodplain	0.4		
	Bankfull Width (m):	2.6		
	Floodplain Observations:	Predominantly grasses with shrubs. Flooded conditions.		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	100% organics		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	14:45		Additional Comments:
	Temperature	21.4	°C	Fully vegetated, low stability, lowly embedded, low compaction.
	Conductivity:	15.2	mS/cm	
	pH:	6.36		
	Turbidity:	N/A	NTU	
	DO:	7.18	mg/L	
		80.4	%	

Project:	21455151	Date Surveyed:	06/24/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-33

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.85	0.00	0		LDB TOB
0.90	0.30	0.02		LDB EOW
1.00	0.32	0.01		
1.10	0.32	0.04		
1.20	0.30	0.05		
1.30	0.34	0.06		
1.40	0.40	0.09		
1.50	0.41	0.11		
1.60	0.42	0.11		
1.70	0.41	0.11		
1.80	0.40	0.11		
1.90	0.42	0.11		
2.00	0.44	0.1		
2.10	0.40	0.09		
2.20	0.36	0.05		
2.30	0.24	0.03		
2.40	0.16	0.02		
2.50	0.16	0.02		
2.60	0.13	0.01		
2.70	0.05	0.01		
2.80	0.02	0		
2.90	0.02	0		
2.95	0.00	0		RDB EOW

Flow Rate (m^3/s):	**0.043**
Notes:	Undefined banks with organics, weeds, and dense alders.

Project:	21455151	Date Surveyed:	06/24/2022

2022
Water Crossing Surveys

RA4-WC-41

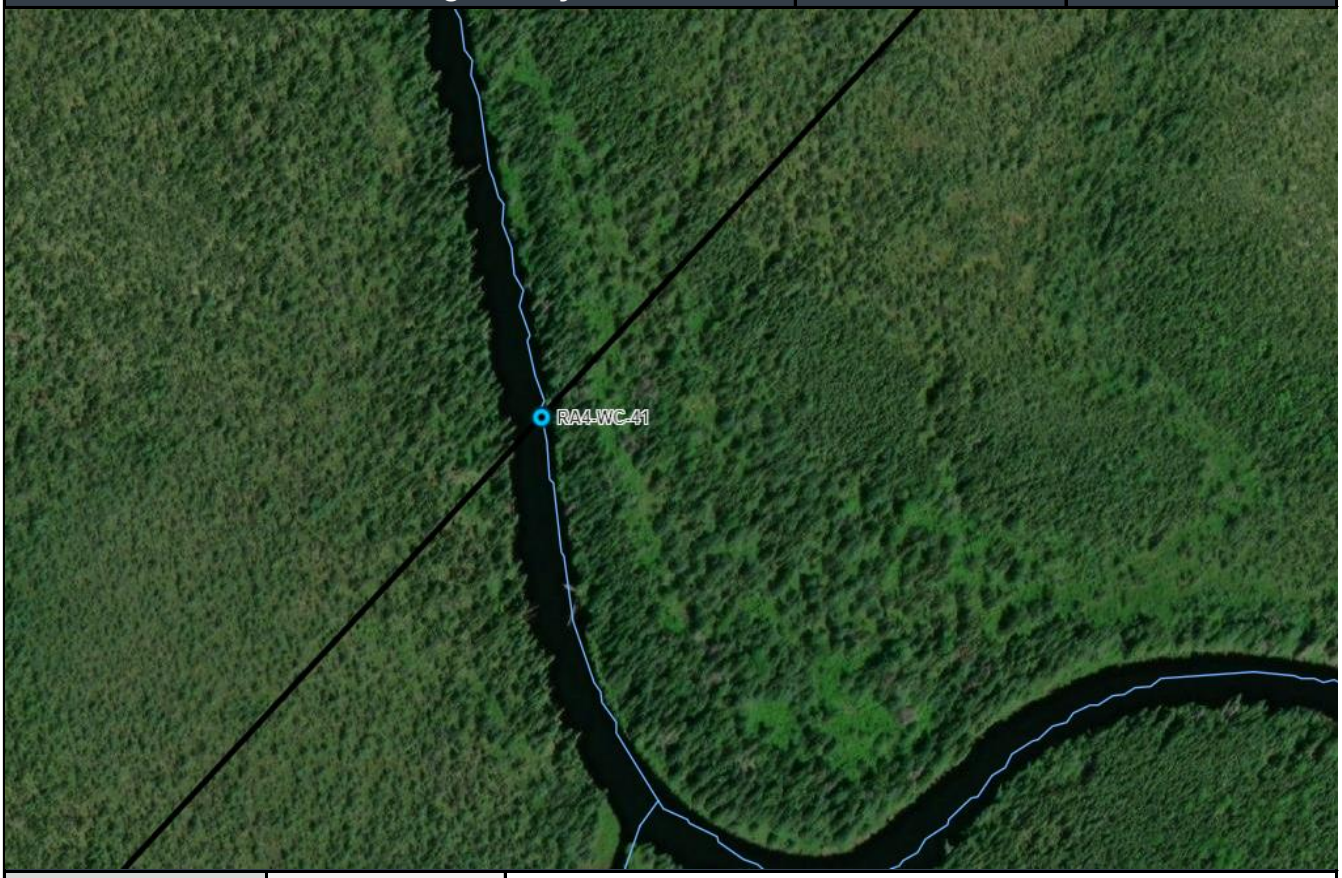
Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-41

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.	Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	06/25/2022				
Location Description:	Crossing located on Gourlic Creek.				
Coordinates of Crossing:	Zone 16	Easting:	526665	Northing:	5715963
Coordinates of Cross Section:	Zone 16	Easting:	526644	Northing:	5715946
Personnel Present:	JF, MH				
Weather Conditions:	Overcast, 20°C				
Project:	21455151		Date Surveyed:		06/25/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-41



Current Metering Section:	Surface Geology:	Unknown, too deep to observe.	
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed.	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Confined	
	Fluvial Geomorphology:	In Regime Stability Index: 0.09	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	Too deep to wade.	
	Wetted Width (m):	32.0	
	Floodplain	Too deep to wade.	
	Bankfull Width (m):	35.0	
	Floodplain Observations:	Some shrubs and predominantly coniferous forest	
Substrate:	Left Downstream Bank:	60% fine sand, 40% silt	
	Bed:	Too deep to wade.	
	Right Downstream Bank:	60% fine sand, 40% silt	
Water Chemistry:	Time measured:	10:50	Additional Comments:
	Temperature	17.6 °C	Fully vegetated, low stability, low embededness, low compaction.
	Conductivity:	47.6 mS/cm	
	pH:	7.26	
	Turbidity:	N/A NTU	
	DO:	7.3 mg/L	
		76.3 %	

Project:	21455151	Date Surveyed:	06/25/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-41

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade, flow measurements and cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	06/25/2022

2022
Water Crossing Surveys
RA4-WC-45

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-45

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.	Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	06/27/2022				
Location Description:	Crossing is located in a large wetland area with floating muskeg mats. The crossing is located on a small, deep, and flowing channelized area. The channel irregular meanders and deeply incised.				
Coordinates of Crossing:	Zone 16	Easting:	530801	Northing:	5722972
Coordinates of Cross Section:	Zone 16	Easting:	530819	Northing:	5722961
Personnel Present:	JF, MH				
Weather Conditions:	Sunny, 21°C				
Project:	21455151		Date Surveyed:		06/27/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-45

Current Metering Section:	Surface Geology:	Organic materials		
	General Description:	Small permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Fluvial	Relatively flat.		
	Relative Entrenchment:	Un-confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.1		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.2		
	Wetted Width (m):	7.0		
	Floodplain	1.3		
	Bankfull Width (m):	100.0		
	Floodplain Observations:	Vast floodplain. Predominantly muskeg with shrubs.		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	100% organics		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	-		Additional Comments:
	Temperature	15.2	°C	Fully vegetated, low stability, low embededness, low compaction.
	Conductivity:	24	mS/cm	
	pH:	6.29		
	Turbidity:	N/A	NTU	
	DO:	4.64	mg/L	
		46.6	%	

Project:	21455151	Date Surveyed:	06/27/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-45

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade, flow measurements and cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	06/27/2022

