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6.6 Birch Lake System

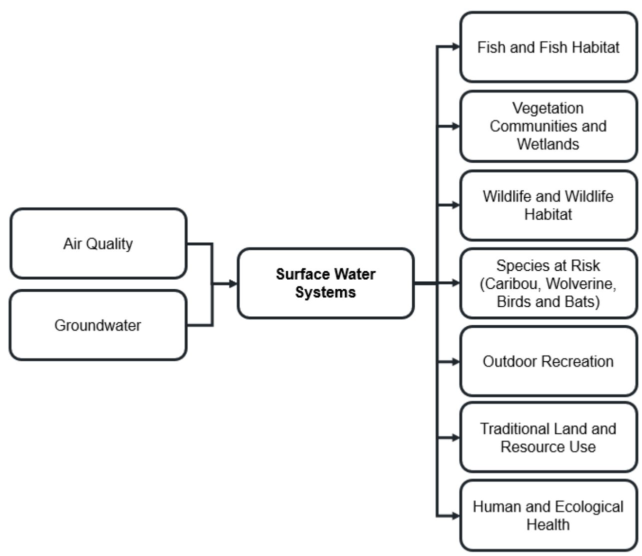
Surface water is selected as a valued component (VC) because it is critical to the life function of human and non-human biota; supports Indigenous, commercial and recreational uses; and provides cultural value to humans. The surface water VCs encompass aspects related to surface water, including hydrology (surface water volume and flow) as well as surface water quality.

The mine site is situated between two lakes, Birch Lake and Springpole Lake (Figure 6.6-1). Springpole Lake is part of the regional Birch Lake watershed. At a regional scale, Springpole Lake flows through the Birch River (via the southeast arm of Springpole Lake), towards Lake St. Joseph, which is approximately 150 kilometres (km) downstream to the south of the mine site. To support the discussion in this section, the effects assessment for surface water (surface water quality, surface water quantity) is divided into the following VCs, shown in Figure 6.6-1, based on the potential for effects:

- Birch Lake system (this Section 6.6);
- Springpole Lake, north basin system (Section 6.7);
- Springpole Lake, southeast arm system (Section 6.8); and
- Local inland waterbody systems (Section 6.9).

In the absence of mitigation, the assessment of potential changes in surface water is directly linked to other VCs and is informed by the following sections:

- **Air Quality (Section 6.2):** The assessment of the potential effects on air quality includes changes in dust deposition during construction and operation of the Springpole Gold Project (Project) that may affect surface water quality.
- **Groundwater (Section 6.5):** The assessment of the potential effects on groundwater includes changes in groundwater quantity and quality during construction, operation and closure of the Project that may affect surface water quantity and quality.



In addition, the assessment of potential changes in surface water systems is also directly linked to other VCs, and informs the analysis of the following sections:

- **Fish and Fish Habitat (Section 6.10):** The assessment of the potential effects on fish and fish habitat is informed by the changes in surface water quantity and quality during construction, operation and closure of the Project.
- **Vegetation Communities and Wetlands (Section 6.11):** The assessment of the potential effects on vegetation communities and wetlands is informed by surface water quantity and quality during construction, operation and closure of the Project

- **Wildlife and Wildlife Habitat (Section 6.12):** The assessment of the potential effects on wildlife and wildlife habitat is informed by surface water quantity and quality during construction, operation and closure of the Project.
- **Species at Risk (SAR) (Section 6.13 to Section 6.16):** The assessment of potential effects on species at risk is informed by the potential to change surface water quantity and quality during construction, operation and closure of the Project, as this may affect species at risk habitat.
- **Outdoor Recreation (Section 6.18):** The assessment of potential effects on outdoor recreation is informed by the potential changes in water quantity during construction and operation of the Project, as this may affect navigation.
- **Traditional Land and Resource Use (Section 6.21):** The assessment of potential effects on Traditional Land and Resource Use is informed by the potential changes in water quantity during construction and operation of the Project, as this may affect the ability to access lands and resources used by Indigenous people.
- **Human and Ecological Health (Section 6.24):** The assessment of potential changes in human and ecological health is informed by the potential changes in water quality during construction and operation of the Project, which may affect human and ecological health through surface water consumption.

The assessment of the potential changes in surface water systems from the Project are compared to relevant provincial and federal criteria (Section 6.6.1.4) and existing conditions (Section 6.6.2). The assessment is informed by:

- Groundwater technical support documentation, including the Baseline Hydrogeology Report (Appendix L-1) and the Hydrogeological Model Report (Appendix L-2);
- Hydrology technical support documentation. including the Baseline Hydrology Report (Appendix M-1), the Mine Site Water Balance Report (Appendix M-2) and the Receiver Water Balance Report (Appendix M-3); and
- Surface water quality technical support documentation including the Baseline Surface Water Quality Report (Appendix N-1), the Surface Water Quality Model Report (Appendix N-2) and the Predictive Modelling of Open Pit Basin Water Quality (Appendix N-3).

6.6.1 Assessment Approach

The approach to the assessment of potential changes to surface water systems includes a description of the relevant regulatory and policy setting, a description of the input obtained through consultation specific to this VC, the identification of criteria and indicators along with the associated rationale, a description of the spatial and temporal boundaries used for this VC along with a description of the attributes used to determine the significance of any residual, adverse effects. The assessment of potential effects is supported by a description of the existing conditions for the VC (Section 6.6.2), the identification and description of applicable pathways of potential effects on the VC (Section 6.6.3) and a description of applicable mitigation measures for the VC (Section 6.6.4). An outline of the analytical methodology conducted for the assessment and the key assumptions and/or conservative approach is found in Section 6.6.5. With the application of mitigation measures to the potential effects on the VC, the residual effects are then characterized in Section 6.6.6 and the significance of the residual effects is determined in Section 6.6.7.

6.6.1.1 Regulatory and Policy Setting

The effects assessment for surface water systems has been prepared in accordance with the requirements of the federal Environmental Impact Statement (EIS) Guidelines (Appendix B-1) and the provincially approved Amended Terms of Reference (ToR; Appendix B-3). Concordance tables, indicating where EIS Guidelines and ToR requirements have been addressed, are provided in Appendix B-2 and B-5, respectively.

As the Project is located in the Province of Ontario, it will need to meet applicable federal and provincial legislation and regulatory requirements; further information regarding anticipated approval requirements is provided in Section 11. Government policies, objectives, standards or guidelines most relevant to the VC are summarized below.

Fisheries Act

The responsibility for the management of fisheries resources in Canada under the *Fisheries Act* (R.S.C., 1985, c. F-14) is administered primarily by Fisheries and Oceans Canada (DFO). The pollution prevention provisions of the *Fisheries Act* (Section 36) are administered by Environment and Climate Change Canada (ECCC).

Metal and Diamond Mining Effluent Regulations

The Metal and Diamond Mining Effluent Regulations (SOR/2002-222), developed under Section 36 of the *Fisheries Act* regulates the deposit of mine effluent into natural waters frequented by fish. To remain in compliance with the *Fisheries Act*, Schedule 4 of the regulations provides the maximum allowable concentrations of identified parameters (pH, total suspended solids, arsenic, copper, lead, nickel, zinc, radium-226, cyanide) in effluents from mining operations. In addition, environmental effects monitoring requirements for mining operations are specified in Schedule 5 of the Metal and Diamond Mining Effluent Regulations.

Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life

The Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life are established by the Canadian Council of Ministers of the Environment (CCME 2024). These guidelines are developed collaboratively among provincial, territorial and federal jurisdictions and regularly updated to reflect current toxicology information and guideline derivation approaches. Canadian water quality guidelines for the protection of aquatic life (WQG PAL) are parameter-specific and are designed to safeguard the most sensitive life stage of the most sensitive aquatic species for periods of indefinite exposure. These guidelines are grounded in rigorous peer-reviewed scientific research and are derived from toxicological data across a range of species and environmental conditions. To account for uncertainties, such as interspecies and environmental variability, most guidelines additionally have conservative safety factors applied, providing a high level of protection for aquatic ecosystems.

Mining Act

The *Mining Act* (R.S.O. 1990, c. M.14), as amended by the *Building More Mines Act, 2023* (S.O. 2023, c. 6 – Bill 71) and Ontario Regulation (O. Reg.) 35/24: Rehabilitation of Lands sets out standards and criteria for mine closure. Specifically, with respect to surface waters, these statutes and regulations identify surface water quality parameters to be monitored from mines, as well as monitoring and certification requirements for assessing the success of closure activities in protecting surface waters from potential mining effects. Additionally, these statutes and regulations provide guidance regarding progressive rehabilitation to accelerate mine site rehabilitation in advance of close out activities. The monitoring requirements during closure for the Project related to surface water will be developed to meet the requirements under O. Reg. 35/24.

Environmental Protection Act

The *Environmental Protection Act* (R.S.O. 1990, c. E.19) is the principal pollution control statute in Ontario and is used in conjunction with the *Ontario Water Resources Act* (OWRA; R.S.O. 1990, c. O.40) to manage development activity that may affect water quality. The *Environmental Protection Act* contains general provisions that can be used to protect surface water and groundwater quality.

***Ontario Water Resources Act* and Related Regulations**

The OWRA is the principal statute governing water quality and quantity in Ontario. It is a general management statute that applies to groundwater and surface water. Administered by the Ministry of the Environment, Conservation and Parks (MECP), the OWRA contains several important regulations that protect water resources, including:

- O. Reg. 387/04: Water Taking and Transfer Regulation, which requires a permit for water takings of more than a total of 50,000 litres per day (L/d) (with some exceptions). Section 34 of the OWRA requires the proponent to obtain a Permit to Take Water, and Section 9 of O. Reg. 387/04 requires all permit holders to collect, record and report data on daily volumes of water withdrawals.
- Section 53 of the OWRA requires that an Environmental Compliance Approval be obtained for industrial sewage systems that release or discharge, store or transport contaminants to groundwater or surface water.

Provincial Water Quality Objectives

The Provincial Water Quality Objectives (PWQOs) developed by the MECP through its responsibilities under the OWRA and *Environmental Protection Act*, along with management policies and guidelines, were developed for the protection of aquatic life and recreational uses; they are numerical and narrative ambient surface water quality criteria that represent a desirable level of surface water quality. Similar to the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life, PWQOs for the protection of aquatic life are intended to be protective of all forms of aquatic life and all aspects of the aquatic life cycle during an indefinite exposure to the water.

MECP Policy *B-1-5 Deriving Receiving Water Based Point Source Effluent Requirements for Ontario Waters* (MECP 2016) describes the procedures to establish receiving-water based effluent requirements for point source discharges to surface waterbodies.

Lakes and Rivers Improvement Act

The *Lakes and Rivers Improvement Act* (R.S.O. 1990, c. L.3), administered by the Ministry of Natural Resources (MNR), governs design, construction, operation, maintenance and safety of dams in any lake or river or any defined portion of a lake or river. MNR approval is required for any work that forwards, holds back or diverts water, such as channelization, pond creation or bypass, dams, weirs and locks. Thus, a mine cannot construct a dam or a feature acting as a dam in a watercourse or lake without written approval.

6.6.1.2 Influence of Consultation with Indigenous Communities, Government and the Public

Consultation has been ongoing for several years, prior to and throughout the Environmental Assessment process, and will continue with Indigenous communities, government agencies and the public through the life of the Project. Section 2 provides more detail on the consultation process. The Record of Consultation

(Appendix D) includes detailed comments received, and responses provided, during the development of the final Environmental Impact Statement / Environmental Assessment (EIS/EA).

Feedback received through consultation has been addressed through direct responses (in writing and follow up meetings) and incorporated in the final EIS/EA, as appropriate. The key comments that influenced the assessment for surface water systems between the draft and final EIS/EA are provided below:

Incorporation of Traditional Knowledge

Cat Lake First Nation (CLFN), Lac Seul First Nation (LSFN) and the Northwestern Ontario Métis Community (NWOMC) requested that Traditional Knowledge be incorporated into the EIS/EA to inform the understanding of potential effects of the Project and disaggregated by the Indigenous community, where possible. Non-confidential information provided during engagement with Indigenous communities and from Traditional Knowledge and Land Use studies has been reviewed and described in Section 6.6.2.3 for all surface water VCs, including Birch Lake, Springpole Lake and other waterbodies within the Regional Study Area (RSA) for surface water. This information is considered in the assessment of potential effects and selection of mitigation measures, and it informs the monitoring programs for surface water. Further, an assessment of the effects on Indigenous people is provided in Section 6.26, which includes an assessment of the effects of changes in the environment related to current use, health, socioeconomics and heritage.

Adequacy of the Baseline Surface Water Quality Dataset

CLFN, LSFN and SFN requested a summary of any data gaps, the rationale for the selection of monitoring sites and the adequacy of these sites to spatially characterize surface water quality. The MECP requested further information on the adequacy of the sampling in Birch Lake and Springpole Lake to characterize baseline conditions. The baseline surface water quality monitoring program has been ongoing since 2011 and is designed to be extensive and appropriate to inform the EIS/EA, encompassing a comprehensive network of sites strategically selected to capture spatial and temporal variations in water quality. This monitoring program will continue through life of mine and be adjusted as needed over time. To address the comments received, water quality monitoring continued through the submission of the draft EIS/EA resulting in an extensive baseline dataset covering and additional three years of data since the draft EIS/EA submission. More than 40 water quality stations have been monitored as part of the baseline program, with over 900 water quality samples having been collected. For representative sampling, the monitoring program includes an extensive number of sites distributed across various waterbody types, including smaller lakes and tributaries and regional stations. These sites are carefully chosen to cover different ecological zones, flow regimes and potential sources of interaction with the Project. Furthermore, the program accounts for seasonal variations by conducting sampling throughout the year, often monthly, capturing fluctuations in water quality associated with different hydrological conditions and climatic patterns. This approach allows to obtain a comprehensive understanding of baseline conditions to help assess potential impacts associated with the Project. Overall, the monitoring sites to characterize water quality spatially and temporally within the area is extensive. The updated baseline water quality samples have been included in the Baseline Surface Water Quality Report (Appendix N-1, Section 3) and described in Section 6.6, Section 6.6.7, Section 6.8 and Section 6.9.

The Impact Assessment Agency of Canada (IAAC) requested additional information on the hydrometric and surface water quality monitoring results. The results from the ongoing hydrology program since the preparation of the draft EIS/EA are included in the Baseline Hydrology Report (Appendix M-1). The results include lake level monitoring of Birch Lake, as well as a number of the small inland lakes (Lake 1, Lake 19, Dole Lake). Monitoring stations have been established where they can support life of mine monitoring and provide long-term data for the Project. Further, flow monitoring data from smaller watersheds on the Project site have been included and may be used to help characterize monthly / seasonal and extreme flows for the Project site. In addition, the results of the surface water quality monitoring program have been updated in the Baseline Surface Water Quality Report (Appendix N-1, Section 3) and reflect the water quality monitoring programs that has varied slightly from year to year and reflects site accessibility and optimization of the proposed Project design. The geographic extent of the surface water quality study is inclusive of watercourses that could be potentially affected by mine development along with unaffected watercourses.

Additional Surface Water Quality Monitoring Locations

CLFN, LSFN and SFN requested additional water quality monitoring stations downstream of Project, and to address traditional land and resource activities. The baseline surface water quality monitoring programs undertaken for the Project is comprehensive, spanning multiple years and covering all surface waterbodies potentially affected by the Project, including those that may be utilized for traditional land and resource activities as described by Traditional Knowledge / Traditional Land Use (TK / TLU) studies. The surface water sampling program has been extended approximately 35 km downstream of the mine site, as previously requested by SFN in 2021 during the review of the initial baseline surface water monitoring reports. The 2022 Surface Water Quality Technical Workplans (Appendix W of the draft EIS/EA) incorporated feedback received from these Indigenous communities, and the results of this additional monitoring have been included in the Baseline Surface Water Quality Report (Appendix N-1, Section 3). FMG continues to be interested in establishing and providing opportunities for members of proximate Indigenous communities to participate in an environment committee(s) for all phases of the mine.

The MECP requested an additional in-stream sampling location near the discharge point of the small stream that originates from lakes L-3 and L-4, adjacent the SW-18 in Birch Lake. The 2019-2020 Aquatic Resources Baseline Report (Appendix O-2, Section 3.1.1) conducted detailed fish habitat characterization studies within Stream 9 and utilized baseline data collected in the other stream habitat to define habitat types. Benthic invertebrate community and sediment quality data collected during the baseline studies are expected to represent existing conditions within the local area habitat types. However, an additional sampling location was added to the 2022 and 2023 field programs and included surface water quality and fish sampling (Appendix O-4, Section 3.2).

CLFN, LSFN and SFN requested additional monitoring sites for the small tributaries and lakes / ponds draining into the larger lakes. Small inland lakes and tributaries have been characterized as part of the Baseline Aquatic Resources Reports (Appendix O-2, Section 3; Appendix O-3, Section 3; and Appendix O-4, Section 3). Additional surface water quality monitoring for small body lakes (including L-1, L-16, L-18 and L-19) were collected in 2021, 2022 and 2023 and the results are included in the Baseline Surface Water Quality Report (Appendix N-1, Section 3).

Additional Surface Water Quality Monitoring Parameters

The Ministry of Mines requested that cyanide be included in routine surface water monitoring to provide a consistent database prior to mining activity. Cyanide was added to the 2021 surface water program and the results are discussed in the Baseline Surface Water Quality Report (Appendix N-1, Section 3).

CLFN, LSFN, SFN and the Ojibway Nation of Saugeen requested further information on the destruction of cyanide throughout the water management system. As described in Section 6.11.5, the in-plant effluent treatment will be using sulphur dioxide / air to destroy cyanide and to precipitate metals in the process plant tailings effluent before it is discharged to the co-disposal facility (CDF). This is the standard proven technology used to treat gold mine tailings effluent at most mines in Ontario. The tailings effluent will be discharged to the CDF and the CDF will generally be operated as a closed loop system. Excess waters collected in the central water storage pond (CWSP) will be treated in an effluent treatment plant (ETP) before being released to the environment. The fully treated effluent will be confirmed to meet all applicable regulatory discharge criteria before being released to the environment at the final discharge location in the southeast arm of Springpole Lake. The ETP will be designed to produce an effluent quality appropriate for discharge to the environment in accordance with applicable regulatory requirements, including the federal Metal and Diamond Mining Effluent Regulations, and the effluent concentrations required by the MECP to protect the receiving water and aquatic resources. Cyanide predictions have been included in the Surface Water Quality Model (Appendix N-2, Section 4) and are used to inform the effects assessment for surface water systems (including this section as well as Section 6.7 and Section 6.8). A rigorous monitoring program will be in place to assess whether effluent and receiver water quality is maintained, as described in Section 12.5.

Surface Water Quality Sampling Methods

The MNR requested further detail on the surface water quality sampling methods used for the field program, including guidelines and/or protocols followed for sampling and quality assurance / quality control methods. The Baseline Surface Water Quality Report (Appendix N-1, Section 2.3) includes the description of the methods used and including quality assurance / quality control measures.