2022
Water Crossing Surveys
RA4-WC-55

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	06/27/2022				
Location Description:	Wabassi River				
Coordinates of Crossing:	Zone 16	Easting:	539004	Northing:	5735928
Coordinates of Cross Section:	Zone 16	Easting:	538999	Northing:	5735944
Personnel Present:	JF, MH				
Weather Conditions:	Sunny, 20°C				
Project:	21455151		Date Surveyed:		06/27/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Current Metering Section:	Surface Geology:	Too deep to wade. Most likely cobble and sand.		
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	None observed		
	Sinuosity:	Moderate sinuosity		
	Fluvial			
	Relative Entrenchment:	Confined		
	Fluvial Geomorphology:	In Regime Stability Index: 0.18		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1		
	Wetted Width (m):	42.0		
	Floodplain	>1		
	Bankfull Width (m):	45.0		
	Floodplain Observations:	Relatively flat, dominated by shrubs and coniferous forest		
Substrate:	Left Downstream Bank:	60% fine sand, 20% silt, 20% cobble		
	Bed:	Too deep to wade		
	Right Downstream Bank:	Unable to assess, visually similar to LDB		
Water Chemistry:	Time measured:	10:30		Additional Comments:
	Temperature	14.7	°C	Partially vegetated, low to medium stability, moderate embededness, moderately compacted banks
	Conductivity:	40	mS/cm	
	pH:	7.25		
	Turbidity:	N/A	NTU	
	DO:	7.89	mg/L	
		79.8	%	

Project:	21455151	Date Surveyed:	06/27/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA4-WC-55

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade, flow measurements and cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	06/27/2022

2022
Water Crossing Surveys
RA1-4-WC-35

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35

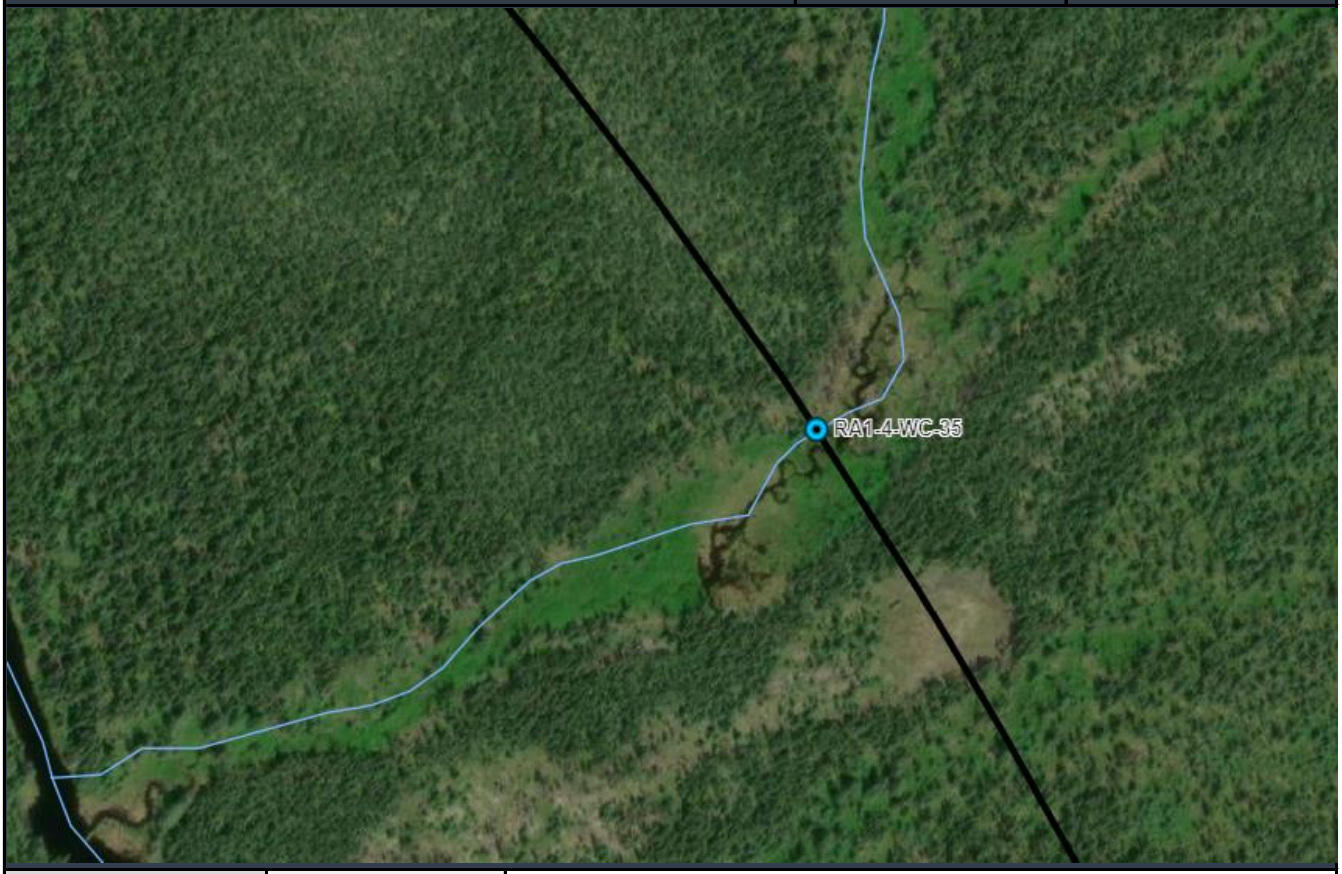
Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Inspection Date (mm/dd/yyyy):	06/28/2022				
Location Description:	Small unnamed watercourse intersecting fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	573750	Northing:	5732816
Coordinates of Cross Section:	Zone 16	Easting:	573752	Northing:	5732807
Personnel Present:	JF, MH				
Weather Conditions:	Overcast, 18°C				
Project:	21455151		Date Surveyed:		06/28/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35



Current Metering Section:	Surface Geology:	Predominantly organics		
	General Description:	Small permanent watercourse with well-defined bed and banks, and unstable channel conditions (i.e., dense aquatic vegetation with limited evidence of erosion and sedimentation).		
	Hydraulic Control:	Cut block 100m north of crossing, beaver dam (downstream from crossing) and beaver lodge near by and an upstream impoundment.		
	Sinuosity:	Low sinuosity		
	Fluvial	Relatively flat		
	Relative Entrenchment:	Un-Confined		
	Fluvial Geomorphology:	Transitional or Stressed Stability Index: 0.33		
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.2		
	Wetted Width (m):	50.0		
	Floodplain	1.2		
	Bankfull Width (m):	51.0		
	Floodplain Observations:	Flooded muskeg and bog, relatively flat with some shrubs and grass.		
Substrate:	Left Downstream Bank:	100% organics		
	Bed:	100% organics		
	Right Downstream Bank:	100% organics		
Water Chemistry:	Time measured:	14:00		Additional Comments:
	Temperature	11.9	°C	Fully vegetated, low bank stability, low embededness, low bank compaction.
	Conductivity:	19.8	mS/cm	
	pH:	6.18		
	Turbidity:	N/A	NTU	
	DO:	6.29	mg/L	
		57.5	%	

Project:	21455151	Date Surveyed:	06/28/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-35

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Not completed

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
0.20				RDB EOW (edge of bank)
0.40	0.18	0.015		
0.60	0.62	0.053		
0.80	0.72	0.08		
1.00	0.74	0.081		
1.20	0.72	0.086		
1.40	0.66	0.073		
1.60	0.64	0.036		
1.80	0.58	0.034		
2.00	0.62	0.054		
2.20	0.68	0.047		
2.40	0.67	0.048		
2.60	0.67	0.047		
2.80	0.64	0.037		
3.00	0.58	0.041		
3.20	0.62	0.023		
3.40	0.60	0.001		
3.60	0.52	0.007		
3.80	0.48	-0.003		
4.00	0.48	0.008		
4.20	0.42	-0.001		
4.40	0.22	-0.001		
4.50				LDB EOW (flooded bank)

Flow Rate (m^3/s):	**0.100**
Notes:	

Project:	21455151	Date Surveyed:	06/28/2022

2022
Water Crossing Surveys
RA1-4-WC-19

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-19

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	06/29/2022				
Location Description:	Unnamed crossing intersecting flooded fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	546802	Northing:	5742739
Coordinates of Cross Section:	Zone 16	Easting:	546816	Northing:	5742739
Personnel Present:	JF, MH				
Weather Conditions:	Sunny, 18°C				
Project:	21455151		Date Surveyed:		06/29/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-19

Current Metering Section:	Surface Geology:	Predominantly organics materials
	General Description:	Large-sized permanent watercourse with moderately defined bed and banks, unconfined and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).
	Hydraulic Control:	None observed.
	Sinuosity:	Low sinuosity
	Fluvial	Relatively flat
	Relative Entrenchment:	Un-Confined
	Fluvial Geomorphology:	In Regime Stability Index: 0.18
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>2m
	Wetted Width (m):	60.0
	Floodplain	>2m
	Bankfull Width (m):	26.0
	Floodplain Observations:	Vast and flat floodplain, dominated by muskeg and, white sprice and alders (flooded ~55m)
Substrate:	Left Downstream Bank:	100% organics
	Bed:	100% organics
	Right Downstream Bank:	100% organics