Interpretation of Surface Water Quality Monitoring Results

CLFN, LSFN, SFN and the MNR requested further information on mercury and a description of the associated monitoring program. As shown in the Baseline Surface Water Quality Report (Appendix N-1, Section 3), the baseline water quality monitoring in the Project waterbodies from 2012 though 2022 indicate that mercury levels are generally below analytical detection limits (less than 0.005 micrograms per litre [µg/L]) and are less than the Canadian WQG PAL for mercury (0.026 µg/L). Further, ultra-low mercury and methylmercury from specialized analyses has occurred at key monitoring locations across the baseline study since 2021, with detection limits of approximately 0.0001 µg/L and 0.00002 µg/L respectively.

It was clarified that mercury is not proposed to be used in the process for gold mining at the Springpole Gold Project, and the Project will not be a source of mercury. A description of key metals in host rock and ore is presented in Section 4.3 of Appendix K-1.1 (Static Geochemical Testing Baseline Report). Solid phase mercury concentrations in the Project rock are low. Specifically, mercury concentrations were below qualitative threshold values (10 times crustal abundance) in 98 percent (%) of the mine rock samples and 94% of the ore-grade samples. The potential for mercury leaching from the rock is also low for materials based on the results of leaching tests (Appendix K-1.1) and humidity cell tests (Appendix K-1.3). A description of inorganic contaminants of potential concern in soil can be found in Appendix R (Human and Ecological Health Risk Assessment Model Report [Appendix R, Section 3.4.3]). The maximum concentration of mercury in the collected soil samples did not exceed federal or provincial guideline values. The predictive models developed to support the EIS/EA which use the baseline data described above indicate that mercury levels remain below threshold criteria for surface water quality and human health and the Project is not a source of mercury. A surface water sampling program has been included in the final EIS/EA and will be further developed during the permitting phase. FMG will continue to engage and consult with local Indigenous communities through the permitting phase as further details are developed. The permitting phase program is expected to include further details on methods, locations and duration, along with monitoring and reporting requirements based on discussions with regulatory agencies. The purpose of the surface water program will be to monitor compliance against regulatory permits and validate the predictions in the EIS/EA.

CLFN, LSFN and SFN requested additional detail on the conclusion that surface water quality parameters that exceeded guideline values was related to natural variation associated with total suspended solids. It was clarified that natural baseline exceedances occurred in less than 5% of observations, are associated with elevated total suspended solids (TSS) levels (total phosphorus, total iron) and are considered representative of the natural heterogeneity of these lake systems, and the natural heterogenicity of waters in the baseline study area have been well characterized by the baseline program. Over 1,100 samples have been collected between as part of baseline surface water monitoring program for the Project. Overall, the results indicate that surface water quality of monitored waterbodies are typical of oligotrophic lakes in northwestern Ontario, including low concentrations of nutrients and anions, low turbidity and saturated to near- saturated dissolved oxygen concentrations. The pH levels of Birch Lake, Springpole Lake, Seagrave Lake, small area lakes and regional monitoring stations are circumneutral; low frequency slightly alkaline to alkaline pH values are associated with summer sampling of surface (epilimnion) waters, wherein elevated pH values are likely driven by photosynthesis and generally warmer water quality conditions. There are no other consistent seasonal trends or inter-annual trends for other monitored parameters. The levels of TSS and total dissolved solids are generally low for all the sampled waterbodies. Similarly, concentrations of most total and dissolved metals are low, consistently below WQG PAL. There were a few occasions where measured baseline concentrations are outside the range established by WQG PAL. Parameters outside the range established by WQG PAL included pH, total phosphorus, total iron and total copper. As noted, these exceedances occur less than 2% of observations, are associated with elevated TSS levels (total phosphorus, total iron) and are considered representative of the natural heterogeneity of these lake systems. This information has been included in the Baseline Surface Water Quality Report (Appendix N-1, Section 3), and described in Section 6.6.2, Section 6.7.2 and Section 6.8.2.

CLFN requested explanation for observed concentrations of copper and phosphorus. It is not uncommon for concentrations of phosphorus and copper to be greater than guidelines for the protection of aquatic life in natural surface waters. These elements can originate from various natural sources, including weathering of rocks and minerals and decomposition of organic matter. This explanation has also been included in the Baseline Surface Water Quality Report (Appendix N-1, Section 3).

CLFN requested further information on the concentrations of total and dissolved metals relative to drinking water guidelines. Surface water quality (concentrations of metals, nutrients and ions) monitored in the area are less than drinking water quality standards for all parameters with drinking water quality guidelines. WQG PAL are more stringent than drinking water quality guidelines for most parameters. This explanation has been included in Section 6.6.2.

CLFN, LSFN and SFN requested further information on the seasonal variability of the surface water quality monitoring program for the Project, and the results of the 2021 field program. The Baseline Surface Water Quality Report (Appendix N-1, Section 3) documents the spatial and temporal variability of surface water quality of the waterbodies that have the potential to be affected by Project and additional unaffected waterbodies. The dataset is extensive when compared to other projects at the environmental assessment stage. The characterization of existing conditions within the local area habitat type is well documented and exceeds requirements to support the environmental assessment. Water quality sampling has continued throughout the Environmental Assessment process, and the data that have been collected through to the end of 2023 are included in the Baseline Surface Water Quality Report (Appendix N-1, Section 3).

CLFN, LSFN and SFN requested a discussion of the surface water quality trends over the period monitored. Trends in surface water quality are discussed in the Baseline Surface Water Quality Report (Appendix N-1, Section 3), and the effects on surface waters are quantitively assessed by predictive modelling (Appendix N-2, Section 4).

Adequacy of the Baseline Hydrology Dataset

CLFN, LSFN and SFN requested a summary of data gaps, the rationale for the selection of monitoring sites and the adequacy of these sites to spatially characterize hydrology. The hydrometric monitoring program was developed primarily on the understanding of the potential effects from the Project, site reconnaissance and observations, and input received through engagement and consultation. An initial gap analyses and site reconnaissance informed the 2021 monitoring work. Although considerations were made to carry forward existing stations, the focus was on the need to establish a monitoring program that aligned with the Project and broad environmental assessment requirements. Stations were established at key locations, including smaller tributaries to Springpole Lake, and where quality data could be collected, in line with Water Survey of Canda Guidelines. The monitoring program has further developed since 2021. A comprehensive list of historical and current monitoring locations has been provided in the Baseline Hydrology Report (Appendix M-1, Table 4-1) and includes the rationale for each of the monitoring locations, as well as the adequacy of the monitoring program to characterize the baseline investigation area.

The MECP requested clarification on the hydrometric stations used to characterize baseline conditions and provide a reference for future monitoring. This was addressed in the Baseline Hydrology Report for the draft EIS/EA and is included in the Baseline Hydrology Report (Appendix M-1, Section 4). It includes information on monitoring parameters, monitoring frequency, the status and purpose of the monitoring stations, period of record, monitoring instrumentation and catchment size.

Additional Hydrometric Monitoring Stations

CLFN, LSFN and SFN requested flow monitoring data for the winter seasons. Winter flow monitoring was collected in 2022 and 2023 (February), and presented in the Baseline Hydrology Report (Appendix M-1, Section 4.4.2) of the EIS/EA, which includes a description of results from the winter monitoring programs; Section 4.5.2 includes a description of the incorporation of this data into the rating curve.

The MNR requested consideration for the establishment of leveloggers outside Springpole Lake and the inclusion of information on drainage areas and elevations. The 2021 hydrology field program included the installation of lake leveloggers in Birch Lake, L-1, L-19 and Dole Lake. The field data include drainage area, and the maximum, minimum and mean elevations, and are presented in the Baseline Hydrology Report (Appendix M-1, Section 4.3).

Inclusion of Additional Hydrology Data

CLFN, LSFN and SFN requested previous information from earlier monitoring programs be included in the main body of the baseline hydrology report. A list of all historical and ongoing hydrometric monitoring stations, including those monitored during previous monitoring programs, has been provided in the Baseline Hydrology Report (Appendix M-1, Table 4-1) and compared to the ongoing dataset.

CLFN, LSFN and SFN requested that updated Climate Normals be incorporated into the baseline hydrology dataset. Climate Normals are typically issued at the completion of each decade, and the Baseline Hydrology Report (Appendix M-1) includes the dataset from the 1981 to 2010 period for the Sioux Lookout, Red Lake A and Pickle Lake A Climate Stations.

The MECP requested clarification on how the Water Survey of Canada (WSC) stations and associated data were being incorporated into the baseline data. The Baseline Hydrology Report (Appendix M-1, Section 3.2) includes a description of the methodology in which WSC flow data are used to characterize runoff conditions for the Project site, a summary of the pro-rated flows for the Springpole Lake catchment areas (F7-HS1 and F8-HS7) and a description of how the average annual runoff from the representative WSC station was used to estimate a natural ground runoff coefficient for the Project site. Further, the Report describes the methodology in which WSC flow data were used to estimate low flow conditions for the Project site's catchment areas, provided low flow indices for the WSC stations considered and the estimated low flow indices for the Project site's catchment areas.

Interpretation and Analysis of Hydrology Monitoring Results

CLFN, LSFN and SFN noted discrepancies with the Casummit Lake weather station and requested that the baseline characterization of precipitation be revised once enough data are collected from the Springpole station. The Project has continued to collect site-specific data from the Springpole weather station to support the development of a climate database for the Project. The assessment is using a dependable, long-term datasets from ECCC, which is a standard approach for the purpose of environmental assessment as the onsite database continues to be developed. The findings have been compared to other datasets, such as the ECCC climate stations in the Section 3.3 of the Baseline Hydrology Report (Appendix M-1).

IAAC requested an analysis of the variability in lake level for Springpole Lake, and a discussion on how that is linked to fish habitat. Leveloggers were installed in Springpole Lake to measure seasonal variability; the results have been included in the Baseline Hydrology Report (Appendix M-1, Section 4) for the EIS/EA. This information has been used to assess the potential effects on fish habitat due to changes in water levels from pit dewatering in Springpole Lake, as described in Section 6.10.6.

CLFN and LSFN requested clarification for time period of the climate change scenario considered in the mine site water balance. A description of the climate change scenarios and associated assumptions are provided in the Mine Site Water Balance Report (Appendix M-2, Section 5.1.5).

Surface Water Quality Guidelines

CLFN, LSFN, SFN and IAAC requested clarification on the water quality guidelines utilized for the EIS/EA. The final EIS/EA uses a consistent set of WQG PAL as per the latest guidance from the MECP. Recent MECP guidance necessitates the utilization of the most current WQG PAL sourced from either the PWQOs / interim PWQOs (iPWQOs, Canadian Water Quality Guidelines or Federal Water Quality Guidelines (FWQG). This has been clarified in Section 6.6.5.

Selection of Surface Water Systems as a Valued Component

The Northwest Ontario Métis Community (NWOMC) requested that the rationale for selecting surface water systems as a VC include consideration for Indigenous values. The language in this section is intended to be inclusive of Indigenous users and is also represented by the reference to cultural values. This has been addressed in the introduction to each surface water system effects assessment, including Section 6.6.

Surface Water System Assessment Criteria and Indicators

SFN requested clarification for why nutrients and TSS are not included in the parameters listed in the indicators and measurable parameters sections. Nutrients (total phosphorus, nitrogen species) have been included in the Surface Water Quality Model (Appendix N-2, Section 3.3). With respect to TSS, the industry-standard surface water quality models used cannot accurately represent or predict TSS levels. This arises from the complexity of TSS sources and transport mechanisms, making it difficult to establish consistent relationships between model input parameters and TSS levels. Instead, in Ontario, mining operations must adhere to stringent regulatory requirements and environmental standards governing water quality, including TSS levels. FMG is committed to environmental protection and has strategically integrated comprehensive water management mitigation strategies for TSS into the Project's design, providing proactive measures to safeguard water quality and minimize the potential for environmental impact. These measures have been included in Section 6.7.4.

Assessment Methods for Potential Effects on Surface Water

CLFN also requested further study on the effects of the removal of catchment areas on aquatic systems. The potential effects of temporary removal of the catchment area are included in Section 6.6.3 as well as the assessment included in Section 6.6.4. The effects of these changes are included in Section 5.2 of the Fish Habitat Offset and Compensation Plan (Appendix F, Section 5.2).

CLFN also requested further study on the effects of sulphate, arsenic, cobalt and copper, which may exceed guideline values and may impact aquatic species, ecosystems, and human or animal consumption of surface water. The potential for mine activities to affect human or ecological health (including aquatic species and ecosystems) has been assessed through a rigorous Human and Ecological Health Risk Assessment (HEHRA) as described in Section 6.24, with the detailed HEHRA modelling report (Appendix R) appended to the EIS/EA. The assessment includes the results of the surface water model for changes in water quality parameters and concludes that with the proposed design and mitigation measures, residual effects on human and ecological health are not predicted. The HEHRA modelling report is included as Appendix R and used to update Section 6.24, to reflect Project optimization since the draft EIS/EA was first circulated for comment.

Mishkeegogamang First Nation and the MNR requested further information on the assessment of the effect of fugitive dust on surface water systems. The potential water quality effects from dust deposition have been quantitatively assessed and results are included in both the Surface Water Quality Model (Appendix N-2, Section 4) as well as the Human and Ecological Health Risk Assessment Modelling Report (Appendix R). Results of these models informed the assessment of potential effects from fugitive dust on surface water systems and are included in Sections 6.6 through 6.9. For Birch Lake, the assessment of dust effects has also been considered and included in Section 6.6.3. The potential effect of dust will be mitigated with a dust management plan as well as an erosion and sediment control plan that will be developed during the permitting phase.

Water Management System

SFN, IAAC and the MECP requested a schematic of the water management system, a summary of the design levels for all water management features and illustration of these features in the mine site layout. In addition, IAAC requested that the boundaries for the water balance model be updated to include runoff on the outside edge of the mine haul roads, and the results from the analysis of CDF and CWSP water levels. Further, IAAC requested a discussion of the resilience of the water management system to extreme climate conditions, including consideration for the risk and consequences of discharge of untreated contact water, particularly from the periphery ditches and water management ponds. Further engineering has occurred since the draft EIS/EA to develop a water management plan for the operation phase of the Project, including a schematic of the water management conveyance and collection systems which is presented in Section 5.10.1.2 and includes the sizing of the key storage facilities. The water management facilities will be designed so that mine contact water is collected, and that infrastructure is sized appropriately to avoid untreated discharge to the environment respecting design criteria. The mine site layout has been updated accordingly with the water management infrastructure. The boundaries for the mine site water balance model (Appendix M-2, Section 5.2) have been updated to include runoff on the outside edge of the mine haul roads for the final EIS/EA. This additional watershed area is extremely small in comparison to the overall total watershed (approximately 935 hectares [ha]) and is not expected to result in any changes to the effects assessment.

Section 9.8 includes consideration for climate change and provides a discussion of the measures to reduce risk and consequences of a discharge of contact water from the ponds during a major storm event. Detailed design of the key water management facilities will be provided to support environmental approvals applications, and to support construction.

Evaporation Estimates used in Mine Site Water Balance

SFN, LSFN, CLFN and IAAC requested clarification on the evaporation estimates that informed the Mine Site Water Balance. Further, IAAC requested a discussion on the use of this value in the assessment and whether additional water would need to be taken from Birch Lake. Estimations of evaporation are based on the Hamon equation and result in an annual value that aligns with other references (i.e., Hydrologic Atlas of Canada). Pan evaporation data collected from the Project site have been considered in the hydrology modelling; however, the site data record was used only in the selection of the methodology used for estimating evaporation at the Project site. This has been described in the Mine Site Water Balance (Appendix M-2, Section 5.1).

Runoff Coefficients used in the Mine Site Water Balance

TheMECP requested further clarification and rationale on the selection of the runoff coefficients used in the mine site water balance. The runoff coefficients applied to the water balance modelling were selected based on experience and involvement in numerous mining-related water balance models in the northern Ontario. Runoff coefficients were further informed by Project-specific groundwater modelling (infiltration rates) and gauged flow records. This has been clarified and rationale provided in the Mine Site Water Balance Report (Appendix M-2, Section 5.3).

Birch Lake Assessment Nodes

The MECP requested an additional node at L-10 in Birch Lake to support the assessment of water levels and flows. Further, the MECP requested that the naming convention for the assessment nodes be clarified to avoid confusion with sampling locations. Naming conventions for the assessment nodes have been revised such that water balance and water quality naming conventions are equivalent in the final EIS/EA. For Birch Lake, the potential effects on water flows and levels have been determined for assessment node 6 (SW-03 in the draft EIS/EA), node 7 (SW-24 in the draft EIS/EA) and node 8 (SW-04 in the draft EIS/EA) and have been supplemented with an additional node at L-10. This assessment node is included in the Receiver Water Balance Report (Appendix M-3) and results are discussed in Section 6.6.6.

Fate of Seepage

The MNR requested clarification on the fate of seepage from the CDF, particularly during closure. Seepage is conservatively assumed to report directly to Birch Lake, Lake L-16 and the north basin of Springpole Lake. The potential influence of seepage on surface water is conservatively modelled as a mass balance and does not account for any attenuation of concentrations along the seepage flow path. No surface water quality parameters are projected to occur at concentrations greater than water quality guidelines in post-closure. This has been described in the Mine Site Water Balance (Appendix M-2, Section 5), including inputs for seepage based on the closure design concept. Water quality results are provided in Section 6.6.5. Additional technical discussion and modelling details are provided in the Receiver Water Balance (Appendix M-3, Section 3) and the Surface Water Quality Modelling report (Appendix N-2, Section 3).

Other Modelling Parameters

The MECP requested additional parameters be included in the modelling, specifically cyanide concentrations in tailings seepage and effluent discharge during operation, and additional monitoring data to support the assessment. Cyanide has been added as a parameter in the surface water quality modelling (Appendix N-2, Table 3.2) and includes the assessment of potential effects on surface water quality in Section 6.6, Section 6.7 and Section 6.8. Operational monitoring requirements for water quality parameters will be confirmed as part of the provincial environmental approvals process and are expected to be required to include cyanide based on other similar mining projects in Ontario.

Surface Water Model Calibration

SFN requested further information on the calibration of surface water models with realistic, conservative inputs to support the interpretation of water quality predictions for future scenarios and improve the confidence with the predicted effects. The importance of calibrating models with realistic and conservative inputs to provide accurate representations of future scenarios, while also aiming to avoid underestimation of potential effects. The surface water models for the final EIS/EA, including mass and water balance models, have incorporated model calibration as well as comprehensive sensitivity analyses to test modelling outputs and increase confidence that water quality predictions. The Surface Water Quality Model (Appendix N-2, Section 3) includes appropriately conservative sensitivity scenarios, including climatic analysis and higher concentrations of parameters of concern in contact waters and seepage.

Potential Effects

MON and Wabauskang First Nation noted the potential for changes in surface water quality and quantity from the Project. A comprehensive assessment of potential effects on Birch Lake, Springpole Lake and local inland waterbodies (Section 6.6, Section 6.7, Section 6.8 and Section 6.9) has been undertaken for the Project, and is based on an extensive baseline dataset and rigorous modelling to understand the potential changes in surface water quantity and quality and how best to mitigate the potential effects.

Mitigation Measures

CLFN also requested further explanation of the conclusion related to increased TSS loading to surface waters due to sedimentation will not have any residual impact due to mitigation efforts. Monitoring of the effectiveness of erosion and sedimentation control measures will be a required component of the Project's permits and approvals; and protective limits for TSS will be included in the site-specific effluent criteria. An Erosion and Sediment Control Plan will be prepared for the site prior to construction based on the detailed designs, construction plans and schedules, as described in Section 6.6.4. A combination of site controls and effluent criteria will assess whether the TSS mitigation is effective and complies with provincial and federal expectation to protect the aquatic receiving environments and biota. Further details of the monitoring plan are provided in Section 12.

The MECP requested further information on the measures to collect and manage seepage from the CDF to reduce potential effects on Birch and Springpole Lake water quality. Since the draft EIS/EA, further engineering has advanced the design of an integrated water management system to collect and control contact water during the construction and operation phases of the Project from the stockpiles, CDF and plant site areas, and water from the open pit is to be recycled and used in processing. The collected contact water not re-used in processing will be treated at the ETP and discharged to the southeast arm of Springpole Lake as needed to maintain the site water balance. Similar water management will continue after operations cease until regulatory requirements for passive discharge from the reclaimed site are met. In addition, the further engineering has been completed to optimize the design of the CDF and includes measures to collect and manage seepage (Section 4.6 of Appendix V-1). The water management measures have been updated in Section 5.10.1, and these measures are included in Section 6.6.4.

CLFN, LSFN and SFN requested a surface water / groundwater interaction monitoring and mitigation plan that is designed to identify areas of potential groundwater / surface water interaction. Seepage quality and quantity estimates are provided in Section 6 of the Hydrogeology Modelling Report (Appendix L-2) of the final EIS, including a schematization to illustrate mitigated potential seepage pathways (Figure 4.2-1). Groundwater mitigation measures as described in Section 6.5.4, have been designed for the CDF and include the siting of the CDF on highly preferred foundation conditions composed of andesite bedrock, the appropriate management of tailings and mine rock within the facility and an engineered perimeter seepage collection system. Section 12 includes follow-up surface water and groundwater monitoring programs for the Project, which will be refined as part of the provincial permitting process, as is standard practice. However, note that the existing surface water quality and groundwater monitoring programs undertaken for the Project are comprehensive, spanning multiple years and form the basis for the follow up monitoring.

Assessment of Residual Effects

IAAC requested further information on the draft EIS/EA base case for seepage estimates from Project facilities and the scenario where 80% seepage capture is used to inform downstream water quality predictions. IAAC also requested additional parameters be included in the assessment of different scenarios. Finally, IAAC requested further information on how the residual 20% would influence surface water quality, sediment quality and fish habitat. Water collection ditches will be constructed and operated around the perimeter of the CDF and ore stockpiles to collect overland flow and seepage and direct it to the integrated water management system. The predicted volume of bypass seepage is described in the Hydrogeology Modelling Report (Appendix L-2, Section 6) and described in the assessment of surface water quality in Birch Lake (Section 6.6.5). The predicted quality of seepage is described in Mine Site Water Quality Report (Appendix K-2, Section 4) and presented in Table 6.6-9. Based on the volumes and quality, the effect of these changes on surface water quality is assessed in Section 6.6.5 under an expected conservative scenario (using a 90% seepage capture rate as predicted by the Hydrogeology Modelling Report) and included three sensitivity scenarios to evaluate an uppercase seepage and extreme climatic conditions. The assessment includes the addition of cyanide, un-ionized ammonia, nitrate, chloride and manganese. The results of the surface water quality assessment for the expected conservative scenario are carried into the assessment of fish and fish habitat (Section 6.10) and the assessment of human and ecological health (Section 6.26).

Follow up Monitoring

NWOMC expressed interest in participating in the development and implementation of a monitoring program to verify the accuracy of predicted effects. Section 12 provides a description of the monitoring program to evaluate the predicted effects and effectiveness of the mitigation measures and along with the extensive surface water quality monitoring program in place currently, will form the basis for monitoring programs refined during the permitting phase. FMG will continue to keep NWOMC informed of the permitting timelines and any changes as the Project progresses.

6.6.1.3 Spatial and Temporal Boundaries

The Project Development Area (PDA) is defined as the footprint of the Project including the mine site area, mine site access road and the transmission line corridor, as well as a buffer in order to allow flexibility for design optimizations. The buffer includes approximately 250 metres (m) around the mine site area. The buffer for the transmission line is included within the 40 m wide corridor and within the 30 m wide corridor for the mine access road. Where the mine access road and transmission line are aligned together, the buffer is included within a 60 m wide corridor.

The spatial boundaries used for the assessment of surface water systems are shown in Figure 6.6-3 and defined as follows:

- **Local Study Area (LSA):** The LSA for surface water extends from the PDA to include the waterbodies and watercourses potentially affected by changes in hydrology and surface water, which may result in a potential effect on surface water quality and quantity. The area is bounded by:
  - Springpole Lake watershed, from the outflow of Cromarty Lake to 1 km downstream of the Birch River crossing at the Wenasaga Road;
  - Northeastern shoreline of Birch Lake, to the north and northeast of the PDA; and
  - A distance of 3 km downstream of the PDA within Birch Lake, to the west.
- **Regional Study Area:** The RSA for surface water systems encompasses the LSA, as well as the contributing sources of water in the Birch Lake watershed. This also extends downstream to the confluence of Birch River with Gull Lake, approximately 8 km downstream of the LSA.

From a surface water perspective, the construction of the transmission line is expected to occur during frozen conditions or will occur within a small area for a very short period of time. Therefore, there are no expected effects on the surface water VC due to the construction and operation of the transmission line. As a result, potential for effects on surface water is limited to the mine site and the mine access road area of the PDA.

The temporal boundaries for the assessment of surface water systems are defined as:

- **Construction Phase:** Years -3 to -1, representing the construction period for the Project.
- **Operations Phase:** Years 1 to 10, with the first year potentially representing a partial year as the Project transitions from construction into operations. Mining of the ore from the open pit will end in Year 10, at which time the pit will begin refilling with water.
- **Decommissioning and Closure Phase:**
  - **Active Closure:** Years 11 to 15, when final decommissioning and the majority of active reclamation activities are carried out; and
  - **Post-closure:** Years 16+, corresponding to the post-closure monitoring period and when the filled open pit basin will be reconnected to Springpole Lake.

Effects on the VC are assessed for each Project phase (i.e., construction, operation and closure).

6.6.1.4 Criteria and Indicators

In undertaking the assessment of surface water effects, the following criteria were used:

- Change in water quantity; and
- Change in water quality.

The specific criteria, measurable indicators and the rationale for the selection of criteria are described in Table 6.6-1.

6.6.1.5 Description of Residual Effect Attributes

The residual effects for surface water are characterized in terms of the following attributes:

- Magnitude;
- Geographic extent;
- Duration;
- Frequency; and
- Reversibility.

These attributes along with the rankings are further described in Table 6.6-2.

In addition, the residual effects for surface water are characterized according to the ecological and/or social context within which the VC is found. This is a qualitative measure of the sensitivity and/or resilience of the VC is to potential change. The following ranking is applicable:

- **Level I:** The VC may or may not be sensitive but is capable of supporting the predicted change with typical mitigation measures.
- **Level II:** The VC is sensitive and requires special measures to support the predicted change.
- **Level III:** The VC is sensitive and unable to support the predicted change even with special measures.

As noted in Section 6.1, a residual effect is defined as significant if both of the following criteria are satisfied:

- A Level II or III rating is attained for all of the attributes involving magnitude, extent, duration, frequency and reversibility; and
- A Level II or III rating is attained for ecological and/or social context.

Conversely, if a Level I rating is achieved for any of the attributes involving magnitude, extent, duration, frequency or reversibility; or, if a Level I rating is achieved for the ecological and/or social context, then the residual effect is considered to be not significant.

In the event there is a significant adverse effect, the likelihood of occurrence is further described.

6.6.2 Existing Conditions

A description of the baseline conditions is presented below to characterize the existing conditions for surface water and is based on several years of study that has resulted in a comprehensive surface water dataset for this stage of Project planning. The existing conditions are used to support the assessment of potential effects from the Project on surface water and will support long-term monitoring for the Project. Additional baseline information on surface water can be found in the technical support documentation including the Baseline Hydrology Report (Appendix M-1) and Baseline Surface Water Quality Report (Appendix N-1).

The surface water monitoring stations are shown in Figure 6.6-1 and the hydrometric stations for the Project are shown in Figure 6.6-2. Meteorological data collected from the Project site has been supplemented with regional ECCC data with longer records. Climate data collected at the Project site weather stations were compared to the data from the regional climate stations, and similar trends were observed in precipitation, temperature and evaporation rates. The results of this analysis indicated that ECCC Ear Falls and Red Lake stations were the most suitable reference stations for Birch Lake and the Project site. Red Lake station was selected due its location and period of record.

6.6.2.1 Surface Water Quantity

Birch Lake is the largest waterbody within the RSA, with an area of 11,623 ha, an average depth of 7.4 m and a maximum depth of 38.0 m. Birch Lake is irregularly shaped and collects all surface water within the Birch Lake subwatershed; its main tributary is the Shabumeni River at the extreme western end of the lake. Birch Lake connects to Cromarty Lake through the Birch River, southwest of the Project where it discharges into Springpole Lake. The total watershed area reporting to Birch Lake, downstream of the Project site, is approximately 762 square kilometres (km^2).

Annualized monthly flow statistics for Birch Lake are estimated in Table 6.6-3. Average monthly flows are expected to be highest in May (12.4 cubic metres per second [m^3/s]) and June (12.7 m^3/s), following the spring freshet, and lowest during the late winter months of February (3.4 m^3/s) and March (3.0 m^3/s). Flow values were determined by pro-rating from long-term flow records for the nearby Water Survey of Canada (WSC) station Sturgeon River at McDougall Mills (05QA004), selected to act as a basis for the development of flow statistics for the Project site based on its length and completeness of record, as well as how its historical data fit with the monitoring datasets considered in the baseline studies (Appendix M-1).

Low flow indices for Birch Lake are provided in Table 6.6-4. These include the 7Q2, 7Q5, 7Q10 and 7Q20 low flow conditions, defined as the lowest consecutive 7-day average flow that is expected to occur in a 2-, 5-, 10- or 20-year return period, respectively. As described in Appendix M-1, low flow runoff is typically correlated to the watershed size, as smaller watersheds experience lower low flow conditions compared to larger ones. For this reason, a regression analysis was carried out to produce the values in Table 6.6-4. Based on the regression analyses, the resulting 7Q20 value for Birch Lake is 0.5 m^3/s. Water levels measured in Birch Lake show seasonal trends of a slight increase in water levels (approximately 0.3 m) between mid-May and mid-June, followed by a steady decrease of approximately 0.4 m to mid-October.

6.6.2.2 Surface Water Quality

Baseline surface quality monitoring of Birch Lake has included the analysis of physicochemical parameters (such as temperature, pH, dissolved oxygen and conductivity), as well monitoring of nutrients, anions, cyanide, and total and dissolved metals.

Results indicate that Birch Lake is typical of oligotrophic lakes in northern Ontario, with very low levels of TSS, total dissolved solids and turbidity, and circumneutral pH (ranging pH 6.0 to pH 7.6). Water temperature, dissolved oxygen and pH can vary with depth in a waterbody. These relationships are most pronounced in deep lakes, like Birch Lake, which become thermally stratified during the summer season in temperate climatic regions, like Ontario. Profile plots for Birch Lake are shown in Figure 6.6-4 and Figure 6.6-5. Thermoclines were generally not present in winter and early spring months, which suggests that Birch

Lake was well mixed at these times of the year. Birch Lake is well oxygenated and dissolved oxygen levels ranged from approximately 8.5 to 15 milligrams per litre (mg/L) over the period of record. Dissolved oxygen levels generally met or were greater than the PWQOs and the Canadian Water Quality Guidelines. Over 260 water quality samples were collected between 2011 and 2022 from Birch Lake to support the effects assessment. Analytical results are compared to a consistent set of WQG PAL listed in Table 6.6-6. Note, surface water quality parameters in Birch Lake are less than health-based drinking water quality standards for all parameters with drinking water quality guidelines. WQG PAL are more stringent than drinking water quality guidelines for most parameters.

Summary statistics of Birch Lake water quality are presented in Table 6.6-7. Water quality results for Birch Lake for each monitoring station (SW-28, SW-20, SW-19b, SW-03, BIRCH-B2, SW-18, SW-24 and SW-04) are presented in the Baseline Surface Water Quality Report (Appendix N-1).

Concentrations of total and dissolved metals in Birch Lake are also very low, often at or below analytical detection limits, and consistently below WQG PAL (Table 6.6-7). Overall, there are few occasions where measured baseline concentrations are outside the range of WQG PAL during the sampling period. These were:

- pH;
- Silver;
- Phosphorous;
- Iron; and
- Cobalt.

Overall, the number of samples having natural water quality above WQG PAL in Birch Lake, are of very low frequency (less than or equal to 5% of total observations over the period of record). Low frequency, sporadic concentrations greater than WQG PAL are considered to be representative of natural heterogeneity of the Birch Lake system. Time series graphs showing illustrating the natural ranges for water quality parameters over the 2011 to 2022 monitoring period are presented in the Baseline Surface Water Quality Report (Appendix N-1).

Additional discussion of baseline concentrations of pH, phosphorus, iron and mercury are provided below. These parameters correspond to identified parameters of interest for Birch Lake based on:

- Exceedance of WQG PAL in baseline conditions (pH, phosphorus, iron). Note, parameters with a single instance of results above WQG PAL across the entire sampling period (2011 through 2022; Appendix N-1) were not considered to be a parameter of interest for Birch Lake for the purposes of this summary discussion. These are silver and cobalt.
- Parameters identified as important by local Indigenous communities during consultation on the draft EIS/EA (mercury).

The pH levels of Birch Lake ranged from 5.95 to 8.03, typical of remote lakes in Northern Ontario. pH values fell outside the range specified by WQG PAL on two instances, a pH of 5.95 at SW-24 in June 2022 and a pH of 6.49 at SW-20 in October 2012. These occasional low pH values are considered to reflect the natural variability within the Birch Lake system.

Total phosphorous concentrations in Birch Lake ranged from 0.001 to 0.175 mg/L. Phosphorus concentrations were above the WQG PAL value of 0.02 mg/L in 14 of 261 samples over the period of record (or approximately 5%); however, overall, phosphorous concentrations are characterized as very low in Birch Lake as both average and 95th percentile concentrations are less than WQG PAL (Table 6.6-7). The highest measured concentrations of total phosphorus were generally associated with lake bottom / hypolimnetic samples collected in 2021 for Birch Lake, at stations BIRCH-B1 and BIRCH-B2. This is likely associated with natural anoxic reduction processes and release of total phosphorus from lake bottom sediment, as part of natural phosphorus cycling in the Birch Lake system. There are no apparent seasonal trends for total phosphorus concentrations.

Total iron concentrations ranged from 0.005 to 3.2 mg/L in Birch Lake. The highest measured concentrations of total iron for Birch Lake were generally associated with lake bottom / hypolimnetic samples collected in 2021, at stations BIRCH-B1 and BIRCH-B2. As described above for total phosphorus, this is likely associated with natural anoxic reduction processes and release of total iron from lake bottom sediment, as part of natural iron cycling in the Birch Lake system. This is supported by Birch Lake total iron concentrations being associated with the dissolved phase (total iron concentrations constitute on average 75% of the dissolved iron, when total iron concentrations are greater than WQG PAL), rather than particulate matter or TSS. There are no apparent seasonal trends for total iron concentrations.

Total and dissolved concentrations of mercury have been monitored in Birch Lake since 2011, with ultra-low detection for total mercury and methylmercury added to the program in 2021. Concentrations of total mercury are very low, with 95% of samples below the analytical detection limit of less than 0.000005 mg/L. Most detectable concentrations of mercury were associated with Station SW-19 in June of 2021. Overall, total mercury concentrations in Birch Lake ranged from less than 0.000005 mg/L to 0.0000128 mg/L, below the WQG PAL limit of 0.000026 mg/L. The highest concentration of detected mercury was at Station SW-20 in June of 2021.

6.6.2.3 Traditional Knowledge

CLFN noted that access to clean drinking water from natural sources on the land is integral to and inseparable from spending time on the land in preferred ways for CLFN members. Members reported collecting drinking water from different lakes, including, but not limited to, Birch Lake, Springpole Lake, Keesic Lake, Gull Lake, Swayne Lake and Zionz Lake. Water is collected from lakes year-round, including during the winters when CLFN members will drill through ice to collect fresh water. Further, it was noted that collecting drinking water from sources north of the Project (e.g., the Keigat area, northeast of the RSA) would be essential for potability. It was also noted that members have experienced unpredictable fluctuations in the water levels of lakes and rivers, which have impacted travel routes and the accessibility of some areas. These lower water levels lead to exposed hazards (i.e., reefs, rocks) within the water that interfere with safe, unhindered passage throughout these freshwater environments, especially in the narrow or shallow passages which occur between some of the commonly used and important lakes.

LSFN noted the importance of water quality and quantity cannot be understated. It was noted that the waters of northern lakes closer to the Project were important and highly valued as places where water was cleaner due to greater distance from the industries and lake uses that might impact lakes closer to the community. Members emphasized the importance of the English River water system in the territory for the ability to collect drinking water safely, and for supporting healthy fish habitats. The lakes and rivers north of Lac Seul were referenced by many participants as being farther away from the roads, industries and settlements and water-level changes which were considered to impact water quality.

Further, LSFN noted that a critical turning point in changes to LSFN’s way of life was 1929, when a dam to power hydroelectricity generation in Manitoba led to using Lac Seul as a water reservoir. Lac Seul’s water levels were raised by 10 feet, and LSFN's reserve lands, homes, farms, wild rice fields and gravesites were lost. Although the hydro-dams and other control structures are used to control water levels, generate power and avoid seasonal flooding; however, for LSFN the result has been frequent and significant changes in the water levels of Lac Seul and surrounding and connected waterbodies. LSFN members have experienced the flooding of important areas, the destruction of camps and other lands through the flooding or erosion of the foreshore, interruptions to navigation through changing depths. In some cases, water level fluctuations were eight to 10 feet. These widely fluctuating water levels (especially high waters) have caused past damage to land-fast infrastructure, and they result in constantly having to repair infrastructure-like docks that support a range of water-based activities (including travel, fishing and hunting). It was noted that the fluctuating water levels have radically reshaped the Lac Seul basin, causing damage to infrastructure, causing erosion, having impacts on fish habitat and introducing navigational risks for the LSFN members who use the lake.

SFN noted that healthy water means that the water in the Cat River System is free of contaminants, and that the water from the land can be consumed by members without concern for wellbeing. It is also important that water volume in the Cat River System is adequate to support lands and their way of life. The rivers and lake systems are noted as being used as travel routes by SFN members. Changes in water levels have had vast impacts on the ability of SFN members to navigate the rivers and lakes. For example, in the summer of 2023, SFN members' ability to access traditional boating routes was notably limited due to abnormally low water levels. These changing water levels have disrupted some of SFN's permanent camps and limited the ability to set up camps. Further, the changes in water levels limit other traditional uses such as several plant harvesting locations that are not accessible when the lake systems are flooded, and traditional foods such as wild rice that cannot go to seed when water levels are high. When water levels are low, SFN members have experienced challenges travelling along more rocky water routes and several members have experienced damage to their boats from rocks. SFN has also noted that algae have been identified to bloom more abundantly when water levels are low and stagnant, leading to other ecosystem changes and impacting deep water fishing for Lake Trout and Lake Sturgeon. SFN noted that their involvement in water quality and quantity monitoring and requested that visitors operating in SFN traditional territory must share the results of water monitoring with SFN.