Water Chemistry:	Time measured:	10:00		Additional Comments:
	Temperature	14.8	°C	Fully vegetated, low bank stability, low embededness, low bank compaction.
	Conductivity:	39.9	mS/cm	
	pH:	6.71		
	Turbidity:	N/A	NTU	
	DO:	5.07	mg/L	
		50.1	%	

Project:	21455151	Date Surveyed:	06/29/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-19

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade, flow measurements and cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	06/29/2022

2022
Water Crossing Surveys
RA1-4-WC-36

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-36

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

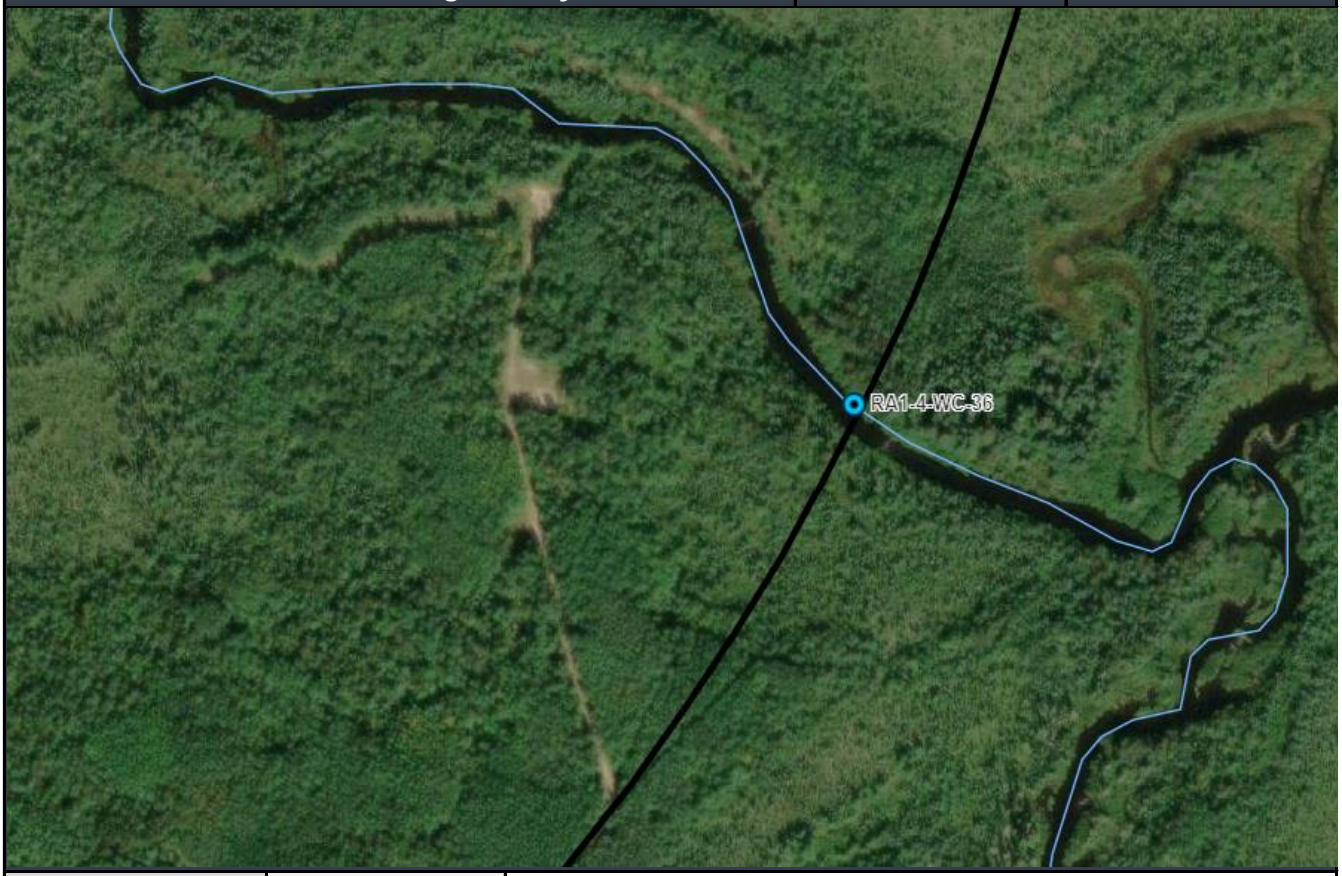
Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	06/28/2022				
Location Description:	Crossing is located on un-named tributary of Ogoki River.				
Coordinates of Crossing:	Zone 16	Easting:	577681	Northing:	5726015
Coordinates of Cross Section:	Zone 16	Easting:	577675	Northing:	5726008
Personnel Present:	JF, MH				
Weather Conditions:	Overcast, 15°C				
Project:	21455151		Date Surveyed:		06/28/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-36



Current Metering Section:	Surface Geology:	Too deep to wade.	
	General Description:	Small permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., well vegetated with limited evidence of erosion and sedimentation).	
	Hydraulic Control:	None observed.	
	Sinuosity:	Low sinuosity	
	Fluvial	Relatively flat	
	Relative Entrenchment:	Un-Confined	
	Fluvial Geomorphology:	In Regime Stability Index: 0.15	
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	Too deep to wade	
	Wetted Width (m):	15.5	
	Floodplain	Too deep to wade	
	Bankfull Width (m):	16.5	
	Floodplain Observations:	Shrubs and coniferous forest	
Substrate:	Left Downstream Bank:	100% organics	
	Bed:	Too deep to wade	
	Right Downstream Bank:	100% organics	
Water Chemistry:	Time measured:	10:30	Additional Comments:
	Temperature	14.4 °C	Fully vegetated, low bank stability, low ebededness, and low compaction.
	Conductivity:	29 mS/cm	
	pH:	6.68	
	Turbidity:	N/A NTU	
	DO:	7.55 mg/L	
		74.1 %	

Project:	21455151	Date Surveyed:	06/28/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-4-WC-36

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade, flow measurements and cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	06/28/2022

2022
Water Crossing Surveys
RA1-WC-66

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-66

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Approx. 50 m downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	06/30/2022				
Location Description:	Small unnamed watercourse intersecting fen/bog terrain.				
Coordinates of Crossing:	Zone 16	Easting:	527414	Northing:	5740047
Coordinates of Cross Section:	Zone 16	Easting:	527393	Northing:	5740043
Personnel Present:	JF, MH				
Weather Conditions:	Overcast, 18°C				
Project:	21455151		Date Surveyed:		06/30/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-66

Current Metering Section:	Surface Geology:	Predominantly organics
	General Description:	Small permanent watercourse with poorly defined bed and banks, unconfined and moderately stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).
	Hydraulic Control:	Series of old beaver impoundments.
	Sinuosity:	Moderate sinuosity
	Fluvial	Relatively flat
	Relative Entrenchment:	Un-Confined
	Fluvial Geomorphology:	In Regime Stability Index: 0.18
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	1.6
	Wetted Width (m):	110.0
	Floodplain	1.6
	Bankfull Width (m):	8.0
	Floodplain Observations:	Flooded area. Floodplain is vast and covered predominantly with floating muskeg.
Substrate:	Left Downstream Bank:	100% organics
	Bed:	100% organics
	Right Downstream Bank:	100% organics

Water Chemistry:	Time measured:	10:15		Additional Comments:
	Temperature	13.9	°C	Fully vegetated banks, low bank stability, low embededness, low bank compaction.
	Conductivity:	27.5	mS/cm	
	pH:	6.27		
	Turbidity:	N/A	NTU	
	DO:	2.48	mg/L	
		24.1	%	

Project:	21455151	Date Surveyed:	06/30/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-66

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade, flow measurements and cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	06/30/2022

2022
Water Crossing Surveys
RA1-WC-67

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-67

Photograph A: Aerial view near crossing location.

Photograph B: Near crossing location; view looking downstream.