MON and NWOMC noted the importance of water in supporting fish and wildlife species that are traditionally harvested and providing access to the areas where traditional harvesting occurs.

6.6.3 Identification of Pathways to Potential Effects

The initial step in the assessment process is to identify interactions between the Project and the VC that can result in pathways to potential effects. These potential effects may be direct, indirect and/or positive effects. Table 6.6-8 includes the potential interactions of the Project with surface water in Birch Lake, prior to the application of the mitigation measures. The professional judgment of technical experts experienced with mining projects in Ontario and other parts of Canada, as well as input from Indigenous communities, government agencies and the public, informed the identification of those interactions that are likely to result in a pathway to a potential effect due to a measurable change on surface water quantity and quality. These pathways to potential effects are further described below for each phase of the Project, along with the rationale for those interactions excluded from further assessment. Section 6.6.4 and Table 6.6-9 provide a description of the mitigation measures applied to potential effects during all phases of the Project. The residual effects, after the application of the mitigation measures, are then described and further evaluated in Section 6.6.4 using the criteria and indicators identified in Section 6.6.1.4.

Construction Phase

The construction phase of the Project is expected to occur over a three-year period and will include preparation of the site and the construction of mine infrastructure. The following interactions with the Project result in pathways to potential effects on the surface water of Birch Lake as described below. After mitigation is applied to each pathway, as described in Table 6.6-9, the residual effects are assessed using the criteria identified for each pathway

- Site preparation activities for the mine site, including clearing, grubbing and bulk earthworks interact with the surface water of Birch Lake.
  - These activities result in pathways to potential effects on the surface water of Birch Lake due to:
    - the change in catchment areas required to management contact and non-contact water, which may affect the quantity of surface water contributing to Birch Lake;
    - ground disturbances that could lead to erosion and sedimentation which may affect surface water quality; and
    - the operation of equipment that generates dust which may affect surface water quality.
  - The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity and quality from these pathways.
- The construction of the onsite haul roads and onsite access roads interacts with the surface water of Birch Lake. These activities result in pathways to a potential effect on the surface water of Birch Lake due to ground disturbances that could lead to erosion and sedimentation, which may affect surface water quality; also, the operation of equipment generates dust that may affect surface water quality. The assessment of potential effects on surface water includes changes in surface water quality from these pathways.
- The controlled dewatering of the open pit basin interacts with the surface water of Birch Lake. This activity results in a pathway to a potential effect on the surface water of Birch Lake due to groundwater management in the open pit basin, which may affect surface water quantity. The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity from this pathway.
- The construction of the starter embankment of the CDF and the initiation of stockpiling of ore interacts with the surface water of Birch Lake.
  - These activities result in pathways to potential effects on the surface water of Birch Lake due to:
    - the change in catchment areas required to management contact and non-contact water, which may the quantity of surface water contributing to Birch Lake;
    - ground disturbances that could lead to erosion and sedimentation, which may affect surface water quality; and
    - the operation of equipment that generates dust, which may affect surface water quality.
  - The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity and quality from these pathways.

- The establishment and operation of the water management and treatment facilities interacts with the surface water of Birch Lake. These activities result in a pathway to a potential effect on the surface water of Birch Lake due to the change in catchment areas required to management contact water, which may affect the quantity of surface water contributing to Birch Lake. The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity and quality from this pathway.

The development of the temporary construction camp and staging areas; the construction of the fish habitat development area; the construction of the dikes in the north basin of Springpole Lake; the construction of buildings and onsite infrastructure; the construction of the CWSP; the stripping of lake bed sediment and overburden in the open pit; the development of the surficial soil stockpile; and the initiation of pit development in rock are not located in the Birch Lake watershed – and they will not interact with the surface waters of Birch Lake.

The construction of the mine access road, aggregate resource areas, airstrip and transmission line are unlikely to have potential effects on the surface waters of Birch Lake given the distance to these components.

The commissioning of the process plant is unlikely to have potential effects on the surface waters of Birch Lake. There is no plausible interaction between the employment and expenditures activities and the surface water of Birch Lake during any Project phase.

Operation Phase

The operation phase is anticipated to occur over a 10-year period. The following interactions with the Project result in pathways to potential effects on the surface water of Birch Lake as described below. After mitigation is applied to each pathway, as described in Table 6.6-9, the residual effects are assessed using the criteria identified for each pathway:

- The operation of the process plant and accommodations complex interacts with the surface water of Birch Lake. These activities result in a pathway to a potential effect on the surface water of Birch Lake due to the requirement for water taking from Birch Lake to supplement the process plant and provide potable water for the accommodation complex, which may affect surface water quantity. The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity from this pathway.
- The operation of the open pit basin, including the associated ongoing water management interacts with the surface water of Birch Lake.
    - These activities result in pathways to potential effects on the surface water of Birch Lake due to:
        - The ongoing management of groundwater and surface water contributing to Birch Lake, which may affect surface water quantity;
        - The blasting of mine rock in the open pit that may result in mine rock with blasting residues, and mine rock with a change in geochemistry, which may affect surface water quality; and
        - The handling and transportation of mine rock and ore that could lead to increased dust deposition in the watershed and may affect surface water quality.
    - The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity and quality from these pathways.

- The operation of the CDF and ore stockpiles, and associated haul roads, interact with the surface water of Birch Lake.
    - These activities result in pathways to potential effects on the surface water of Birch Lake due to:
        - The handling and transportation of mine rock and ore that could lead to increased dust deposition in the watershed and may affect surface water quality;
        - The ongoing management of contact and non-contact water contributing to Birch Lake with the establishment of diversion ditches and ponds, which may affect surface water quantity; and
        - The changes in groundwater quality as a result of seepage from the CDF and ore stockpiles, which may affect the surface water quality.
    - The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity and quality from these pathways.
- The operation of the water management facilities within the mine site area (including diversion ditches and ponds) interacts with the surface water of Birch Lake. These activities result in a pathway to a potential effect on the surface water of Birch Lake due to the ongoing management of contact and non-contact water contributing to Birch Lake, which may affect surface water quantity. The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity from this pathway.
- Progressive reclamation activities interact with the surface water of Birch Lake. These activities result in pathways to a potential effect on the surface water of Birch Lake due to ground disturbances that could lead to erosion and sedimentation, which may affect surface water quality; also, the operation of equipment generates dust that may affect surface water quality. The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity and quality from these pathways.

The operation and maintenance of other mine site infrastructure is not expected to have an interaction with the surface waters of Birch Lake.

Decommissioning and Closure Phase

Activities occurring during the active closure phase, which is expected to occur over a five-year period, are similar to those that occur during the construction phase and use similar mining equipment but generally on a smaller scale. The following interactions with the Project result in pathways to potential effects on the surface water of Birch Lake as described below. After mitigation is applied to each pathway, as described in Table 6.6-9, the residual effects are assessed using the criteria identified for each pathway:

- The stabilization of disturbed areas during final reclamation, including regrading, placement of an appropriate cover to facilitate revegetation, if needed, and revegetation (active or passive). These activities result in pathways to a potential effect on the surface water of Birch Lake due to ground disturbances that could lead to erosion and sedimentation, which may affect surface water quality; also, the operation of equipment generates dust that may affect surface water quality. The assessment of potential effects on surface water in Birch Lake includes changes in surface water quantity and quality from these pathways.

- Closure of the CDF interacts with the surface water of Birch Lake. This activity results in pathways to potential effect on the surface water of Birch Lake due to changes in the management of contact and non-contact water contributing to Birch Lake due to altered catchment areas, which may affect surface water quantity; also, the changes in groundwater quality and quantity resulting from CDF seepage once tailings deposition is complete may affect the surface water quality and quantity. The assessment of potential effects on surface water includes changes in surface water quantity and quality from these pathways.
- The filling of the open pit basin with water interacts with the surface water of Birch Lake. This activity results in pathways to potential effects on the surface water of Birch Lake due to the discontinuation of groundwater management in the open pit that will lead to changes in the groundwater levels that may affect surface water quantity. The assessment of potential effects on the surface water of Birch Lake includes the changes in surface water quantity from this pathway.

During active closure, the Project's water management system will continue to operate until site runoff, and excess water from the reclaimed open pit basin (Section 6.7), is of acceptable quality to report directly to the receiving environment.

During decommissioning and closure, the removal of assets, demolition of remaining materials, disposal of demolition-related wastes, the filling of the open pit basin with water and monitoring are unlikely to have potential effects on the surface waters of Birch Lake.

The interaction between the surface water of Birch Lake and potential spills are not a planned activity that would occur within the normal operating conditions. However, the risk of an unplanned spill is fully assessed in Section 9, and includes consideration of the design and operational safeguards to avoid a spill, an assessment of the potential risks to the environment as a result of an unplanned spill, and the contingency and emergency measures that would be put into place in the event that a spill occurs.

6.6.4 Mitigation Measures

Measures to be implemented to avoid or minimize the effects of the Project on Birch Lake surface water quality and quantity include:

- Implementation of mitigation measures for potential effects on air quality relevant to dust (Section 6.2) including:
    - During construction, operations and active closure, a dust management plan will be implemented to identify potential sources of fugitive dusts, outline mitigation measures that will be employed to control dust generation and detail the inspection and record keeping required to demonstrate that fugitive dusts are being effectively managed; and
    - Dust emissions from roads and mineral stockpiles will be controlled through the application of water spray and supplemented by dust suppressants, if required;
    - Site roads will be maintained in good condition, with regular inspections and timely maintenance completed to minimize the silt loading on the roads; and
    - Vehicle speeds will be limited.
- Implementation of mitigation measures for potential effects on groundwater relevant to surface water (Section 6.5) including:

  - Locating the CDF on favourable geologic conditions at the Project site to support long-term stability and effective seepage management; and
  - During construction, a geosynthetic clay liner will be installed on the upstream side of the perimeter embankment of the CDF south cell (specifically the south, west and east sides) to mitigate seepage potential during the operation and closure phases.
- Development of a compact mine site to limit the areal extent of disturbance, and to limit the overall areas of site contact water that requires management.
- Maintain a minimum 120 metre setback from Birch Lake to the CDF, the low grade ore stockpile and the associated seepage collection system.
- During construction, operation and active closure, an integrated water management system will be designed to collect and control contact water from the stockpiles, CDF and plant site areas. Collected contact water that is not recycled in ore processing will be treated at the ETP and discharged to the southeast arm of Springpole Lake in accordance with permitting requirements.
- During construction, operation and active closure, an erosion and sediment control (ESC) plan will be implemented to manage runoff water around disturbed areas. The ESC plan will be prepared prior to the construction phase with the purpose of minimizing site erosion and protecting surface water from sedimentation. The ESC plan will provide further details on measures to minimize slope length and grade, ditching and diversion berms, contact water management ponds, use of natural vegetation buffers runoff controls, and working in and around water such as with the installation of the water intake.
- During construction, operation and active closure phases, water collection ditches will be constructed and operated around the perimeter of infrastructure, including the CDF and stockpiles to collect overland flow and seepage and direct it to the integrated water management system. Non-contact water will be diverted away from Project components using ditches, diversion berms and other suitable measures.
- During construction and operation, best management practices (such as following approved blasting plans and using appropriate drilling, explosive handling and loading procedures) will be implemented for the use of explosives use to reduce the potential presence of blasting residuals in the open pit and on stockpiled mine rock and ore.
- During construction and operation, co-manage and store potentially acid generating (PAG) mine rock and thickened non-acid generating (NAG) tailings in the north cell of the CDF. PAG mine rock will be encapsulated with thickened NAG tailings to isolate it from atmospheric oxygen and mitigate potential acid generation and metal leaching.
- During operation, in-plant destruction of cyanide in tailings using the sulphur dioxide / oxygen treatment process to minimize residual cyanide and metals concentrations in the CDF.
- During operation, to reduce freshwater demand from Birch Lake, water recycling measures will be implemented. For example, water collected in the CDF internal pond will be reclaimed and redirected to the plant / mill, minimizing the need for additional freshwater intake from the lake.
- During operation and closure phases, revegetation and encouragement of natural revegetation / recolonization of disturbed areas will be undertaken as part of progressive and final reclamation to minimize the length of time disturbed areas are exposed, to reduce erosion.

The application of mitigation measures for the pathways of potential effects is illustrated in Table 6.6-9. Mitigation measures described in this section are expected to be effective for their intended purposes given their effective implementation at similar projects.

Monitoring programs will be implemented to verify the accuracy of the predicted effects, assess the effectiveness of the implemented mitigation measures and may be further optimized in response to monitoring data. Extensive monitoring programs are in place for the Project with previous data collection completed. Monitoring for the Project going forward is further described in Section 12 and will be further refined during the permitting phase to incorporate conditions of approvals and permits. Consultation on the monitoring programs is expected to continue through all phases of the Project.

6.6.5 Analytical Methodology

Assessment of surface water effects for Birch Lake has been completed in accordance with generally and widely accepted assessment methods. The prediction and assessment of effects involved the following steps:

- Determine baseline surface water conditions in the absence of the Project;
- Identify key pathways of interaction of the Project with surface water (Section 6.6.2.1);
- Identify key indicators of changes to surface water, including water quality parameters and compounds potentially released to surface water from the identified sources;
- Identify relevant regulatory surface water standards and criteria, and establish the appropriate assessment criteria for a site in Ontario, noting that there may be more than one applicable criterion for some of the parameters;
- Predict changes to surface water using appropriate surface water modelling methods and established data sources; and
- Compare surface water quality and hydrology modelling outputs to applicable assessment criteria.

The modelling methods, data inputs and assumptions used to support the surface water effects assessment are described below. Water balance modelling details are provided in Appendix M (Appendices M-2 and M-3) and surface water quality modelling details are provided in Appendix N (Appendices N-2 and N-3).

6.6.5.1 Water Balance Modelling

The mine site water balance model (Appendix M-2) and receiving environment water balance model (Appendix M-3) quantify potential changes to surface water quantity (volume and flow) as a result of Project development.

Mine site water balance modelling was developed in GoldSim version 14.0 to simulate the volume and flow of water on a monthly time step over the life of the Project. GoldSim has been extensively and successfully applied to simulate complex water resource management, mining operations, contaminant transport and waste management projects; it represents a robust industry-standard modelling software. The Project phases (construction, operation, active closure – pit filling, and post-closure) were simulated deterministically under various climate conditions to support the receiver water quality and flow effects assessment. The water balance included conceptual sizing of major storage facilities. Additional detailed design of major water management facilities will be performed to support environmental approval applications and subsequent construction, as is standard practice. These facilities will comply with applicable legislation and regulations, including the *Ontario Water Resources Act*, to so that mine contact water can be collected, and infrastructure is appropriately sized to avoid untreated discharge into the environment.

For the receiving environment, monthly flows were simulated at various modelling nodes surrounding the mine site; these nodes were strategically placed in areas where changes to water quantity or quality due to interactions with the Project may be observed (Figure 6.6-6). For Birch Lake, these are:

- Directly north of the mine site (node 06);
- Directly west of the CDF (node 07); and
- Downstream of all Project influences on Birch Lake, upstream of the southeast arm of Springpole Lake (node 08).

Water balance model predictions were generated for nodes in Birch Lake (this section), Springpole Lake (Sections 6.7 and 6.8), and small inland waterbodies within and adjacent to the PDA (Section 6.9).

Water balance model predictions were completed for all phases of the Project. Water balance model schematics for each phase are provided in Figure 6.6-6 through Figure 6.6-8.

The water balance model estimated monthly flow conditions at each assessment node by pro-rating long-term flow statistics from a representative Water Survey of Canada station to match the subwatershed area for each node (Appendix M-3). Changes to monthly flow conditions at each assessment node for each Project phase were simulated to reflect changes to inflowing local catchment area due to the development of Project infrastructure, as well as effects from open pit water management, water taking and seepage from Project components. Flows were simulated at each assessment node for average, 1:100 wet and 1:100 dry year climatic conditions. A high-level climate change post-closure scenario was also assessed. The simulated flows were compared to the baseline conditions to quantify the change in flow for each Project phase. Water balance model inputs and assumptions are detailed in Appendix M-2 and Appendix M-3. To support the understanding of the effects assessment, key water management activities and inputs are described as follows:

- During construction, dikes will be installed to isolate the open pit basin, and controlled dewatering of the open pit basin will occur as needed to support open pit mining. Controlled dewatering will occur at a rate of up to 10% of the Springpole Lake inflow.
- Open pit development and mining will occur over the 10-year mine life, and open pit water management waters will be directed to the CWSP. The potential changes to groundwater baseflow from open pit water management activities are considered greatest at the end of operation, due to the zone of influence created by open pit water management.
- The CDF will contain tailings and mine rock and be composed of two cells: the north cell and south cell. Runoff within the CDF catchment area is captured and directed to the CDF internal pond within the south cell.
- During construction, operation and active closure, excess site contact waters will be directed to the CWSP and subsequently sent to the ETP. Treated water from the ETP is discharged to the southeast arm of Springpole Lake.
- Domestic wastewater generated from the site will be treated in the sewage treatment plant (STP) prior to being combined with ETP effluent and discharged to the southeast arm of Springpole Lake.

- Fresh water taking from Birch Lake will occur in accordance with regulatory requirements and as required to support the Project. During construction, water taking is assumed to be equal to the demand from the accommodations complex. During operation, water taking will be required to support the process plant and supply the water needs of the accommodations complex. Smaller quantities of fresh water will continue to be sourced from Birch Lake for the accommodations complex during active closure.
- Filling of the open pit with water during active closure (i.e., the pit filling phase) is expected to commence once operation and ore processing have ceased. During the pit filling phase, the transfer of water from the open pit basin to the CWSP will cease. All mine site contact water will continue to be collected and excess water will be treated and discharged to the southeast arm of Springpole Lake, except for water collected in the open pit basin (including local runoff, groundwater inflows and seepage from site facilities).
- Approximately five years will be needed to fill the open pit basin, including the fish habitat development area, to the average natural elevation of Springpole Lake (391 metres above mean sea level [m amsl]). During active closure (pit filling period), excess water will be drawn from Springpole Lake in a controlled manner, with monitoring, to expedite the filling process. The model uses a withdrawal of 10% of the available monthly flow at the inlet of Springpole Lake (outlet of Cromarty Lake) based on federal guidelines (DFO 2013) to avoid detectable ecological effects on downstream habitats.
- Post-closure represents when the site is reclaimed, and water quality of the open pit basin and site runoff is acceptable for passive discharge to the environment. At this time, the reclaimed open pit basin will be connected to Springpole Lake, the ETP is decommissioned, and site runoff passively drains to Birch Lake and Springpole Lake.