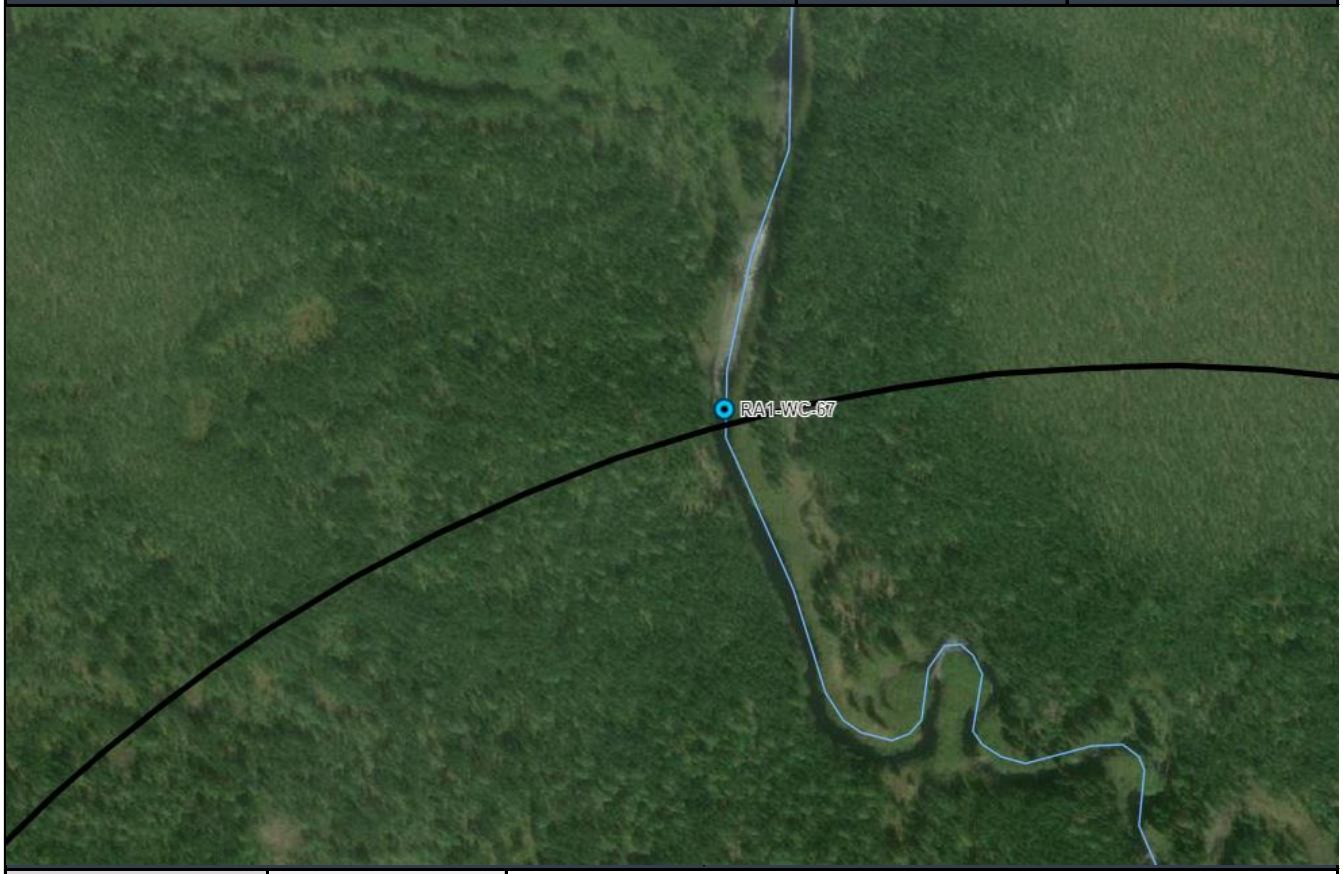
Photograph C: Near crossing location: view looking upstream.

Photograph D: Upstream of crossing; view looking downstream.

Photograph E: Downstream of crossing; view looking upstream.

Inspection Date (mm/dd/yyyy):	06/30/2022				
Location Description:	Large unnamed watercourse intersect forested terrain.				
Coordinates of Crossing:	Zone 16	Easting:	531917	Northing:	57741009
Coordinates of Cross Section:	Zone 16	Easting:	531907	Northing:	57741006
Personnel Present:	JF, MH				
Weather Conditions:	Overcast, 18°C				
Project:	21455151		Date Surveyed:		06/30/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-67



Current Metering Section:	Surface Geology:	Unknown, too deep to observe
	General Description:	Large-sized permanent watercourse with well-defined bed and banks, and stable channel conditions (i.e., fully vegetated banks with limited evidence of erosion and sedimentation).
	Hydraulic Control:	None observed.
	Sinuosity:	Moderate sinuosity
	Fluvial	Relatively flat
	Relative Entrenchment:	Confined
	Fluvial Geomorphology:	In Regime Stability Index: 0.15
Basic Obervations at Crossing (taken at date indicated below):	Wetted Depth (m):	>1.5
	Wetted Width (m):	20.0
	Floodplain	>1.5
	Bankfull Width (m):	23.0
	Floodplain Observations:	Predominantly shrubs and coniferous forest.
Substrate:	Left Downstream Bank:	40% organics, 30% fine sand, 20% coarse sand, 10% silt
	Bed:	Too deep to wade.
	Right Downstream Bank:	40% organics, 30% fine sand, 20% coarse sand, 10% silt

Water Chemistry:	Time measured:	14:15		Additional Comments:
	Temperature	15.3	°C	Fully vegetated banks, moderately stable banks, low embededness, and low compaction.
	Conductivity:	27.3	mS/cm	
	pH:	6.62		
	Turbidity:	N/A	NTU	
	DO:	6.95	mg/L	
		69.1	%	

Project:	21455151	Date Surveyed:	06/30/2022

Marten Falls CAR Water Crossing Survey	Crossing Location:	RA1-WC-67

Cross Section Survey

Distance (m)	Rod	Elevation	Comments
-	-	-	Too deep to wade

Notes: CL = centerline; EOW = edge of water; LDB = left downstream bank; RDB = right downstream bank; TOB = top of bank

Manual Flow Measurements

Distance (m)	Depth (m)	Velocity (m/s)		Comments
		60% Depth	80% / 20% Depth	
-	-	-		Too deep to wade

Flow Rate (m^3/s):	-
Notes:	Too deep to safely wade, flow measurements and cross-sectional survey not completed.

Project:	21455151	Date Surveyed:	06/30/2022

Attachment I – Rapid Geomorphic Assessments

Table I-1: Rapid Geomorphic Assessments - Marten Falls Community Acess Road Project