Water balance model scenarios informing the effects assessment are:

- **Base Case (average climatic conditions):** Represents average annual precipitation conditions. Monthly snowfall distribution (percent of precipitation that falls as snow) and runoff coefficients are based on Climate Normals and calibrated to observed runoff at a representative nearby streamflow gauge (Appendix M).
- **Extreme Wet (a 1:100 wet year):** The monthly annualized 99th percentile flow which represents the 1:100 wet year conditions. The runoff coefficients are applied to simulate runoff from natural subwatershed areas.
- **Extreme Dry (a 1:100 dry year):** The monthly annualized 1st percentile flow represents the 1:100 dry year conditions. The runoff coefficients are applied to simulate runoff from natural subwatershed areas.
- **Climate change:** uses a historical climate sequence representative of near-average conditions to assess inter-annual variability.

6.6.5.2 Water Quality Modelling

Surface water quality modelling was performed to evaluate the potential effects of the Project on the concentrations of total and dissolved metals, nutrients and anions in Birch Lake, as well as for the north basin of Springpole Lake (Section 6.7), the southeast arm of Springpole Lake (Section 6.8) and local inland waterbodies (Section 6.9).

The surface water quality model for the Project (Appendix N-2) is a mass-balance model developed in GoldSim (Version 14.0). It estimates the volume and flow of water as well as the concentrations and transport of chemical species as a function of time. In the surface water quality model, the Project interacts with the receiving environment through four general pathways:

- Diverted non-contact water and freshwater takings;
- Contact runoff and seepage from Project components;
- Discharges from the ETP and STP to the receiving environment, in the southeast arm of Springpole Lake; and
- The re-establishment of connection of the open pit basin to Springpole Lake.

Inputs informing the surface water quality model are based on extensive data collected from baseline studies, laboratory geochemical tests, predictions from numerical hydrogeological modelling (Section 6.5), and water balance modelling (as described above) as well as professional knowledge and experience with other similar projects. Where uncertainty exists, a conservative assessment or approach was applied (6.6.5.2) or a sensitivity analysis was completed.

To support the effects assessment, water quality was modelled for a conservative expected case (Base Case) using the following inputs:

- **Initial baseline concentration:** The water quality model assumes a 75th percentile baseline concentration for water quality parameters to represent initial conditions.
- **Expected metal release rates**: This applies to the mine rock, open pit wall loadings, ore stockpile and tailings, and corresponds to the use of median release rates from ongoing Project humidity cell tests (Appendix K-1.3).
- **Water balance model results for average conditions:** The construction, open pit mining and closure phase were modelled under average annual climatic conditions. Monthly snowfall distribution (percent of precipitation that falls as snow) and runoff coefficients were based on Climate Normals and calibrated to observed runoff at a representative nearby streamflow gauge (Appendix M-1).
- **Expected groundwater changes**: The interaction between groundwater and surface water was assessed in the model by analyzing water budgets at surface water features determined through hydrogeological modelling (Appendix L-2). These modelled water budget changes provide a measure of potential changes in groundwater contribution (or losses) to surface water or baseflow of the receiving environment and the associated water balance. During operation, most surface water features will experience an overall reduction in groundwater contributions to baseflow (Section 6.5).
- **Expected seepage rates:** Seepage rates from Project components to surface water were modelled for operation and closure; material seepages from Project components are not expected in advance of mine operation and tailings production. Hydrogeological model results for the CDF design demonstrate that more than 90% of seepages emanating from the north and south cell of the CDF report to the seepage collection system and then routed to the internal pond of the CDF south cell for eventual recycling in the process plant. The primary receiver of limited bypass seepage is the open pit, followed by Birch Lake (Section 6.5).

In addition to the conservative Base Case, the following sensitivity analyses were completed to support the effects assessment for surface water quality:

- **Base Case:** Includes average climatic conditions, expected groundwater inflows, 75th percentile baseline water quality concentrations, expected geochemical source terms and expected seepage rates.
- **Uppercase Seepage:** Includes average climatic conditions, expected groundwater inflows, 75th percentile baseline water quality concentrations, uppercase geochemical source terms and uppercase seepage rates.
- **Extreme Wet:** Includes extreme wet climatic conditions, expected groundwater inflows, 75th percentile baseline water quality concentrations, expected geochemical source terms and expected seepage rates.
- **Extreme Dry:** Includes extreme dry climatic conditions, expected groundwater inflows, 75th percentile baseline water quality concentrations, expected geochemical source terms and expected seepage rates.

A discussion on the model inputs for the Base Case and the identified sensitivity scenarios are provided in Appendix N and Appendix M.

6.6.5.3 Pit Water Quality Modelling

Model simulations were conducted to evaluate the future water quality of the refilled isolated basin using PitMod (Appendix N-3). PitMod is a numerical hydrodynamic model used for predicting the spatial and temporal distribution of temperature, density, dissolved oxygen and water quality parameters in lakes (Dunbar 2013; Martin et al. 2017). The model considered the entire refilled basin retained in isolation from Springpole Lake, inclusive of the following:

- Open pit and re-contouring material;
- Fish habitat development area;
- Exposed lake sediments as bounded by the east and west dikes;
- Water balance for the various inflows, including controlled conveyance of water from Springpole Lake which serves to accelerate the re-filling of the open pit basin; and
- Geochemical source terms for the various inflows.

Pit lake modelling included equilibrium chemistry modelling using PHREEQC, a industry-standard geochemical model originally produced by the U.S. Geological Survey (Parkhurst and Appelo 1999). For the filled open pit basin, PHREEQC was used to: 1) predict the pH of the pit lake during the filling period; and 2) predict water quality conditions in the pit lake following the neutralization of acidic pit wall runoff (Appendix N-3).

Model results provide information on the chemistry of water layers with depth and time. Model outputs for temperature, dissolved oxygen and total dissolved solids suggest that the water column will form a permanently stratified density structure (meromixis), which will limit mixing between the surface mixed layer and water at depth. These model observations indicate that the effects of wind-driven and convective mixing are not sufficient to mix the water column below a surface mixed layer depth of approximately 40 m. Under conditions of meromixis, anoxic conditions are predicted to develop below the surface mixed layer over time.

Improvements in surface water quality within the isolated area are predicted to occur over time as filling occurs, and can be attributed to several time-dependent factors, including submerging of pit walls and cessation of sulphide mineral oxidation; reduced loadings from CDF seepage as the hydraulic gradient lessens; the input of direct precipitation to the lake surface increases relative to pit wall runoff; and the development of pit lake stratification serves to isolate more saline water quality. Further details regarding the modelling approach and the water quality predictions are provided in Appendix N-3.

Pit water quality modelling results indicate that PWQOs and iPWQOs for the protection of aquatic life are expected to be achieved within approximately four to five years. These results have informed the assumed duration of the active closure phase (Section 6.6.1.3). Reconnection of the open pit to the north basin of Springpole Lake will only occur once water quality meets the required standards. If water quality in the open pit and site contact water is not suitable for passive discharge to the environment at that time, excess water will continue to be directed to the ETP for treatment prior to discharge into the southeast arm of Springpole Lake. Model predictions supporting this contingency plan can be found in Appendix M-2 (Mine Site Water Balance) and Appendix N-2 (Surface Water Quality Model).

Monitoring during re-filling of the open pit basin will provide considerable time to validate the model predictions and to identify and implement additional mitigation measures if needed.

Water Quality Parameters and Standards

The concentration of water quality parameters (mg/L) in treated effluent discharge, bypass seepage, pit water quality and the surface water receiving environment were modelled. Modelled water quality parameters are listed in Table 6.6-6 and include:

- Parameters with PWQOs and iPWQOs for the protection of aquatic life;
- Nutrients and anions (nitrate, nitrate, ammonia, phosphorus, sulphate);
- Parameters identified by the Rehabilitation of Lands Regulation (O. Reg 35/24), including cyanide; and
- Parameters with effluent criteria as per the federal Metal and Diamond Mining Effluent Regulations.

Modelled parameters do not include TSS. The industry-standard water quality models used cannot accurately represent or predict TSS levels due to the complexity of TSS sources and transport mechanisms that make it difficult to establish consistent relationships between model input parameters and TSS levels. In Ontario, mining operations must adhere to stringent regulatory requirements and environmental standards governing water quality, including TSS levels. Comprehensive water management mitigation strategies for TSS were strategically integrated into the Project’s design, providing proactive measures to safeguard water quality and minimize the potential for environmental impact.

To support the effects assessment, water quality model results were benchmarked against a consistent set of WQG PAL as per the latest guidance from the MECP. WQG PAL are based on rigorous studies to specifically safeguard the most sensitive life stages of aquatic species for periods of indefinite exposure. For parameters with PWQOs and iPWQOs, recent MECP guidance is the utilization of the most up-to-date and scientifically defensible WQG PAL sourced from either the PWQOs / iPWQOs, Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME) or Federal Environmental Quality Guidelines (FEQG). This approach allows for alignment with the evolving regulatory landscape and reflects the commitment to adhere to the most up-to-date standards in safeguarding aquatic ecosystems. WQG PAL are listed in Table 6.6-6.

6.6.5.4 Assumptions and the Use of the Conservative Approach

Conservative approaches are defined as those that provide estimates that will tend to be higher than expected, as a means to avoid the underestimation of potential effects from the Project. For the surface water models, those approaches include the following:

- Receiving water quality predictions are based on the principle of mass-balance such that water quality parameters behave conservatively and are not further reduced by mechanisms such as secondary mineral formation, attenuation through sorption processes or biogeochemical reactions (such as assimilation and biodegradation). This will result in an overestimation for some parameters, in particular total cyanide, nitrogen species and phosphorus.
- Mass-balance modelling that informs the assessment for the operation phase is conservatively restricted to the final year of operation (i.e., maximum build-out when concentrations of water quality parameters in the CDF, CWSP and open pit water are at their maximum values).
- Water quality predictions for the receiving environment are mass-balanced relative to informing monthly flows (flow from upstream nodes, catchment area inputs, seepage flow, ETP discharges) reporting to each assessment node (Figure 6.6-6) and do not account for additional dilution and mixing within the lake basins. This is a conservative assumption for model nodes that are generally located at riverine lake outlets and along the southeast arm of Springpole Lake, to avoid the underestimation of potential residual effects on water quality. For nodes within the large basins (Birch Lake), this will result in an overestimate of model parameters.
- The potential influence of seepage on surface water is modelled as a mass balance and does not account for any attenuation of concentrations along the seepage flow path.
- The receiving environment water quality model assumes a 75th percentile baseline concentration for water quality parameters to represent initial condition of the receiving environment.
- Calculated available assimilation capacity of the southeast arm of Springpole Lake (Appendix N-2) to receive treated effluent discharge was conservatively calculated accessing the maximum predicted discharge rate from the ETP (Appendix N-2).

The conservative approach outlined above demonstrates that predicted effects on surface water will not be underestimated, and with the application of mitigation measures, there will be reliable environmental protection of surface water.

6.6.6 Characterization of Potential Residual Effects

Residual effects of the Project on the surface water of Birch Lake were assessed using both quantitative water balance and water quality modelling (Appendix M and Appendix N, respectively) as well as qualitative methods, as discussed below.

6.6.6.1 Change in Surface Water Quantity

For the Birch Lake VC, the potential residual effects on surface water quantity are assessed by evaluating relative changes to watershed area and using quantitative water balance modelling (Section 6.6.5) to estimate changes to monthly inflows and overall hydrology of Birch Lake. The geographic extent of potential residual effects was determined by defining strategically selected locations in the water balance modelling domain (i.e., model nodes), focusing on locations where interactions between the Project and water quantity are most likely to occur. The assessment focuses on the following areas (Figure 6.6-6):

- Directly north of the mine site (node 06);
- Directly west of the CDF (node 07); and
- Downstream of all Project influences on Birch Lake, upstream of the southeast arm of Springpole Lake (node 08).

The key mitigation measures that will be applied to pathways to potential effects on surface water quantity in Birch Lake during construction, operation and closure are further described in Table 6.6-9, and include:

- Development of a compact mine site to limit the areal extent of disturbance;
- An integrated water management system will collect and control contact water from the stockpiles, CDF and plant site areas;
- Water collection ditches will be constructed around the perimeter of infrastructure and divert non-contact water away from Project; and
- Collected contact water that is not recycled in ore processing will be treated at the ETP and discharged to the southeast arm of Springpole Lake in accordance with permitting requirements.

With the implementation of these mitigation measures, the model results indicate that changes to surface water quantity of Birch Lake are driven by the following activities:

- Changes to local surface water catchment area because of the development of mine site infrastructure and water management facilities;
- Water takings from Birch Lake; and
- Changes in groundwater contributions to surface water flows during open pit dewatering and the operation of the CDF.

These activities and potential residual effects on Birch Lake are described in the following paragraphs.

Construction

The development of Project infrastructure and water management facilities is predicted to reduce the local surface water catchment area of Birch Lake by approximately 3 km^2. This accounts for approximately 0.4% of the natural catchment area reporting to assessment node 08 (Figure 6.6-6).

Operation

Freshwater takings from Birch Lake are proposed to support the Project. The water intake will include an appropriately sized screen to meet DFO's Code of Practice (2020). Direct water takings from Birch Lake during construction and active closure are required for the accommodations complex and predicted to be a maximum of approximately 86 cubic metres per day (m^3/day) (Appendix M-3). During operation, freshwater takings for Birch Lake are required for both the accommodations complex and occasionally to support the process plant; maximum water takings are predicted to be up to 12,973 m^3/day and 5,765 m^3/day as an annual average (Appendix M-3).

Effects of open pit water management are anticipated as the open pit will generally act as a sink to groundwater flow (i.e., hydraulic low), drawing groundwater into the pit from immediately adjacent areas during mine operation. This is expected and typical of all open pit mining operation. Water balance modelling indicates a small relative reduction in groundwater contributions to Birch Lake as a result of open pit water management as follows:

Feature	Groundwater Contribution Change from Baseline (m^3/day and relative percent change)(1),(2)	
	Operation	Final Closure
Birch Lake	-106 (15%)	-31 (4%)

Notes:
(1) Groundwater-surface water interactions (i.e., water budget) changes given as [mining phase model] – [baseline model].
(2) Includes reduction due to upstream feature overprint (L-3, L-4, L-17 and L-18).

Monthly water balance modelling was performed to quantify the potential residual effects of proposed water takings, effects of open pit water management and changes to local watershed area, relative to baseline conditions across the life of the Project. As identified in Section 6.6.5.1, a variety of climatic conditions were considered including average hydrology for Base Case well as Extreme Dry and Extreme Wet model cases. Water balance model results are conservatively based on estimations of changes to inflows (Section 6.6.5.4).

Model results demonstrate that the water balance of Birch Lake will be indistinguishable from background conditions (Table 6.6-10). Birch Lake, downstream of all potential Project effects (node 08) shows minimal changes in annual inflows, with maximum variations of less than -5% as estimated by the Extreme Dry model case. Similarly, water balance results for assessment node 07 indicate maximum estimated change of -15%. Based on Fisheries and Oceans Canada guidance (DFO 2013) and Locke and Paul (2011), a 10% to 15% reduction in instantaneous flows are unlikely to have detectable ecological effects on the downstream habitats. During construction and operation, the water balance model predicts larger reductions to inflows to Birch Lake near the CDF and mine site footprint (Table 6.6-9), where much of the local catchment area is impacted.

These estimated changes to inflows to Birch Lake near the Project site are relatively small relative to the overall Birch Lake inflows to the Birch Lake system in the LSA and the estimated changes to inflows to Birch Lake are not expected to measurably affect water levels or velocities. Further, Birch Lake is outlet-controlled, and therefore water levels will be governed by the downstream lake outlet. As a result, the estimated changes to inflows near the Project site in the PDA are not large enough or material as to effect water levels or flow velocities given the large overall watershed area of Birch Lake. Additional discussion and evidence of this understanding of nodes within lake bodies is provided in Appendix M-3, which summarizes a dynamic wave routing model developed for the Project.

Closure

In active closure, active mining will cease, open pit water management will cease, and the open pit will be allowed to fill. The water balance model predictions for the initial closure and pit filling stages for Birch Lake show that the predicted changes for birch lake (assessment nodes 06, 07 and 08) are low and/or indistinguishable from background conditions and are similar to construction and operation phases (Table 6.6-10).

During post-closure, the PDA will return to a near-natural state, the collection and treatment of site runoff ceases and runoff passively drains to either Springpole Lake or Birch Lake. In Birch Lake, the annual flows in Birch Lake are predicted to increase relative to flows predicted during construction and operation and return to baseline conditions (Table 6.6-10). This is due to:

- Revegetation and reclamation activities in the mine site area of the PDA;
- A predicted decrease in the relative proportion of groundwater flows reporting to the filled open pit basin; and
- Passive discharge of the catchment area around the ore stockpile back to Birch Lake.

6.6.6.2 Change in Surface Water Quality

The surface water quality effects assessment for Birch Lake aims to evaluate the potential effects of the proposed Project on concentrations of water quality parameters to support the understanding of how Project activities might alter water quality and to assess whether mitigation measures are appropriately designed. For the Birch Lake VC, residual effects on surface water quality were identified through quantitative water quality modelling (Section 6.6.5), assessing potential changes in monthly water quality of Birch Lake. To evaluate the geographic extent of these changes, model simulations were conducted at strategically selected locations (i.e., model nodes) where interactions between the Project and water quality are most likely to occur. These locations align with those used in the water balance model (Figure 6.6-6) and are as follows:

- Directly north of the mine site (node 06);
- Directly west of the CDF (node 07); and
- Downstream of all Project influences on Birch Lake, upstream of the southeast arm of Springpole Lake (node 08).

Surface water quality model results are presented in Appendix N-2 and Table 6.6-8 though Table 6.6-9. Model results for surface water quality in Birch Lake inform the downstream surface water quality assessment of the southeast arm of Springpole Lake (Section 6.8).

Construction

During construction, key mitigation measures to reduce the potential effects on surface water quality in Birch Lake are the implementation of effective erosion and sediment control measures and the establishment of 120 metre setback from the adjacent waterbody, as described in Table 6.6-10. With the implementation of these mitigation measures for this pathway, the incidences of increased TSS loading to surface waters due to sedimentation will be mitigated. As result, a residual effect on surface water quality in Birch Lake due to this pathway is not predicted.

Similarly, there will be no pathway to a potential effect on water quality in Birch Lake due to site runoff or bypass seepage reporting to Birch Lake during construction. Predicted water quality in Birch Lake is below WQG PAL for all modelled parameters for Base Case (Table 6.6-8 though Table 6.6-9) and model sensitivity cases (Appendix N-2).

Operations

The potential effects on surface water quality in Birch Lake during operation are driven by changes in surface water inflows (as described in Section 6.6.6) and the limited bypass seepage from Project components, based on modelling results. The key mitigation measures to reduce these potential effects are described in Table 6.6-9, and include:

- Locating the CDF on favourable geologic conditions at the Project site to support long-term stability and effective seepage management;
- Installing a geosynthetic clay liner on the upstream side of the perimeter embankment of the CDF south cell (specifically the south, west and east sides) to mitigate seepage; and
- Implementation of water collection ditches around the perimeter of the CDF and stockpiles to collect overland flow and seepage and direct it to an integrated water management system.