			Evidence of Aggradation (AI)								Evidence of Degradation (DI)												Evidence of Widening (WI)												Evidence of Planimetric Form Adjustment (PI)									
Site	Date Visited (dd/mm/yy)	Matlook Figure Location	Lobate Bar	Coarse Material in riffles embedded	Siltation in Pools	Medial bars	Accretion on point bars	Poor longitudinal sorting of bed materials	Deposition in the overbank zone	RATIO OF INDICES[1]	Exposed bridge footing(s)	Exposed sanitary/storm sewer/pipeline	Elevated storm sewer outlet(s)	Undermined gabion basket/concrete apron/etc.	Scour pools d/s of culverts/storm sewer outlets	Cut face on bar forms	Head cutting due to nick point migration	Terrace cut through older bar material	Suspended armor layer visible in bank	Channel worn into undisturbed overburden/bedrock	RATIO OF INDICES[1]	Fallen/leaning trees/fence posts/etc.	Occurrence of large organic debris	Exposed tree roots	Bitual scour on inside meander bends	Bitual scour on both sides of channel through riffle	Gabion basket/concrete wall/grdr, out flanked	Length of basal scour > 50% through subject reach	Exposed length of previously buried pipe/cable/etc.	Fracture lines along top of bank	Exposed building foundation	RATIO OF INDICES[1]	Formation of cut(s)	Single thread channel to multiple channel	Evolution of pool+riffle form to low bar/ trail form	Cutoff channel(s)	Formation of island(s)	Thalweg alignment out of phase meander form	Bar forms poorly formed/reworked/removed	RATIO OF INDICES[1]	**STABILITY INDEX[2] (AI+DI+WI+PI)/4**	
RA1-4-WC-01	11-Sep-21	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	X	X	-	X	X	-	X	0.71	**0.24**	Transitional or Stressed
RA1-4-WC-02	8-Sep-19	I-3	X	X	-	-	-	X	-	0.43	-	-	-	-	-	-	-	X	-	0.10	X	-	X	-	-	-	-	-	-	-	0.20	-	-	-	-	-	-	-	0.00	0.18	In Regime
RA1-4-WC-07	6-Sep-19	I-3	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	X	-	-	-	-	-	0.14	0.11	In Regime
RA1-4-WC-07	11-Sep-21	I-3	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	X	X	-	X	X	-	X	0.71	**0.24**	Transitional or Stressed
RA1-4-WC-14	19-Oct-20	I-6	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	X	0.10	X	X	-	-	-	-	-	-	-	-	0.20	-	X	-	-	X	-	-	0.29	0.18	In Regime
RA1-4-WC-19	29-Jun-22	I-6	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	X	-	X	-	-	X	0.43	0.18	In Regime
RA1-4-WC-21	8-Sep-19	I-6	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	X	-	X	-	-	-	-	-	X	-	0.30	-	-	-	-	-	-	-	0.00	0.08	In Regime
RA1-4-WC-21	1-Jul-22	I-6	-	-	X	X	X	-	-	0.43	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	X	X	-	X	X	-	X	0.71	**0.36**	Transitional or Stressed
RA1-4-WC-21	16-Aug-22	I-6	-	-	X	-	-	-	X	0.29	-	-	-	-	-	-	-	-	-	0.00	X	X	-	-	-	-	-	-	-	-	0.20	-	-	-	X	-	-	-	0.14	0.16	In Regime
RA1-4-WC-33	19-Oct-20	I-6	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.00	In Regime
RA1-4-WC-33	24-Jun-22	I-7	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	-	-	-	-	-	X	0.14	0.11	In Regime
RA1-4-WC-35	16-Oct-20	I-7	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.04	In Regime
RA1-4-WC-35	28-Jun-22	I-7	-	-	X	-	-	X	-	0.29	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	X	X	-	X	X	-	X	0.71	**0.33**	Transitional or Stressed
RA1-4-WC-36	28-Jun-22	I-7	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	-	-	-	-	-	-	0.00	0.11	In Regime
RA1-4-WC-37	14-Oct-20	I-7	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	X	-	-	-	-	-	0.14	0.15	In Regime
RA1-4-WC-37	26-Jun-22	I-7	-	-	X	X	-	-	-	0.29	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	X	X	-	X	X	-	X	0.71	**0.33**	Transitional or Stressed
RA1-4-WC-37	16-Aug-22	I-7	-	X	X	-	-	X	-	0.57	-	-	-	-	-	-	-	-	-	0.10	X	X	X	-	-	-	-	-	-	-	0.30	-	X	-	X	-	X	X	0.57	**0.39**	Transitional or Stressed
RA1-WC-02	14-Sep-21	I-1	-	X	X	-	X	-	-	0.57	-	-	-	-	-	X	-	-	-	0.10	X	X	X	X	X	-	-	-	-	-	0.50	-	X	-	-	X	-	X	0.43	**0.40**	In Adjustment
RA1-WC-05	9-Sep-19	I-2	-	-	-	-	-	X	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.04	In Regime
RA1-WC-09	9-Sep-19	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	X	-	-	0.20	X	X	X	X	-	X	-	X	-	-	0.60	-	-	-	-	X	-	-	0.14	**0.27**	Transitional or Stressed
RA1-WC-09	17-Sep-21	I-2	-	-	X	X	-	-	-	0.29	-	-	-	-	-	-	-	-	-	0.00	X	X	X	X	X	-	-	-	-	-	0.50	X	X	-	-	X	-	X	0.57	**0.34**	Transitional or Stressed
RA1-WC-11	21-Aug-22	I-2	-	-	X	-	-	-	X	0.29	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.07	In Regime
RA1-WC-14	22-Aug-22	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	X	X	0.20	X	X	-	-	-	-	-	-	-	-	0.20	-	-	-	X	X	-	-	0.29	**0.21**	Transitional or Stressed
RA1-WC-16	19-Aug-22	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.04	In Regime
RA1-WC-17	19-Aug-22	I-2	-	X	X	-	-	-	X	0.43	-	-	-	-	-	-	-	-	X	0.10	-	X	-	-	-	-	-	X	-	-	0.20	-	-	-	-	-	-	-	0.00	0.18	In Regime
RA1-WC-22	21-Aug-22	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	X	X	-	-	-	-	-	-	-	-	0.20	-	-	-	-	-	-	-	0.00	0.09	In Regime
RA1-WC-23	15-Sep-21	I-3	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	X	X	-	-	-	-	X	0.43	0.17	In Regime
RA1-WC-26	10-Oct-20	I-3	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	X	-	X	0.20	X	X	X	-	-	-	-	-	-	-	0.30	-	X	-	-	X	-	-	0.29	**0.23**	Transitional or Stressed
RA1-WC-27	24-Oct-20	I-3	-	X	X	-	-	X	-	0.43	-	-	-	-	-	-	-	X	-	0.10	-	X	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.13	In Regime
RA1-WC-28	24-Oct-20	I-4	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	X	-	X	0.20	-	X	X	-	-	-	-	-	-	-	0.20	-	-	-	-	-	-	-	0.00	0.14	In Regime
RA1-WC-52	17-Oct-20	I-4	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	X	-	0.14	0.06	In Regime
RA1-WC-57	10-Sep-19	I-5	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.04	In Regime
RA1-WC-57	20-Oct-20	I-5	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.00	In Regime
RA1-WC-66	20-Oct-20	I-5	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.00	In Regime
RA1-WC-66	30-Jun-22	I-5	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	X	-	X	-	-	X	0.43	0.18	In Regime
RA1-WC-67	18-Sep-21	I-5	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	X	X	-	-	X	-	X	0.57	**0.25**	Transitional or Stressed
RA1-WC-67	30-Jun-22	I-5	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	-	-	-	-	-	-	0.00	0.11	In Regime
RA4B-WC-01	15-Oct-20	I-2	-	-	-	X	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	X	-	-	0.14	0.07	In Regime
RA4B-WC-02	23-Aug-22	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	X	X	0.20	X	X	-	-	-	-	-	-	-	-	0.20	-	-	-	-	X	-	-	0.14	0.17	In Regime
RA4-WC-00	25-Aug-22	I-1	-	-	X	-	-	-	X	0.29	-	-	-	-	X	-	-	-	X	0.20	-	X	-	-	-	-	-	-	-	-	0.10	-	X	-	-	X	-	X	0.43	**0.25**	Transitional or Stressed
RA4-WC-02	17-Sep-21	I-1	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	X	X	X	X	-	-	-	-	-	-	0.40	X	X	-	X	X	-	X	0.71	**0.31**	Transitional or Stressed
RA4-WC-05	26-Jun-22	I-1	-	-	X	-	-	-	X	0.29	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.07	In Regime
RA4-WC-12	9-Sep-19	I-1	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	X	X	X	-	-	X	-	X	-	0.50	-	-	-	-	-	-	-	0.00	0.13	In Regime
RA4-WC-15	25-Oct-20	I-2	-	-	X	-	-	X	-	0.29	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.07	In Regime
RA4-WC-17	28-Jun-22	I-2	-	-	-	-	-	-	X	0.14	-	-	-	-	-	-	-	-	-	0.00	X	X	-	-	-	-	-	-	-	-	0.20	-	-	-	-	-	-	-	0.00	0.09	In Regime
RA4-WC-18	7-Sep-19	I-2	-	X	-	-	-	X	-	0.29	-	-	-	-	-	-	-	X	X	0.20	-	X	X	-	-	-	-	X	-	-	0.30	-	X	-	-	X	-	-	0.14	**0.23**	Transitional or Stressed
RA4-WC-18	15-Oct-20	I-2	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.00	In Regime
RA4-WC-19	22-Aug-22	I-2	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	X	-	0.10	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.03	In Regime
RA4-WC-21	18-Sep-21	I-2	-	-	X	X	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	X	X	-	X	X	-	X	0.71	**0.24**	Transitional or Stressed
RA4-WC-21	24-Aug-22	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	X	0.10	-	X	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	-	-	0.00	0.09	In Regime
RA4-WC-22	25-Oct-20	I-2	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	X	0.10	-	X	X	-	-	-	-	-	-	-	0.20	-	-	-	-	-	-	-	0.00	0.11	In Regime
RA4-WC-22	24-Aug-22	I-2	-	-	X	-	-	-	X	0.29	-	-	-	-	-	-	-	X	-	0.10	-	X	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	-	-	0.00	0.12	In Regime
RA4-WC-24	27-Jun-22	I-2	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	X	0.10	X	X	-	-	-	-	-	-	-	-	0.20	-	X	-	-	-	-	-	0.14	0.11	In Regime
RA4-WC-25	6-Sep-19	I-2	-	X	X	X	-	-	-	0.43	-	-	-	-	-	X	-	-	X	0.30	X	X	X	-	-	-	-	X	-	-	0.40	-	X	-	-	X	-	X	0.43	**0.39**	Transitional or Stressed
RA4-WC-26	13-Sep-21	I-2	-	X	X	X	-	-	-	0.43	-	-	-	-	-	-	-	-	-	0.00	-	X	-	X	-	-	-	-	-	-	0.20	X	X	-	X	X	-	X	0.71	**0.34**	Transitional or Stressed
RA4-WC-27	7-Sep-19	I-3	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	X	0.10	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.03	In Regime
RA4-WC-27	15-Sep-21	I-3	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	X	X	-	-	X	-	X	0.57	0.20	Transitional or Stressed
RA4-WC-31	18-Oct-20	I-3	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	X	X	-	-	-	-	-	-	-	0.20	-	-	-	-	-	-	-	0.00	0.05	In Regime
RA4-WC-34	6-Sep-19	I-4	-	X	X	-	-	X	-	0.43	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.11	In Regime
RA4-WC-34	26-Oct-20	I-4	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.00	In Regime
RA4-WC-34	15-Sep-21	I-4	-	X	-	-	-	-	-	0.14	-	-	-	-	-	-	-	X	-	0.10	-	X	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	-	X	0.14	0.12	In Regime
RA4-WC-37	12-Sep-21	I-4	-	-	X	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	X	X	-	X	X	-	X	0.71	**0.24**	Transitional or Stressed
RA4-WC-41	25-Jun-22	I-4	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	X	X	-	-	-	-	-	-	-	0.20	-	-	-	-	-	-	X	0.14	0.09	In Regime
RA4-WC-42	19-Oct-20	I-4	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.00	In Regime
RA4-WC-45	18-Oct-20	I-4	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	0.00	0.00	In Regime
RA4-WC-45	27-Jun-22	I-4	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	-	X	-	-	-	-	X	0.29	0.10	In Regime
RA4-WC-55	22-Oct-20	I-6	-	X	-	-	-	-	-	0.14	-	-	-	-	-	-	-	X	X	0.20	X	-	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	-	-	0.00	0.11	In Regime
RA4-WC-55	16-Sep-21	I-6	-	X	X	-	-	-	-	0.29	-	-	-	-	-	-	-	-	-	0.00	-	X	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	-	X	0.14	0.13	In Regime
RA4-WC-55	27-Jun-22	I-6	-	-	X	-	-	-	X	0.29	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	-	-	-	-	-	X	0.14	0.18	In Regime
RA4-WC-57	16-Sep-21	I-6	-	-	X	X	-	-	-	0.29	-	-	-	-	-	X	-	-	-	0.10	-	X	-	-	-	-	-	-	-	-	0.10	X	X	-	X	X	-	X	0.71	**0.30**	Transitional or Stressed
RA4-WC-58	18-Oct-20	I-6	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	0.00	X	X	X	-	-	-	-	-	-	-	0.30	-	-	-	-	-	-	-	0.00	0.08	In Regime