Hydrogeological modelling conducted (Section 6.5.6) for the Project based on the CDF design predicts small quantities bypass seepage reporting to Birch Lake as:

Assessment Node	Seepage – Operation (m^3/day)			Seepage – Post Closure (m^3/day)	
	Low Grade Ore Stockpile	CDF South Cell	CDF North Cell	CDF South Cell	CDF North Cell
North of the Project site, Node 06	10	0	5	0	19
West of the CDF, Node 07	0	0	50	0	26
Downstream from the CDF, Node 08	0	0	28	0	26

Over 90% of the seepage is captured by the water collection ditches (Appendix M-2). Bypass seepage represents shallow groundwater flow that emanates from the source zone (CDF or low-grade ore stockpile) that isn't capture by the seepage collection system and discharges along the flow path to Birch Lake. Geochemical characterization studies for the Project (Appendix K) indicate that drainage and bypass seepage from the CDF will be circumneutral to slightly alkaline pH (e.g., pH 7 to 9). The predicted quality of seepage from the CDF is presented in Table 6.6-9.

Water quality model results for Birch Lake are summarized in Table 6.6-10; corresponding timeseries graphs are provided for key water quality parameters in Figure 6.6-10 through Figure 6.6-12 as well as Appendix N-2.

During operation, the general patterns for water quality predictions in Birch Lake can be attributed to the seasonal water balance and conservative model assumptions related to the mass balance (Section 6.6.5.2). The predicted water quality for assessment of Birch Lake, downstream of all Project influences (node 08), is below (i.e., better than) WQG PAL for all modelled parameters. In the Upper-case Seepage scenario, while water quality estimates increase relative to Base Case, no exceedances of WQG PAL are predicted.

During operation, water quality in Birch Lake adjacent to the Project site within the PDA (Node 06, Node 07) is below (i.e., better than) WQG PAL for all modelled parameters. Some parameters are shown to change relative to baseline concentrations (Table 6.6-12 and Table 6.6-13) with the greatest increases relative to baseline being observed for nitrate-N, sulphate, antimony, cobalt, selenium and uranium concentrations, though predicted concentrations of these parameters remain well below WQG PAL. In the Upper-case Seepage scenario, while operation water quality estimates increase relative to Base Case, no exceedances of WQG PAL are predicted. Changes to concentrations during operation immediately adjacent to the mine site reflect the highly conservative nature of the water quality model. As discussed in Section 6.6.5.4, water quality predictions were made based on inflows and did not assume dilution and mixing within the full basin. Further, it was assumed that operation water quality predictions are equivalent to the final year of operation (maximum extent), and that there is no delay or attenuation along seepage flow pathways. In contrast, concentrations of water quality parameters in the CDF and seepage are expected to increase over time to these maximum values, coincident with mining of the open pit and expansion of corresponding facilities. The conservative approach aims to avoid the underestimation of potential residual effects on water quality; however, based on model results, measurable changes to baseline water quality for Birch Lake are not expected.

Closure

During active closure and post-closure, the general patterns for water quality predictions in Birch Lake can be attributed to the seasonal water balance and conservative model assumptions related to the mass balance (Section 6.6.5.2). The key mitigation measures to reduce potential effects during active closure include the ongoing operation of the integrated water management system and the water collection ditches, and the reclamation of the CDF at closure.

The Project's water management system will continue to operate in active closure until runoff from the reclaimed mine site, and excess water from the reclaimed open pit basin (see Section 6.7), is of acceptable quality to report directly to the environment. Runoff from the reclaimed mine site and seepage / contact water from the CDF will report to Birch Lake in post-closure. The predicted water quality for assessment node 08 within Birch Lake, downstream of all Project influences, is below (i.e., better than) WQG PAL for all modelled parameters (Table 6.6-14). Assessment nodes within the PDA (Node 06, Node 07) are also below (i.e., better than) WQG PAL water quality guidelines for all modelled parameters. Some post-closure parameters are shown to change relative to baseline concentrations (Table 6.6-12 and Table 6.6-13), with the greatest increases relative to baseline being observed for sulphate, aluminum, antimony and cobalt concentration, though predicted concentrations of these parameters remain well below WQG PAL. In the Upper-case Seepage scenario, while water quality estimates for operations increase relative to Base Case immediately adjacent to the mine site, no exceedances of WQG PAL are predicted.

During all phases, Project activities have the potential to result in the generation and airborne transport of fugitive dust. Principal sources of fugitive dust are identified and discussed in Section 6.2 and include vehicles travelling on unpaved site roads and mining activities such as bulldozing, grading, stockpiling, drilling and blasting. Aerial deposition of Project-generated dust on surface water has the potential to affect surface water quality. With the implementation of the key mitigation measures for dust, the pathway to a potential effect on surface water quality in Birch Lake from dust deposition will be reduced. The effects from atmospheric deposition on water quality are assessed in the Human and Ecological Health Risk Assessment model and determined to be indiscernible from Base Case predictions (Appendix R). As such, potential effects on surface water quality from the dust deposition pathway are not anticipated to result in a residual effect.

Water quality results for Birch Lake were relatively insensitive to other sensitivity cases specific to climatic conditions (Appendix N-2). No additional elevated results above water quality guidelines were identified (Appendix N-2).

6.6.7 Significance of Residual Effects

6.6.7.1 Change in Surface Water Quantity

The residual effect for surface water quantity of the Birch Lake system is a seasonal small decrease in catchment and base flows in the PDA during construction and operation due the development of Project infrastructure and open pit water management (Table 6.6-10). The magnitude is of the residual effect on the surface water quantity of Birch Lake is low (Level I) the development of Project will reduce the catchment area of Birch Lake by approximately 0.4% and the estimated changes to inflows to Birch Lake will not measurably affect water levels or velocities as Birch Lake is outlet controlled. The duration of the residual effect is characterized as moderate (Level II), due to change in the predicted inflows being affected throughout the construction and operation phase. The geographic extent of the residual effect is low (Level I), as it is discrete within the PDA and does not extend beyond the LSA. The frequency of the residual effects is high (Level III) as it will occur on a generally continuous basis through the operation phase. The residual effects are expected to be fully reversible (Level I) with appropriate mitigation measures at closure. The Birch Lake surface water VC is capable of supporting the predicted residual effects, which are localized and minimized with proven mitigation measures, and therefore the ecological and social context is considered low (Level I). As a result, the adverse residual effect on the surface waters of Birch Lake due to a change in surface water quantity is predicted to be not significant.

6.6.7.2 Change in Surface Water Quality

With the implementation of mitigation measures, including seepage capture with perimeter ditching, the residual effect for water quality of the Birch Lake system is a minor increase in concentrations above baseline conditions for some parameters in the PDA with no exceedances of water quality guidelines; the magnitude of the water quality effect is thus characterized as low (Level I). The geographic extent of the residual effect is moderate (Level II), as some parameters are estimated to be greater than baseline conditions at assessment node 08 due to the conservative nature of the mass balance modelling. The duration of the residual effect is high (Level III) as changes relative to baseline extend into post-closure on a seasonal basis for some parameters. The residual effect is predicted to be partially reversible (Level II) during the closure phase, as most parameters return to baseline conditions. The Birch Lake system VC is capable of supporting the predicted residual effects, which are less than WQG PAL, with typical measures, and therefore the ecological and social context is considered low (Level I). As a result, the adverse residual effect on the surface waters of Birch Lake due to a change in surface water quality is predicted to be not significant.

6.6.8 Confidence Prediction

There is high confidence in the results of this residual effects assessment for predicted water quality effects on Birch Lake. Input data used in predictive modelling are of high quality, and the range of existing and projected variability in both the existing regime and the mine-influenced regime are well constrained by model sensitivity cases applied, including water balance modelling (Appendix M-2), surface water quality modelling (Appendix N-2) and hydrogeological numerical modelling (Section 6.5 and Appendix L-2). The predicted effects were determined using well-established models and the conservative approach of the assessment demonstrates that predicted effects on surface water are not underestimated, and with the application of mitigation measures, there will be reliable environmental protection of surface water. Surface water monitoring will be ongoing during construction, operation and closure and will support the validation of the predictions.

6.6.9 References

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Table 6.6-1: Criteria, Indicators and Rationale for Birch Lake

Criteria	Indicators	Rationale
Change in water quantity	• Surface water levels (m amsl) • Catchment area (km^2) • Flow (m^3/s)	The management of contact water can affect the catchment contributing surface water to local waterbodies. Project activities can result in changes in surface runoff, infiltration and subsequently change the water levels and flows in local waterbodies and watercourses.
Change in water quality	• Concentration of total and dissolved metals (mg/L) • Concentration of nutrients and anions (mg/L) • Concentration of cyanide (mg/L)	Discharge of treated effluent from the effluent treatment plant and seepage from the CDF and ore stockpiles can affect receiving water quality.

Table 6.6-2: Significance Determination Attributes and Rankings for Birch Lake

Attribute	Description	Category
Magnitude	A qualitative or quantitative measure to describe the size or degree of the residual effects relative to baseline conditions	**Level I:** Project-related change of surface water quality in receiving waters is consistent with assessment criteria / water quality guidelines; or Project-related change in surface water quantity less than or equal to 15% of seasonal norms. **Level II:** Project-related change in surface water quality in receiving waters is inconsistent with assessment criteria / water quality guidelines but there is no realistic potential to adversely affect aquatic life beyond any defined mixing zone; Project-related change in surface water quantity is greater than 15% of seasonal norms excluding provisions for offsetting and compensation. **Level III:** Project-related change in surface water quality in receiving waters is inconsistent with assessment criteria / water quality guidelines and is likely to result in an unacceptable adverse effect on aquatic life beyond any defined mixing zones; Project-related change in surface water quantity greater than 15% of seasonal norms is likely to result in an unacceptable adverse effect on aquatic life, excluding provisions for offsetting and compensation.
Geographic Extent	The spatial extent over which the residual effect will take place	**Level I:** Effect is restricted to the PDA. **Level II:** Effect is restricted to the LSA. **Level III:** Effect extends beyond and/or into the RSA.
Duration	The time period over which the residual effect will or is expected to occur	**Level I:** Effect occurs over the short term: less than or equal to 3 years. **Level II:** Effect occurs over the medium term: more than 3 years but less than 20 years. **Level III:** Effect occurs over the long term: greater than 20 years.
Frequency	The rate of occurrence of the residual effect	**Level I:** Effect occurs once, infrequently or not at all. **Level II:** Effect occurs intermittently or with a certain degree of regularity. **Level III:** Effect occurs frequently or continuously.
Reversibility	The extent to which the residual effect can be reversed	**Level I:** Effect is fully reversible. **Level II:** Effect is partially reversible or potentially reversible with difficulty. **Level III:** Effect is not reversible.

Table 6.6-3: Annualized Monthly and Annual Flow Statistics for Birch Lake at SW-04

	Pro-Rated Monthly Flows (m^3/s)[1]													Mean Annual Runoff (mm)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	
Mean	4.0	3.4	3.0	4.3	12.4	12.7	9.4	6.8	6.5	6.7	6.5	5.1	6.8	280.1
1st percentile[2]	1.9	1.6	1.4	2.0	5.7	5.9	4.3	3.1	3.0	3.1	3.0	2.3	3.1	155.0
99th percentile[2]	7.0	5.9	5.2	7.5	21.7	22.1	16.3	11.8	11.3	11.6	11.3	8.8	11.8	457.7

Notes:

(1) Watershed area is 762 km^2. Watershed outlet taken at 15U 0542242 5690867.

(2) The percentile monthly values are annualized monthly values, pro-rated using annual flow statistics, not percentile values calculated from individual monthly data.

Table 6.6-4: Estimated Birch Lake Low Flow Indices

Station	Distribution[1]	Birch Lake	
		Catchment = 762 km^2	
7-Day Low Flows [2]		m^3/s	m^3/day
7Q2	Lognormal	1.3	109,697
7Q5	Lognormal	0.8	71,960
7Q10	Log-Pearson Type III	0.7	57,649
7Q20	Log-Pearson Type III	0.5	45,251

Notes:
(1) Results presented for the most conservative distribution selected from Gumbel, Lognormal and Log-Pearson Type III.
(2) Defined as the lowest consecutive 7-day average flow that is expected to occur in 2-year (7Q2), 5-year (7Q5), 10-year (7Q10) or 20-year (7Q20) return periods.

Table 6.6-5: Water Quality Parameters

Nutrients and Anions	Total and Dissolved Metals	
Sulphate	Aluminum (Al)	Molybdenum (Mo)
Phosphorus	Antimony (Sb)	Nickel (Ni)
Nitrate	Arsenic (As)	Strontium
Nitrite	Beryllium (Be)	Selenium (Se)
Ammonia	Boron (B)	Silver (Ag)
Total Cyanide	Cadmium (Cd)	Strontium
	Chromium (Cr)	Uranium (U)
Major Cations	Cobalt (Co)	Thallium
Calcium (Ca)	Copper (Cu)	Tungsten
Magnesium (Mg)	Iron (Fe)	Vanadium (V)
Manganese (Mn)	Lead (Pb)	Zinc (Zn)
Potassium (K)	Mercury (Hg)	Zirconium (Zr)

Table 6.6-6: Water Quality Criteria

Water Quality Parameter	Water Quality Guidelines[(1),(2)]	
	Value	Source
pH	6.5 to 8.5 (s.u.)	PWQOs
Nitrate-N	3.0	CCME
Nitrite-N	0.06	CCME
Ammonia-N	1.8	CCME
Total Cyanide[3]	0.005	PWQOs
Aluminum (Al)	0.83	FEQG
Antimony (Sb)	0.02	PWQOs
Arsenic (As)	0.005	iPWQOs
Beryllium (Be)	0.011	PWQOs
Boron (B)	1.5	CCME
Cadmium (Cd)	0.00053	CCME
Chromium (Cr)	0.0089	CCME
Cobalt (Co)	0.00078	FEQG
Copper (Cu)	0.005	iPWQOs
Iron (Fe)	0.3	PWQOs
Lead (Pb)	0.009	FEQG
Mercury (Hg)	26 (ng/L)	CCME
Methylmercury (MeHg)	4 (ng/L)	CCME
Molybdenum (Mo)	0.073	CCME
Nickel (Ni)	0.025	PWQOs
Phosphorus (P)	0.02	iPWQOs
Selenium (Se)	0.1	PWQOs
Silver (Ag)	0.00025	CCME
Uranium (U)	0.015	CCME
Vanadium (V)	0.12	FEQG
Zinc (Zn)	0.0254	CCME

Notes:

(1) Values are mg/L (unless otherwise indicated).

(2) Equivalent to WQG PAL (long-term exposure). Water quality guidelines represent generic criteria that are inherently conservative as they are developed by governments or international organizations to identify the concentrations of parameters in the receiving environment that are protective of the most sensitive aquatic species for periods of indefinite exposure. As applicable, numerical guideline values summarized here were calculated using the most conservative approach (i.e., 25th percentile Birch Lake baseline values for ameliorating factors, save for zinc, which uses 75th percentile pH for the FEQG calculation).

(3) Water quality guidelines in Ontario are for free cyanide in an unfiltered water sample. To support the effects assessment, have conservatively assumed that free cyanide is equivalent to total cyanide concentrations.

ng/L = nanograms per litre.

Table 6.6-7: Baseline Surface Water Quality, Birch Lake

Parameter	Guideline	Count	Minimum	25th	Average	75th	95th
Hardness (as $CaCO_3$)	-	260	25	27.9	32.7	31.1	31.1
pH (unitless)	6.5 to 8.5	260	6.0	7.4	7.5	7.6	7.6
Total suspended solids	-	260	0.5	1.5	7.7	1.5	1.5
Total dissolved solids	-	260	1.5	37	45	53	53
Acidity (as $CaCO_3$)	-	166	1	1	1.91	2.5	2.5
Alkalinity, total (as $CaCO_3$)	-	261	15	28	35.1	31.6	31.6
Ammonia, total (as N)	2.22	260	0.0025	0.0166	0.204	0.15	0.15
Chloride	128	112	0.16	0.25	0.458	0.5	0.5
Chloride	128	112	0.16	0.25	0.458	0.5	0.5
Nitrate-N	3.0	221	0.01	0.01	0.0444	0.05	0.05
Nitrite-N	0.06	221	0.005	0.005	0.005	0.005	0.005
Nitrate + Nitrite	-	43	0.05	0.05	0.0733	0.05	0.05
Phosphorus, total	0.02	261	0.001	0.0074	0.0123	0.0128	0.0128
Phosphorus-dissolved	-	126	0.0015	0.007	0.0148	0.025	0.025
Sulphate	-	205	0.5	1.01	1.22	1.26	1.26
Dissolved inorganic carbon	-	120	3.9	5.8	7.95	10	10
Dissolved organic carbon	-	193	5.1	8.1	9.77	9.77	9.77
Aluminum (Al)	0.8	260	0.0015	0.0085	0.0155	0.0148	0.0148
Antimony (Sb)	0.02	260	0.00005	0.00005	0.000101	0.00005	0.00005
Arsenic (As)	0.005	253	0.00038	0.00083	0.00105	0.0011	0.0011
Beryllium (Be)	0.011	260	0.00001	0.00001	0.000065	0.00005	0.00005
Cadmium (Cd)	0.0001	259	0.0000025	0.0000025	0.000012	0.000005	0.000005
Cobalt (Co)	0.00078	259	0.00005	0.00005	0.0001	0.00005	0.00005
Copper (Cu)	0.005	253	0.00025	0.00055	0.000716	0.00076	0.00076
Iron (Fe)	1	253	0.005	0.024	0.0642	0.05	0.05
Lead (Pb)	0.009	260	0.000025	0.000025	0.000077	0.000056	0.000056
Mercury (Hg)	0.000026	215	0.0000025	0.0000025	3.55E-06	0.000002	0.000002
Moly. (Mo)	0.073	260	0.000025	0.00008	0.000135	0.000155	0.000155
Nickel (Ni)	0.025	260	0.00025	0.00025	0.000374	0.00025	0.00025
Selenium (Se)	0.1	260	0.000025	0.0000768	0.000255	0.000116	0.000116
Silver (Ag)	0.0001	260	0.000005	0.000005	0.0000157	0.000025	0.000025
Thallium (Tl)	0.00025	260	0.000005	0.000005	0.0000124	0.000005	0.000005
Uranium (U)	0.005	253	0.000005	0.000015	0.0000238	0.000021	0.000021
Vanadium (V)	0.006	260	0.00025	0.00025	0.000272	0.00025	0.00025
Zinc (Zn)	0.02	260	0.0015	0.0015	0.00214	0.0025	0.0025
Zirconium (Zr)	0.004	250	0.00003	0.0001	0.000176	0.0001	0.0001

Notes:
WQG: Water Quality Guideline for the Protection of Aquatic Life (long-term exposure), refer to Table 6.6-6.
All units are mg/L (unless indicated otherwise).
All results are reported as total concentrations (e.g., total metals), unless indicated otherwise.
Results less than the analytical detection limit (DL) were incorporated into summary statistics as half DL (0.5*DL).
Grey shaded values are greater than identified WQG (none).
- = indicates value is not available.