Note(s):

[1] Ratio of Indices or Factor = Number of Indices Present / Total Number of Indices.

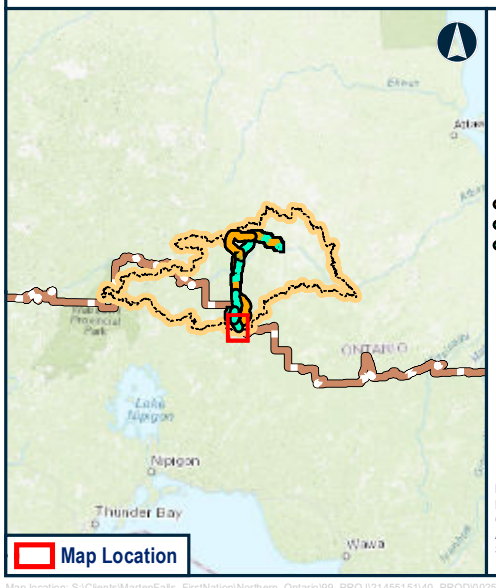
[2] Stability Index or SI values inferred as follows: 0.20 or lower = In Regime; 0.21 to 0.40 = Transitional or Stressed; and 0.41 or higher = In Adjustment.

[3] Crossings with a Stability Index of Transitional, Stressed or In Adjustment are bolded.

"X" Indicates evidence of selected parameter.

Sourced and adapted from: *Ontario Ministry of the Enviroment, 2003. Stormwater Management Planning and Design Manual.*

RA4-WC-12
HARROGATE LAKE
ESSER LAKE
OGOKI RIVER
RA1-WC-02
MCCAW LAKE
RA4B-WC-02
RA4-WC-05
PAINTER LAKE
DEBAERE LAKE
RA4-WC-02
ORVISS LAKE
COLPITTS LAKE
BURY LAKE
PIGMENT LAKE
RA4-WC-00
CRONY LAKE
RENWICK LAKE
ZURBRIGG LAKE
BURNABY LAKE
SAGA LAKE
KAPIKOTONGWA RIVER
PERCY LAKE
LITTLE CURRENT RIVER
JUNGFRAU LAKE
LITTLE JUNGFRAU LAKE
FARRELL LAKE
MURIEL RIVER
RUNWAY LAKE



Legend

- RAPID GEOMORPHIC ASSESSMENT LOCATIONS
- CONSTRUCTION DISTURBANCE AREA
- *POTENTIAL CAMP SITE (Size)*
  - 50 PERSONS
  - 200 PERSONS
- COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
  - ALTERNATIVE 1
  - ALTERNATIVE 4
  - ALTERNATIVE 1 AND ALTERNATIVE 4
  - APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
  - APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- POTENTIAL AGGREGATE SOURCE
  - BEDROCK
  - SAND AND GRAVEL
  - ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Rapid Geomorphic Assessment Locations

0 — 2.25 — 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure I-1

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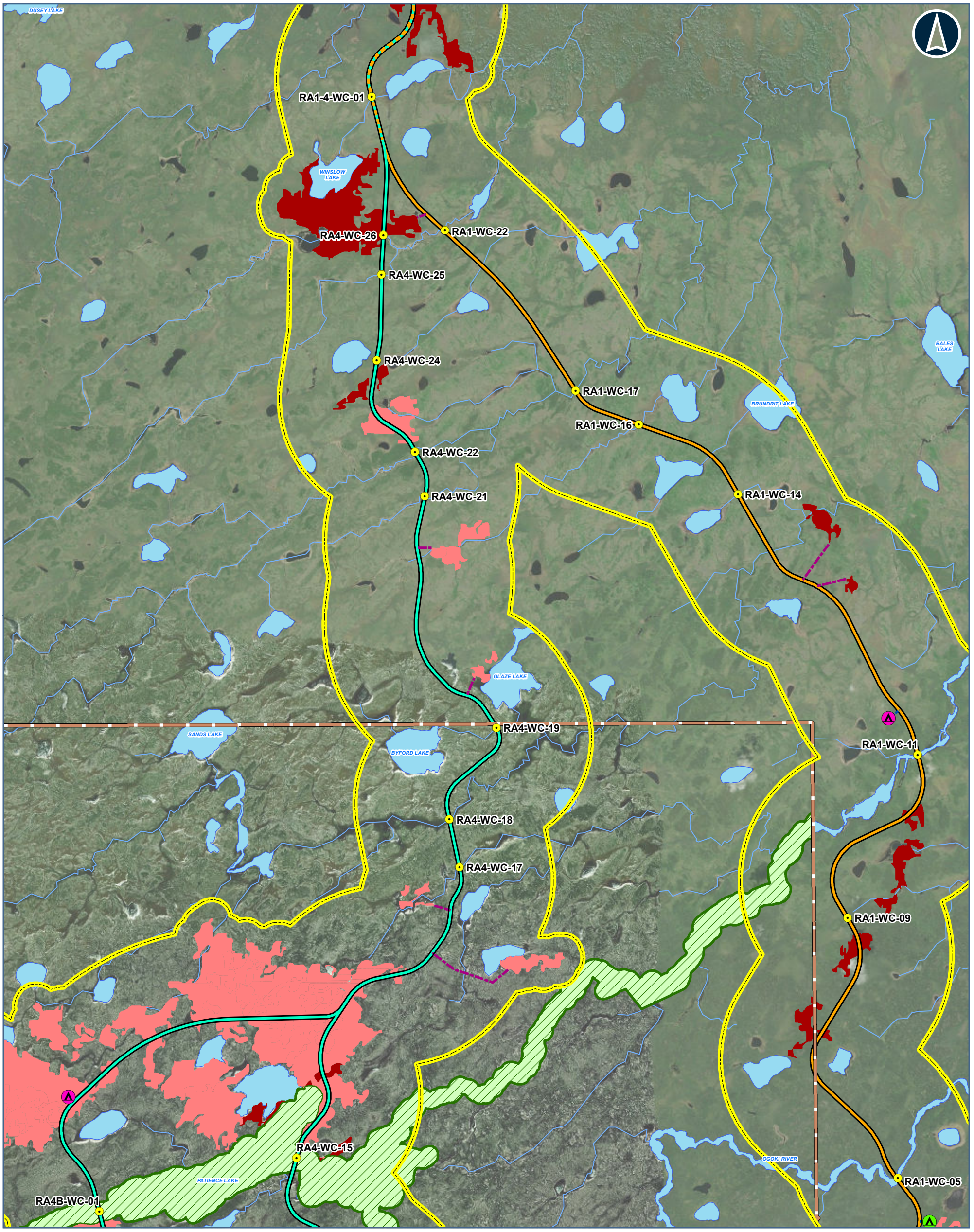
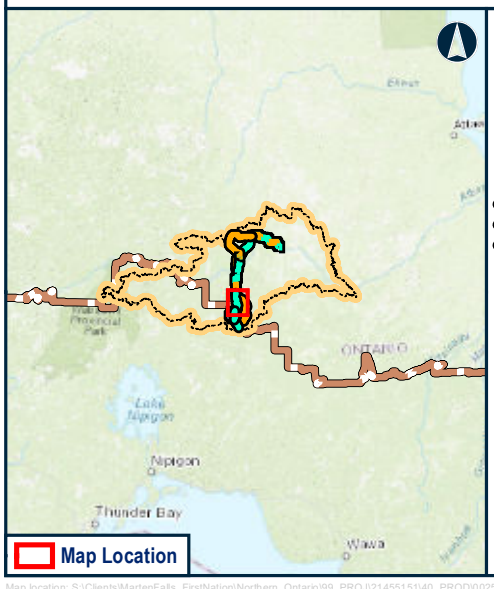
Date Saved: 2/11/2026 1:32:14 PM User Name: gld_rduval