Table 6.6-8: Potential Interactions of Project Components with Birch Lake

Project Component / Activity	Birch Lake System
Construction Phase	
Site preparation activities, including clearing, grubbing and bulk earthworks	Yes
Construction of the mine access road and airstrip, including the development and operation of aggregate resource areas	Yes
Development of temporary construction camp and staging areas	-
Construction of the fish habitat development area	-
Construction of the transmission line to the Project site	-
Construction of the onsite haul and access roads	Yes
Construction of dikes in the north basin of Springpole Lake	-
Construction of buildings and onsite infrastructure	-
Construction of the CWSP	Yes
Controlled dewatering of the open pit basin	Yes
Construction of the starter embankments for the CDF	Yes
Stripping of lake bed sediment and overburden at the open pit	-
Development of the surficial soil stockpile	-
Initiation of pit development in rock	-
Initiation of stockpiling of ore	Yes
Establishment and operation of water management and treatment facilities	Yes
Commissioning of the process plant	-
Employment and expenditures	-
Operation Phase	
Operation of the process plant	Yes
Operation of open pit mine	Yes
Management of overburden, mine rock, tailings and ore in designated facilities	Yes
Operation of water management and treatment facilities	Yes
Accommodations complex operations	Yes
Operation and maintenance of mine site infrastructure	Yes
Progressive reclamation activities	Yes
Employment and expenditures	-
Decommissioning and Closure Phase	
Removal of assets that can be salvaged	-
Demolition and recycling and/or disposal of remaining materials	-
Removal and disposal of demolition-related wastes in approved facilities	-
Reclamation of impacted areas, such as by regrading, placement of cover and revegetation	Yes
Filling the open pit basin with water	-
Monitoring and maintenance	-
Employment and expenditures	-

Note:
- = the interaction is not expected, and no further assessment is warranted.

Table 6.6-9: Proposed Mitigation Measures for Potential Birch Lake Effects

	Phase			
Pathways to Potential Effects / Criteria	**Con.**	**Op.**	**Cl.**	**Proposed Mitigation Measure**
Change in water quantity	•	•	–	Development of a compact mine site to limit the areal extent of disturbance, and to limit the overall areas of site contact water that requires management.
	•	•	–	To reduce freshwater demand from Birch Lake, water recycling measures will be implemented. For example, water collected in the CDF internal pond will be reclaimed and redirected to the plant / mill, minimizing the need for additional freshwater intake from the lake.
	•	•	•	Water collection ditches will be constructed and operated around the perimeter of infrastructure, including the CDF and stockpiles to collect overland flow and seepage and direct it to the integrated water management system. Non-contact water will be diverted away from Project components using ditches, diversion berms and other suitable measures.
Change in water quality	•	•	–	Development of a compact mine site to limit the areal extent of disturbance, and to limit the overall areas of site contact water that requires management.
	•	•	•	Maintain a minimum 120 m setback from Birch Lake to the CDF, the low-grade ore stockpile and the associated seepage collection system.
	•	•	•	Implementation of mitigation measures for potential effects on air quality relevant to dust (Section 6.2), including: ○ During construction, operations and active closure, a dust management plan will be implemented to identify potential sources of fugitive dusts, outline mitigation measures that will be employed to control dust generation and detail the inspection and record keeping required to demonstrate that fugitive dusts are being effectively managed; and ○ Dust emissions from roads and mineral stockpiles will be controlled through the application of water spray and supplemented by dust suppressants, if required; ○ Site roads will be maintained in good condition, with regular inspections and timely maintenance completed to minimize the silt loading on the roads; and ○ Vehicle speeds will be limited.
	•	–	–	Implementation of mitigation measures for potential effects on groundwater relevant to surface water (Section 6.5) including: ○ Locating the CDF on favourable geologic conditions at the Project site to support long-term stability and effective seepage management; and

Table 6.6-9: Proposed Mitigation Measures for Potential Birch Lake Effects

	Phase			
Pathways to Potential Effects / Criteria	**Con.**	**Op.**	**Cl.**	**Proposed Mitigation Measure**
				During construction, a geosynthetic clay liner will be installed on the upstream side of the perimeter embankment of the CDF south cell (specifically the south, west and east sides) to mitigate seepage potential during the operation and closure phases.
	•	•	•	An integrated water management system will be designed to collect and control contact water from the stockpiles, CDF and plant site areas. Collected contact water that is not used in ore processing will be treated at the effluent treatment plant and discharged to the southeast arm of Springpole Lake in accordance with permitting requirements
	•	•	•	An ESC plan will be implemented to manage runoff water around disturbed areas. The ESC plan will be prepared prior to the construction phase with the intent to minimize site erosion and protect surface water from sedimentation. The ESC plan will provide further details on measures to minimize slope length and grade, ditching and diversion berms, contact water management ponds, use of natural vegetation buffers and runoff controls.
	•	•	•	Water collection ditches will be constructed and operated around the perimeter of infrastructure, including the CDF and stockpiles to collect overland flow and seepage and direct it to the integrated water management system. Non-contact water will be diverted away from Project components using ditches, diversion berms and other suitable measures.
	•	•	–	Best management practices (such as following approved blasting plans, and using appropriate drilling, explosive handling and loading procedures) will be implemented for the use of explosives used to reduce the potential presence of blasting residuals in the open pit and on stockpiled mine rock and ore.
	•	•	–	During construction and operation, co-manage and store potentially acid generating (PAG) mine rock and thickened non-acid generating (NAG) tailings in the north cell of the CDF. PAG mine rock will be encapsulated with thickened NAG tailings to isolate it from atmospheric oxygen and mitigate potential acid generation and metal leaching.
	–	•	–	In-plant destruction of cyanide in tailings using the sulphur dioxide / oxygen treatment process to minimize residual cyanide and metals concentrations in the CDF.
	–	•	•	Revegetation and encouragement of natural revegetation / recolonization of disturbed areas will be undertaken as part of progressive and final reclamation to minimize the length of time disturbed areas are exposed, to reduce erosion.

Notes:
Con = construction; Op = operation; Cl = closure; • = mitigation is applicable; – = mitigation is not applicable.

Table 6.6-10: Water Balance Model Predictions, Birch Lake

Assessment Node	Model Case	Project Phase	Water Balance Model Results (m^3/s)														Change in Flow (%)
			January	February	March	April	May	June	July	August	September	October	November	December	Average	Change in Flow (m^3/s)	
Node 6	Base case (average hydrology)	Baseline	0.018	0.015	0.013	0.019	0.056	0.057	0.042	0.030	0.029	0.030	0.029	0.023	0.030	-	
		Construction	0.015	0.013	0.011	0.017	0.050	0.051	0.037	0.027	0.026	0.026	0.025	0.020	0.027	-0.004	-12
		Operation	0.010	0.008	0.0061	0.012	0.045	0.046	0.032	0.022	0.021	0.021	0.020	0.015	0.022	-0.0086	-28
		Active closure (pit filling)	0.013	0.010	0.009	0.014	0.047	0.049	0.035	0.024	0.023	0.024	0.023	0.017	0.024	-0.0059	-20
		Final closure	0.016	0.013	0.011	0.017	0.050	0.051	0.038	0.027	0.026	0.026	0.026	0.020	0.027	-0.0033	-11
	Extreme dry (1:100 year)	Baseline	0.0083	0.0070	0.0061	0.0089	0.026	0.026	0.019	0.014	0.013	0.014	0.013	0.010	0.014	-	
		Construction	0.0066	0.0054	0.0046	0.0071	0.022	0.023	0.017	0.012	0.011	0.012	0.011	0.009	0.012	-0.002	-16
		Operation	0.0015	0.0003	-0.0005	0.0021	0.017	0.018	0.012	0.007	0.0062	0.0065	0.0061	0.0035	0.007	-0.0072	-52
		Active closure (pit filling)	0.0042	0.0030	0.0022	0.0047	0.020	0.021	0.014	0.009	0.009	0.009	0.009	0.006	0.009	-0.0046	-33
		Final closure	0.0068	0.0056	0.0048	0.0073	0.023	0.023	0.017	0.012	0.012	0.012	0.011	0.0087	0.012	-0.0020	-14
	Extreme wet (1:100 year)	Baseline	0.031	0.026	0.023	0.033	0.097	0.099	0.073	0.053	0.051	0.052	0.050	0.039	0.052	-	
		Construction	0.028	0.023	0.020	0.030	0.088	0.090	0.066	0.047	0.045	0.046	0.045	0.035	0.047	-0.01	-10
		Operation	0.023	0.018	0.015	0.025	0.083	0.085	0.061	0.042	0.040	0.041	0.040	0.030	0.042	-0.0104	-20
		Active closure (pit filling)	0.025	0.021	0.018	0.027	0.085	0.087	0.063	0.045	0.043	0.044	0.043	0.033	0.045	-0.0078	-15
		Final closure	0.028	0.023	0.020	0.030	0.088	0.09	0.066	0.048	0.046	0.047	0.045	0.035	0.047	-0.0051	-9.8
Node 7	Base case (average hydrology)	Baseline	0.055	0.046	0.041	0.059	0.17	0.17	0.13	0.093	0.089	0.091	0.089	0.069	0.092	-	
		Construction	0.047	0.040	0.035	0.051	0.15	0.15	0.11	0.080	0.077	0.079	0.076	0.060	0.080	-0.01	-14
		Operation	0.048	0.040	0.035	0.051	0.15	0.15	0.11	0.081	0.077	0.079	0.077	0.060	0.080	-0.012	-13
		Active closure (pit filling)	0.047	0.040	0.035	0.051	0.15	0.15	0.11	0.081	0.077	0.079	0.077	0.060	0.080	-0.012	-13
		Final closure	0.047	0.040	0.035	0.051	0.15	0.15	0.11	0.080	0.077	0.079	0.076	0.060	0.080	-0.013	-14
	Extreme dry (1:100 year)	Baseline	0.025	0.021	0.019	0.027	0.079	0.080	0.059	0.043	0.041	0.042	0.041	0.032	0.043	-	
		Construction	0.021	0.018	0.016	0.023	0.068	0.069	0.051	0.037	0.035	0.036	0.035	0.027	0.036	-0.01	-15
		Operation	0.022	0.018	0.016	0.023	0.068	0.070	0.051	0.037	0.035	0.036	0.035	0.027	0.037	-0.0060	-14
		Active closure (pit filling)	0.022	0.018	0.016	0.023	0.068	0.069	0.051	0.037	0.035	0.036	0.035	0.027	0.037	-0.0061	-14
		Final closure	0.021	0.018	0.016	0.023	0.068	0.069	0.051	0.037	0.035	0.036	0.035	0.027	0.036	-0.0062	-15
	Extreme wet (1:100 year)	Baseline	0.096	0.081	0.071	0.10	0.30	0.30	0.22	0.16	0.16	0.16	0.15	0.12	0.16	-	
		Construction	0.083	0.070	0.061	0.089	0.26	0.26	0.19	0.14	0.13	0.14	0.13	0.10	0.14	-0.02	-13
		Operation	0.083	0.070	0.061	0.089	0.26	0.26	0.19	0.14	0.13	0.14	0.13	0.10	0.14	-0.021	-13
		Active closure (pit filling)	0.083	0.070	0.061	0.089	0.26	0.26	0.19	0.14	0.13	0.14	0.13	0.10	0.14	-0.021	-13
		Final closure	0.083	0.070	0.061	0.089	0.26	0.26	0.19	0.14	0.13	0.14	0.13	0.10	0.14	-0.021	-13
Node 8	Base case (average hydrology)	Baseline	4.0	3.4	3.0	4.3	12	13	9.4	6.8	6.5	6.7	6.5	5.1	6.8	-	
		Construction	4.0	3.4	3.0	4.3	12	13	9.3	6.8	6.5	6.6	6.4	5.0	6.7	-0.031	-0.46
		Operation	3.9	3.2	2.8	4.2	12	13	9.3	6.7	6.4	6.6	6.4	5.0	6.6	-0.102	-1.5
		Active closure (pit filling)	4.0	3.4	3.0	4.3	12	13	9.3	6.8	6.5	6.6	6.4	5.0	6.7	-0.033	-0.49
		Final closure	6.9	5.8	5.1	7.5	22	22	16	12	11	12	11	8.7	12	0.0044	0.038
	Extreme dry (1:100 year)	Baseline	1.9	1.6	1.4	2.0	5.7	5.9	4.3	3.1	3.0	3.1	3.0	2.3	3.1	-	
		Construction	1.8	1.6	1.4	2.0	5.7	5.8	4.3	3.1	3.0	3.1	3.0	2.3	3.1	-0.017	-0.53
		Operation	1.7	1.4	1.2	1.9	5.7	5.8	4.2	3.0	2.9	2.9	2.8	2.1	3.0	-0.15	-4.7
		Active closure (pit filling)	1.8	1.6	1.4	2.0	5.7	5.8	4.3	3.1	3.0	3.1	3.0	2.3	3.1	-0.019	-0.60
		Final closure	3.2	2.7	2.4	3.5	10	10	7.5	5.4	5.2	5.3	5.2	4.0	5.4	-0.0040	-0.073
	Extreme wet (1:100 year)	Baseline	7.0	5.9	5.2	7.5	22	22	16	12	11	12	11	8.8	12	-	
		Construction	7.0	5.9	5.2	7.5	22	22	16	12	11	12	11	8.8	12	-0.051	-0.43
		Operation	6.9	5.7	5.0	7.4	22	22	16	12	11	12	11	8.7	12	-0.12	-0.99
		Active closure (pit filling)	7.0	5.9	5.2	7.5	22	22	16	12	11	12	11	8.8	12	-0.053	-0.45
		Final closure	12	10	8.9	13	38	38	28	21	20	20	19	15	20	0.0051	0.025

Notes:

For each Assessment Node on Birch Lake, water balance model results (flows; m^3/s) are compared to flows observed during baseline studies to quantify the change in flow by Project phase.

Represents the period when open pit mining has ceases and the open bit basin is being actively filled from water takings from the north basin of Springpole Lake.

Blue highlighted rows represent the baseline flow condition.

Grey highlighted values are greater than 15% change in flow (ΔQ) relative to baseline conditions.

Table 6.6-11: Predicted CDF Seepage Water Quality

Parameter	Seepage Quality Operation(1)		Seepage Quality Active Closure		Seepage Quality Final Closure(2)	
	Base Case	Conservative Case	Base Case	Conservative Case	Base Case	Conservative Case
Sulphate	2200	2200	2200	2200	27	111
Aluminum	0.637	0.82	0.637	0.82	0.58	0.97
Antimony	0.553	0.551	0.553	0.551	0.012	0.021
Arsenic	0.0000236	0.0000507	0.00002	0.00005	0.0121	0.0203
Beryllium	0.0000000174	0.0000000231	0.0000000174	0.0000000231	0.00000768	0.0000221
Boron	0.325	0.354	0.325	0.354	0.035	0.098
Cadmium	0.000109	0.000275	0.000109	0.000275	0.0000277	0.00207
Chromium	0.00432	0.00695	0.00432	0.00695	0.0051	0.0057
Cobalt	0.0569	0.0666	0.0569	0.0666	0.000696	0.0397
Copper	0.000765	0.000811	0.000765	0.000811	0.00264	0.00316
Iron	0.0000479	0.0000444	0.0000479	0.0000444	0.000044	0.00005
Lead	0.000000435	0.000000492	0.000000435	0.000000492	0.00018	0.000162
Mercury	0.000138	0.000149	0.000138	0.000149	0.0000489	0.0000568
Molybdenum	0.03	0.03	0.03	0.03	0.0045	0.071
Nickel	0.00378	0.00418	0.00378	0.00418	0.00295	0.0205
Phosphorus	0.00535	0.013	0.00535	0.013	0.16	0.398
Selenium	0.0358	0.038	0.0358	0.038	0.0012	0.0041
Silver	0.000523	0.000675	0.000523	0.000675	0.00013	0.00056
Thallium	0.00442	0.00472	0.00442	0.00472	0.00016	0.00042
Tungsten	0.03	0.03	0.03	0.03	0.00239	0.00367
Uranium	0.0932	0.0937	0.0932	0.0937	0.0022	0.0028
Vanadium	0.00000272	0.00000474	0.00000272	0.00000474	0.00927	0.00969
Zinc	0.00281	0.00434	0.00281	0.00434	0.0104	0.0435

Notes:

All units are mg/L.

(1) Operation seepage predictions represent average and maximum monthly concentrations for Year 10 of mining (maximum extent of mine operations).

(2) Final closure represents the future condition where residual pore water has been completely released from the tailings pile, and the only loading sources are the covered tailings and mine rock.