Legend

- RAPID GEOMORPHIC ASSESSMENT LOCATIONS
- CONSTRUCTION DISTURBANCE AREA
- POTENTIAL CAMP SITE (Size)
  - 50 PERSONS
  - 200 PERSONS
- COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
  - ALTERNATIVE 1
  - ALTERNATIVE 4
  - ALTERNATIVE 1 AND ALTERNATIVE 4
  - APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
  - APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- POTENTIAL AGGREGATE SOURCE
  - BEDROCK
  - SAND AND GRAVEL
  - WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Rapid Geomorphic Assessment Locations

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure I-2

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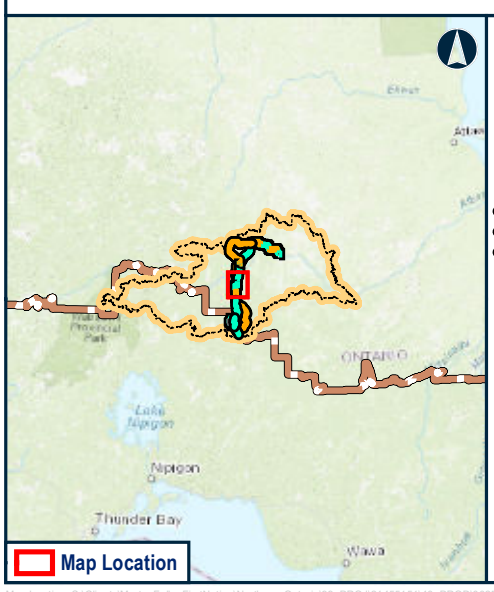
RA1-WC-27
RA1-WC-26
RA4-WC-31
TEABEAU LAKE
ALBANY RIVER
TOLFREE LAKE
RA1-WC-23
RA4-WC-27
SUWALA LAKE
RA1-4-WC-07
DUSEY RIVER
RA1-4-WC-02
TANASE LAKE
DUSEY LAKE



Legend

- RAPID GEOMORPHIC ASSESSMENT LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Rapid Geomorphic Assessment Locations

0 2.25 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure I-3

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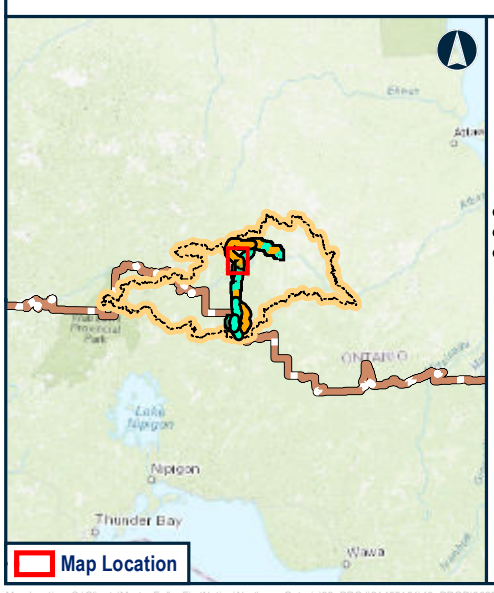
RA1-WC-52
WABASSI RIVER
VENTON LAKE
MAXEY LAKE
RA4-WC-45
TREBELL LAKE
RA4-WC-42
RA4-WC-41
ALBANY RIVER
SAARIMAKI LAKE
RA4-WC-37
RA4-WC-34
RA1-WC-28



Legend

- RAPID GEOMORPHIC ASSESSMENT LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Rapid Geomorphic Assessment Locations

0 2.25 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure I-4

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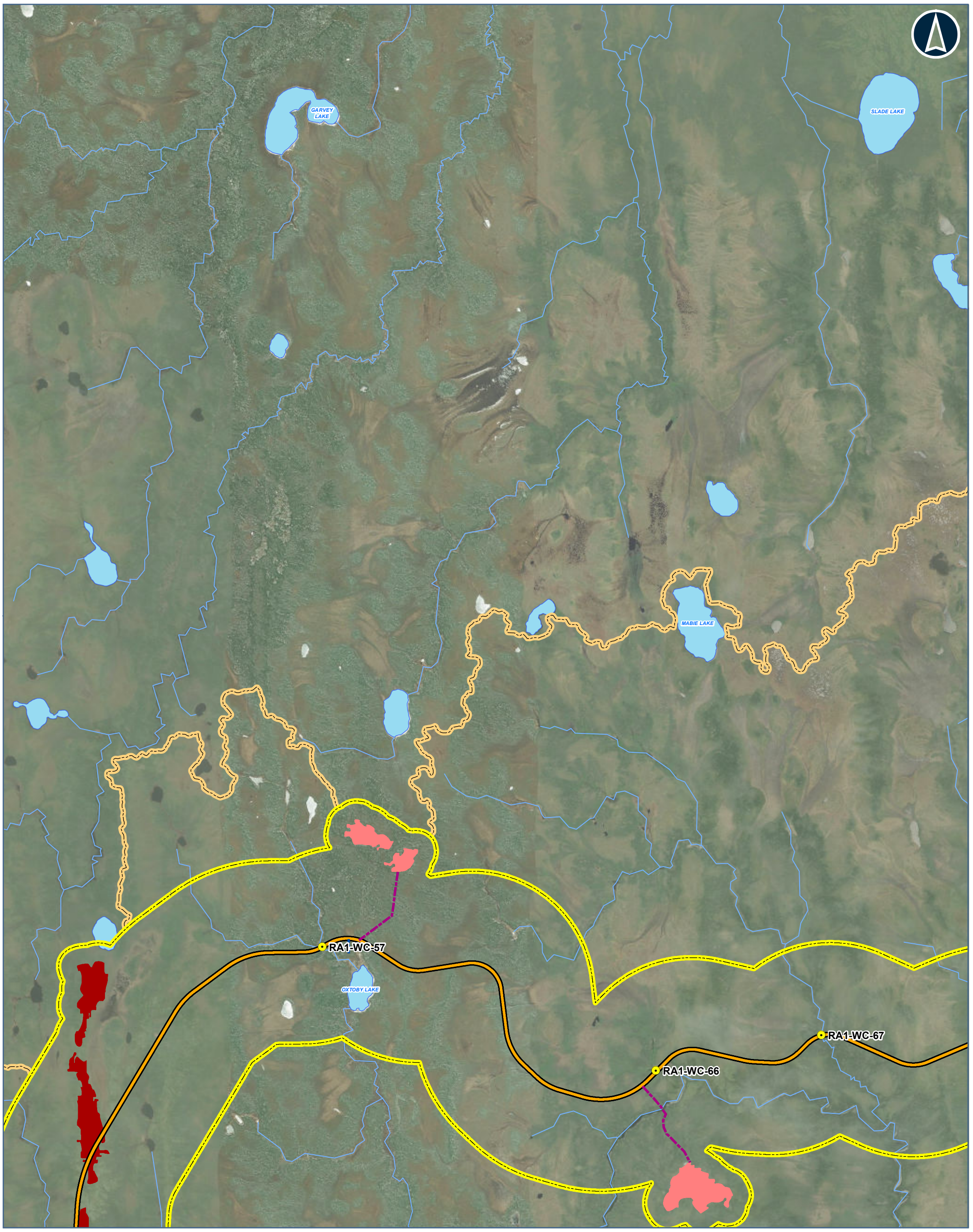

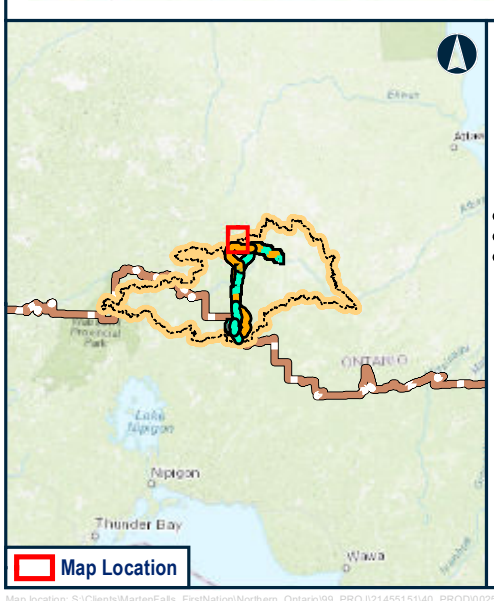

Legend

- RAPID GEOMORPHIC ASSESSMENT LOCATIONS
- CONSTRUCTION DISTURBANCE AREA
- *POTENTIAL CAMP SITE (Size)*
  - 50 PERSONS
  - 200 PERSONS
- COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
  - ALTERNATIVE 1
  - ALTERNATIVE 4
  - ALTERNATIVE 1 AND ALTERNATIVE 4
  - APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
  - APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- POTENTIAL AGGREGATE SOURCE
  - BEDROCK
  - SAND AND GRAVEL
  - WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Rapid Geomorphic Assessment Locations

0 — 2.25 — 4.5
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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Figure I-5

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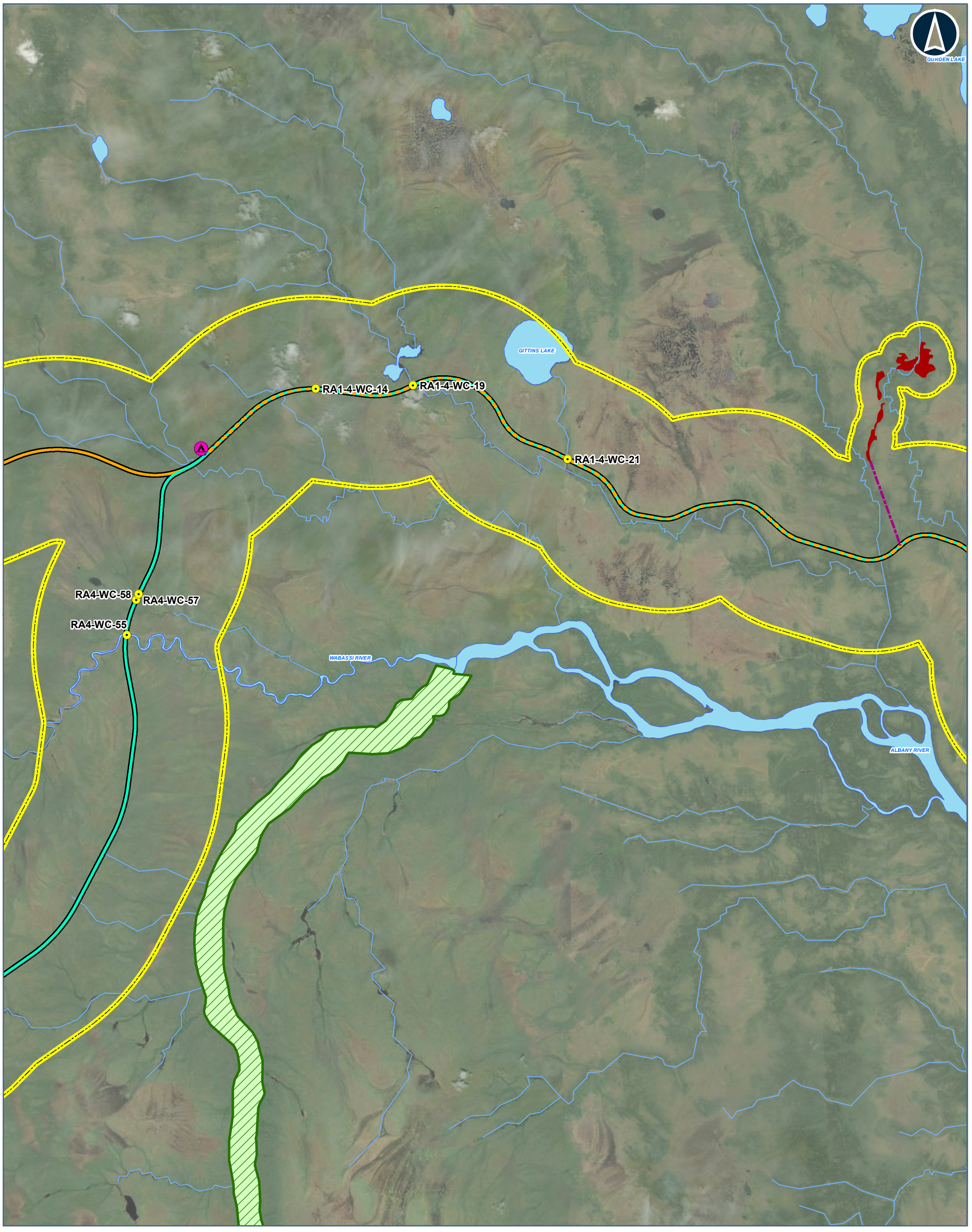

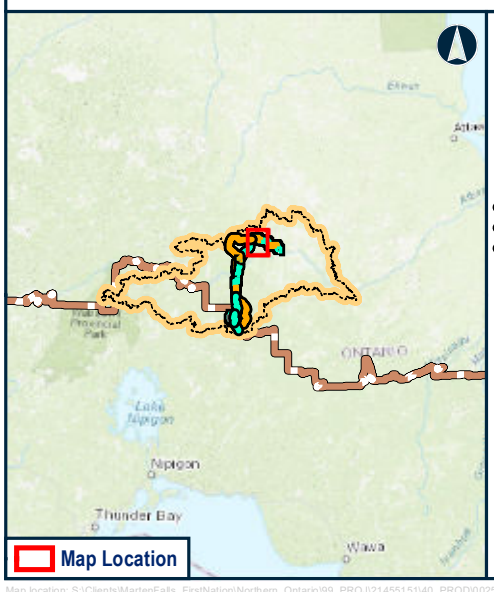

Legend

- RAPID GEOMORPHIC ASSESSMENT LOCATIONS

CONSTRUCTION DISTURBANCE AREA

POTENTIAL CAMP SITE (Size)

- 50 PERSONS
- 200 PERSONS

COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE

- ALTERNATIVE 1
- ALTERNATIVE 4
- ALTERNATIVE 1 AND ALTERNATIVE 4
- APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
- APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP

POTENTIAL AGGREGATE SOURCE

- BEDROCK
- SAND AND GRAVEL
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- PROVINCIAL PARK
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Rapid Geomorphic Assessment Locations

0 2.25 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Figure I-6

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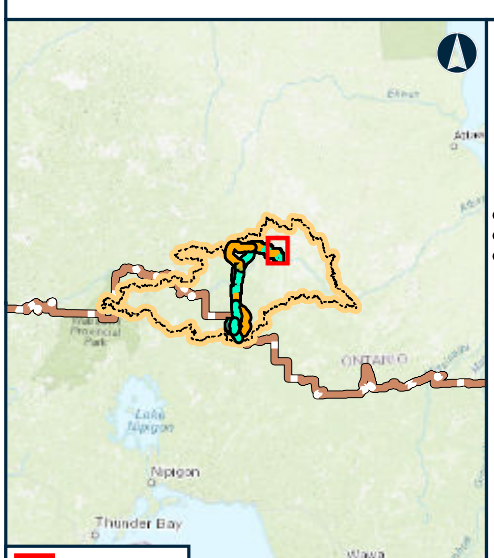
SEBERT LAKE
GURDEN LAKE
TIFFIN LAKE
RA1-4-WC-33
RA1-4-WC-35
RA1-4-WC-36
RA1-4-WC-37
ALBANY RIVER



Legend

- RAPID GEOMORPHIC ASSESSMENT LOCATIONS
- CONSTRUCTION DISTURBANCE AREA
- *POTENTIAL CAMP SITE (Size)*
  - 50 PERSONS
  - 200 PERSONS
- COMMUNITY ACCESS ROAD ALTERNATIVES CENTERLINE
  - ALTERNATIVE 1
  - ALTERNATIVE 4
  - ALTERNATIVE 1 AND ALTERNATIVE 4
  - APPROXIMATE ACCESS ROAD TO POTENTIAL AGGREGATE SITE
  - APPROXIMATE ACCESS ROAD TO POTENTIAL CONSTRUCTIONS CAMP
- POTENTIAL AGGREGATE SOURCE
  - BEDROCK
  - SAND AND GRAVEL
  - ROAD
- WATERCOURSE
- WATERBODY
- FAR NORTH BOUNDARY
- FIRST NATION COMMUNITY
- AQUATIC LOCAL STUDY AREA
- AQUATIC REGIONAL STUDY AREA

Data Source:
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MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

Rapid Geomorphic Assessment Locations

0 — 2.25 — 4.5
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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Phone: 1-800-764-9114 **Email:** info@martenfallsaccessroad.ca **Web:** http://www.martenfallsaccessroad.ca