Table 6.6-12: Water Quality Model Results, Node 06

Project Phase	Month	Parameter: Ammonia-N	Nitrate-N	Nitrite-N	Total Cyanide	Aluminum	Antimony	Arsenic	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tungsten	Uranium	Vanadium	Zinc
	WQG PAL	1.8	3	0.02	0.005	0.83	0.020	0.005	0.01100	1.50	0.0001	0.001	0.00078	0.005	0.3	0.00906	0.000026	0.073	0.025	0.1	0.00025	0.0008	0.03000	0.005	0.12	0.011
Existing Condition	January	0.014	0.050	0.0050	0.001	0.009	0.0001	0.0011	0.00005	0.005	0.000002	0.0003	0.00005	0.00068	0.035	0.000025	0.0000025	0.00025	0.00050	0.0010	0.000050	0.000050	0.00005	0.00005	0.0003	0.002
	February	0.014	0.050	0.0050	0.001	0.009	0.0001	0.0011	0.00005	0.005	0.000002	0.0003	0.00005	0.00068	0.035	0.000025	0.0000025	0.00025	0.00050	0.0010	0.000050	0.000050	0.00005	0.00005	0.0003	0.002
	March	0.014	0.050	0.0050	0.001	0.009	0.0001	0.0011	0.00005	0.005	0.000002	0.0003	0.00005	0.00068	0.035	0.000025	0.0000025	0.00025	0.00050	0.0010	0.000050	0.000050	0.00005	0.00005	0.0003	0.002
	April	0.110	0.010	0.0050	0.001	0.016	0.0001	0.0008	0.00005	0.005	0.000010	0.0002	0.00005	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	May	0.110	0.010	0.0050	0.001	0.016	0.0001	0.0008	0.00005	0.005	0.000010	0.0002	0.00005	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	June	0.110	0.010	0.0050	0.001	0.016	0.0001	0.0008	0.00005	0.005	0.000010	0.0002	0.00005	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	July	0.023	0.010	0.0050	0.001	0.012	0.0001	0.0010	0.00005	0.005	0.000002	0.0003	0.00005	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	August	0.023	0.010	0.0050	0.001	0.012	0.0001	0.0010	0.00005	0.005	0.000002	0.0003	0.00005	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	September	0.023	0.010	0.0050	0.001	0.012	0.0001	0.0010	0.00005	0.005	0.000002	0.0003	0.00005	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	October	0.104	0.010	0.0050	0.001	0.011	0.0001	0.0012	0.00001	0.005	0.000002	0.0002	0.00005	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	November	0.104	0.010	0.0050	0.001	0.011	0.0001	0.0012	0.00001	0.005	0.000002	0.0002	0.00005	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	December	0.104	0.010	0.0050	0.001	0.011	0.0001	0.0012	0.00001	0.005	0.000002	0.0002	0.00005	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
Construction	January	0.014	0.050	0.0050	0.001	0.009	0.0001	0.0011	0.00005	0.005	0.000002	0.0003	0.00005	0.00068	0.035	0.000025	0.0000025	0.00025	0.00050	0.0010	0.000050	0.000050	0.00005	0.00005	0.0003	0.002
	February	0.014	0.050	0.0050	0.001	0.009	0.0001	0.0011	0.00005	0.005	0.000002	0.0003	0.00005	0.00068	0.035	0.000025	0.0000025	0.00025	0.00050	0.0010	0.000050	0.000050	0.00005	0.00005	0.0003	0.002
	March	0.014	0.050	0.0050	0.001	0.009	0.0001	0.0011	0.00005	0.005	0.000002	0.0003	0.00005	0.00068	0.035	0.000025	0.0000025	0.00025	0.00050	0.0010	0.000050	0.000050	0.00005	0.00005	0.0003	0.002
	April	0.110	0.010	0.0050	0.001	0.016	0.0001	0.0008	0.00005	0.005	0.000010	0.0002	0.00005	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	May	0.110	0.010	0.0050	0.001	0.016	0.0001	0.0008	0.00005	0.005	0.000010	0.0002	0.00005	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	June	0.110	0.010	0.0050	0.001	0.016	0.0001	0.0008	0.00005	0.005	0.000010	0.0002	0.00005	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	July	0.023	0.010	0.0050	0.001	0.012	0.0001	0.0010	0.00005	0.005	0.000002	0.0003	0.00005	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	August	0.023	0.010	0.0050	0.001	0.012	0.0001	0.0010	0.00005	0.005	0.000002	0.0003	0.00005	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	September	0.023	0.010	0.0050	0.001	0.012	0.0001	0.0010	0.00005	0.005	0.000002	0.0003	0.00005	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	October	0.104	0.010	0.0050	0.001	0.011	0.0001	0.0012	0.00001	0.005	0.000002	0.0002	0.00005	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	November	0.104	0.010	0.0050	0.001	0.011	0.0001	0.0012	0.00001	0.005	0.000002	0.0002	0.00005	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
	December	0.104	0.010	0.0050	0.001	0.011	0.0001	0.0012	0.00001	0.005	0.000002	0.0002	0.00005	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000050	0.00005	0.00002	0.0003	0.002
Operations	January	0.016	0.093	0.0051	0.001	0.010	0.0010	0.0011	0.00005	0.006	0.000003	0.0003	0.00014	0.00068	0.035	0.000025	0.0000027	0.00030	0.00051	0.0011	0.000051	0.000032	0.00010	0.00021	0.0002	0.002
	February	0.016	0.106	0.0051	0.001	0.010	0.0012	0.0011	0.00005	0.006	0.000003	0.0003	0.00017	0.00068	0.035	0.000025	0.0000028	0.00031	0.00051	0.0011	0.000051	0.000034	0.00011	0.00025	0.0002	0.002
	March	0.017	0.117	0.0051	0.001	0.011	0.0015	0.0011	0.00005	0.006	0.000003	0.0003	0.00020	0.00068	0.035	0.000025	0.0000029	0.00033	0.00051	0.0011	0.000051	0.000036	0.00013	0.00029	0.0002	0.002
	April	0.113	0.087	0.0052	0.001	0.017	0.0017	0.0008	0.00005	0.006	0.000010	0.0002	0.00022	0.00100	0.050	0.000025	0.0000029	0.00019	0.00051	0.0002	0.000007	0.000038	0.00014	0.00029	0.0002	0.002
	May	0.112	0.062	0.0051	0.001	0.017	0.0011	0.0008	0.00005	0.006	0.000010	0.0002	0.00016	0.00100	0.050	0.000025	0.0000028	0.00016	0.00051	0.0002	0.000006	0.000034	0.00011	0.00020	0.0002	0.002
	June	0.112	0.064	0.0051	0.001	0.017	0.0012	0.0008	0.00005	0.006	0.000010	0.0002	0.00017	0.00100	0.050	0.000025	0.0000028	0.00016	0.00051	0.0002	0.000006	0.000034	0.00011	0.00021	0.0002	0.002
	July	0.025	0.063	0.0051	0.001	0.013	0.0012	0.0010	0.00005	0.006	0.000003	0.0003	0.00016	0.00065	0.037	0.000025	0.0000028	0.00017	0.00026	0.0002	0.000006	0.000014	0.00011	0.00021	0.0002	0.002
	August	0.026	0.083	0.0052	0.001	0.014	0.0016	0.0010	0.00005	0.006	0.000003	0.0003	0.00021	0.00065	0.037	0.000025	0.0000029	0.00019	0.00026	0.0002	0.000006	0.000017	0.00013	0.00028	0.0002	0.002
	September	0.026	0.077	0.0051	0.001	0.014	0.0015	0.0010	0.00005	0.006	0.000003	0.0003	0.00020	0.00065	0.037	0.000025	0.0000028	0.00018	0.00026	0.0002	0.000006	0.000016	0.00013	0.00026	0.0002	0.002
	October	0.106	0.080	0.0051	0.001	0.013	0.0015	0.0012	0.00001	0.006	0.000003	0.0002	0.00020	0.00063	0.038	0.000025	0.0000029	0.00017	0.00026	0.0002	0.000006	0.000017	0.00013	0.00027	0.0002	0.002
	November	0.106	0.078	0.0051	0.001	0.013	0.0015	0.0012	0.00001	0.006	0.000003	0.0002	0.00020	0.00063	0.038	0.000025	0.0000029	0.00017	0.00026	0.0002	0.000006	0.000017	0.00013	0.00026	0.0002	0.002
	December	0.105	0.043	0.0051	0.001	0.012	0.0008	0.0012	0.00001	0.005	0.000003	0.0002	0.00012	0.00063	0.038	0.000025	0.0000027	0.00013	0.00025	0.0001	0.000006	0.000011	0.00009	0.00014	0.0002	0.002
Active Closure	January	0.017	0.051	0.0050	0.001	0.011	0.0021	0.0011	0.00005	0.006	0.000003	0.0003	0.00026	0.00068	0.035	0.000025	0.0000030	0.00036	0.00051	0.0011	0.000052	0.000041	0.00016	0.00040	0.0002	0.002
	February	0.018	0.051	0.0050	0.001	0.012	0.0026	0.0011	0.00005	0.007	0.000003	0.0003	0.00032	0.00068	0.035	0.000025	0.0000031	0.00039	0.00052	0.0012	0.000052	0.000046	0.00019	0.00049	0.0002	0.002
	March	0.019	0.052	0.0050	0.001	0.012	0.0031	0.0011	0.00005	0.007	0.000003	0.0003	0.00037	0.00068	0.035	0.000025	0.0000033	0.00042	0.00052	0.0012	0.000053	0.000050	0.00022	0.00057	0.0002	0.002
	April	0.115	0.012	0.0050	0.001	0.020	0.0036	0.0008	0.00005	0.007	0.000011	0.0002	0.00041	0.00100	0.050	0.000025	0.0000034	0.00029	0.00052	0.0003	0.000008	0.000053	0.00024	0.00061	0.0002	0.002
	May	0.113	0.012	0.0050	0.001	0.018	0.0025	0.0008	0.00005	0.006	0.000010	0.0002	0.00030	0.00100	0.050	0.000025	0.0000031	0.00023	0.00051	0.0003	0.000007	0.000044	0.00018	0.00043	0.0002	0.002
	June	0.113	0.012	0.0050	0.001	0.018	0.0026	0.0008	0.00005	0.006	0.000010	0.0002	0.00031	0.00100	0.050	0.000025	0.0000031	0.00024	0.00051	0.0003	0.000007	0.000045	0.00019	0.00044	0.0002	0.002
	July	0.027	0.012	0.0050	0.001	0.015	0.0025	0.0010	0.00005	0.006	0.000003	0.0003	0.00030	0.00065	0.037	0.000025	0.0000031	0.00024	0.00027	0.0003	0.000007	0.000025	0.00018	0.00043	0.0002	0.002
	August	0.028	0.012	0.0050	0.001	0.016	0.0034	0.0010	0.00005	0.007	0.000003	0.0003	0.00039	0.00065	0.037	0.000025	0.0000033	0.00029	0.00027	0.0003	0.000008	0.000032	0.00023	0.00058	0.0002	0.002
	September	0.028	0.012	0.0050	0.001	0.015	0.0031	0.0010	0.00005	0.007	0.000003	0.0003	0.00037	0.00065	0.037	0.000025	0.0000033	0.00027	0.00027	0.0003	0.000008	0.000030	0.00022	0.00054	0.0002	0.002
	October	0.108	0.012	0.0050	0.001	0.015	0.0033	0.0012	0.00001	0.007	0.000003	0.0002	0.00038	0.00063	0.038	0.000025	0.0000033	0.00027	0.00027	0.0003	0.000008	0.000031	0.00022	0.00056	0.0002	0.002
	November	0.108	0.012	0.0050	0.001	0.015	0.0032	0.0012	0.00001	0.007	0.000003	0.0002	0.00037	0.00063	0.038	0.000025	0.0000033	0.00026	0.00027	0.0003	0.000008	0.000030	0.00022	0.00055	0.0002	0.002
	December	0.106	0.011	0.0050	0.001	0.013	0.0017	0.0012	0.00001	0.006	0.000003	0.0002	0.00022	0.00063	0.038	0.000025	0.0000029	0.00018	0.00026	0.0002	0.000007	0.000018	0.00014	0.00029	0.0002	0.002

Table 6.6-12: Water Quality Model Results, Node 06

Project Phase	Month	Parameter	Ammonia-N	Nitrate-N	Nitrite-N	Total Cyanide	Aluminum	Antimony	Arsenic	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tungsten	Uranium	Vanadium	Zinc
		WQG PAL	1.8	3	0.02	0.005	0.83	0.020	0.005	0.01100	1.50	0.0001	0.001	0.00078	0.005	0.3	0.00906	0.000026	0.073	0.025	0.1	0.00025	0.0008	0.03000	0.005	0.12	0.011
Post Closure	January		**0.119**	**0.090**	0.0056	**0.002**	**0.056**	**0.0010**	**0.0020**	0.00005	**0.008**	**0.000005**	**0.0006**	**0.00011**	**0.00084**	0.031	**0.000039**	**0.0000064**	**0.00059**	**0.00070**	0.0010	0.000055	0.000035	**0.00024**	**0.00023**	**0.0010**	0.002
	February		**0.140**	**0.098**	**0.0058**	**0.002**	**0.065**	**0.0012**	**0.0022**	0.00004	**0.008**	**0.000005**	**0.0007**	**0.00012**	**0.00087**	0.030	**0.000042**	**0.0000072**	**0.00066**	**0.00074**	0.0010	0.000056	0.000038	**0.00028**	**0.00026**	**0.0012**	0.002
	March		**0.158**	**0.105**	**0.0059**	**0.003**	**0.073**	**0.0014**	**0.0023**	0.00004	**0.009**	**0.000006**	**0.0008**	**0.00013**	**0.00090**	0.030	**0.000044**	**0.0000079**	**0.00072**	**0.00078**	0.0010	0.000057	0.000039	**0.00032**	**0.00029**	**0.0013**	0.002
	April		**0.250**	**0.078**	**0.0060**	**0.003**	**0.085**	**0.0015**	**0.0022**	0.00004	**0.009**	**0.000012**	**0.0008**	**0.00013**	**0.00118**	0.041	**0.000046**	**0.0000084**	**0.00065**	**0.00080**	**0.0002**	**0.000021**	0.000041	**0.00034**	**0.00029**	**0.0014**	**0.003**
	May		**0.216**	**0.061**	0.0057	**0.002**	**0.068**	**0.0012**	**0.0018**	0.00004	**0.008**	0.000011	**0.0007**	**0.00011**	0.00113	0.043	**0.000041**	**0.0000070**	**0.00051**	**0.00073**	**0.0002**	**0.000017**	0.000037	**0.00027**	**0.00022**	**0.0011**	0.002
	June		**0.219**	**0.063**	0.0057	**0.002**	**0.070**	**0.0012**	**0.0019**	0.00004	**0.008**	0.000011	**0.0007**	**0.00012**	0.00114	0.043	**0.000041**	**0.0000071**	**0.00053**	**0.00074**	**0.0002**	**0.000017**	0.000037	**0.00028**	**0.00023**	**0.0011**	0.002
	July		**0.143**	**0.062**	0.0057	**0.002**	**0.065**	**0.0012**	**0.0020**	0.00004	**0.008**	**0.000005**	**0.0007**	**0.00011**	**0.00084**	0.033	**0.000041**	**0.0000070**	**0.00052**	**0.00052**	**0.0002**	**0.000017**	0.000020	**0.00027**	**0.00023**	**0.0011**	0.002
	August		**0.175**	**0.075**	**0.0059**	**0.003**	**0.080**	**0.0015**	**0.0023**	0.00004	**0.009**	**0.000006**	**0.0008**	**0.00013**	**0.00089**	0.031	**0.000045**	**0.0000082**	**0.00063**	**0.00059**	**0.0002**	**0.000020**	0.000024	**0.00033**	**0.00028**	**0.0013**	**0.003**
	September		**0.166**	**0.071**	**0.0059**	**0.003**	**0.075**	**0.0014**	**0.0022**	0.00004	**0.009**	**0.000005**	**0.0008**	**0.00013**	**0.00087**	0.032	**0.000044**	**0.0000079**	**0.00060**	**0.00057**	**0.0002**	**0.000019**	0.000023	**0.00032**	**0.00026**	**0.0013**	0.002
	October		**0.236**	**0.073**	**0.0059**	**0.003**	**0.077**	**0.0014**	**0.0024**	0.00001	**0.009**	**0.000006**	**0.0008**	**0.00013**	**0.00086**	0.032	**0.000045**	**0.0000081**	**0.00060**	**0.00058**	**0.0002**	**0.000020**	0.000023	**0.00032**	**0.00027**	**0.0013**	**0.003**
	November		**0.234**	**0.072**	**0.0059**	**0.003**	**0.076**	**0.0014**	**0.0024**	0.00001	**0.009**	**0.000006**	**0.0008**	**0.00013**	**0.00086**	0.032	**0.000044**	**0.0000080**	**0.00060**	**0.00057**	**0.0002**	**0.000020**	0.000023	**0.00032**	**0.00027**	**0.0013**	0.002
	December		**0.180**	**0.047**	0.0055	**0.002**	**0.049**	**0.0009**	**0.0019**	0.00001	**0.007**	**0.000004**	**0.0005**	**0.00010**	**0.00076**	0.034	**0.000036**	**0.0000057**	**0.00039**	**0.00044**	**0.0002**	**0.000014**	0.000016	**0.00021**	**0.00016**	**0.0009**	0.002

Notes:
All units are mg/L.
Water quality model results presented in this table are Base Case (Expected Case); results of model sensitivity cases are presented in Appendix N-2.
WQG PAL: Water Quality Guideline for the Protection of Aquatic Life (long-term exposure) identified in Table 6.6-3.
As applicable, numerical guideline values were calculated using the most conservative approach (i.e., 25th percentile baseline values for ameliorating factors, save for zinc, which uses 75th percentile pH for the FEQG calculation). For Birch Lake, these data were as follows:

	25th	75th
pH	7.4	7.6
Hardness (mg/L)	28	
DOC (mg/L)	8.1	
Chloride (mg/L)	0.25	
Alkalinity (mg/L)	28	

Only model results for parameters with WQG PAL are summarized here; results for all modelled parameters are presented in Appendix N-2.
Grey shaded values are greater than water quality guidelines (none).
Bolded purple values are estimated to be measurably different than existing conditions (15% or greater change relative to baseline conditions).

Table 6.6-13: Water Quality Model Results, Node 07

Project Phase	Month	Ammonia-N	Nitrate-N	Nitrite-N	Total Cyanide	Aluminum	Antimony	Arsenic	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tungsten	Uranium	Vanadium	Zinc
	WQG PAL	**1.8**	**3**	**0.02**	**0.005**	**0.83**	**0.020**	**0.005**	**0.011**	**1.50**	**0.0001**	**0.001**	**0.00078**	**0.005**	**0.3**	**0.00906**	**0.000026**	**0.073**	**0.025**	**0.1**	**0.00025**	**0.0008**	**0.0300**	**0.005**	**0.12**	**0.011**
Existing Condition	**January**	0.014	0.048	0.005	0.001	0.006	0.0001	0.0012	0.000050	0.005	0.000003	0.0002	0.00005	0.0008	0.016	0.000025	0.0000025	0.00017	0.00025	0.0001	0.000025	0.00001	0.0001	0.00002	0.0003	0.002
	February	0.014	0.048	0.005	0.001	0.006	0.0001	0.0012	0.000050	0.005	0.000003	0.0002	0.00005	0.0008	0.016	0.000025	0.0000025	0.00017	0.00025	0.0001	0.000025	0.00001	0.0001	0.00002	0.0003	0.002
	March	0.014	0.048	0.005	0.001	0.006	0.0001	0.0012	0.000050	0.005	0.000003	0.0002	0.00005	0.0008	0.016	0.000025	0.0000025	0.00017	0.00025	0.0001	0.000025	0.00001	0.0001	0.00002	0.0003	0.002
	April	0.051	0.010	0.005	0.001	0.011	0.0001	0.0009	0.000050	0.005	0.000003	0.0002	0.00005	0.0005	0.036	0.000025	0.0000025	0.00025	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	May	0.051	0.010	0.005	0.001	0.011	0.0001	0.0009	0.000050	0.005	0.000003	0.0002	0.00005	0.0005	0.036	0.000025	0.0000025	0.00025	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	June	0.051	0.010	0.005	0.001	0.011	0.0001	0.0009	0.000050	0.005	0.000003	0.0002	0.00005	0.0005	0.036	0.000025	0.0000025	0.00025	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	July	0.130	0.010	0.005	0.001	0.011	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0007	0.027	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	August	0.130	0.010	0.005	0.001	0.011	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0007	0.027	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	September	0.130	0.010	0.005	0.001	0.011	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0007	0.027	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	October	0.120	0.010	0.005	0.001	0.012	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0006	0.055	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	November	0.120	0.010	0.005	0.001	0.012	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0006	0.055	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	December	0.120	0.010	0.005	0.001	0.012	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0006	0.055	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
Construction	**January**	0.014	0.048	0.005	0.001	0.006	0.0001	0.0012	0.000050	0.005	0.000003	0.0002	0.00005	0.0008	0.016	0.000025	0.0000025	0.00017	0.00025	0.0001	0.000025	0.00001	0.0001	0.00002	0.0003	0.002
	February	0.014	0.048	0.005	0.001	0.006	0.0001	0.0012	0.000050	0.005	0.000003	0.0002	0.00005	0.0008	0.016	0.000025	0.0000025	0.00017	0.00025	0.0001	0.000025	0.00001	0.0001	0.00002	0.0003	0.002
	March	0.014	0.048	0.005	0.001	0.006	0.0001	0.0012	0.000050	0.005	0.000003	0.0002	0.00005	0.0008	0.016	0.000025	0.0000025	0.00017	0.00025	0.0001	0.000025	0.00001	0.0001	0.00002	0.0003	0.002
	April	0.051	0.010	0.005	0.001	0.011	0.0001	0.0009	0.000050	0.005	0.000003	0.0002	0.00005	0.0005	0.036	0.000025	0.0000025	0.00025	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	May	0.051	0.010	0.005	0.001	0.011	0.0001	0.0009	0.000050	0.005	0.000003	0.0002	0.00005	0.0005	0.036	0.000025	0.0000025	0.00025	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	June	0.051	0.010	0.005	0.001	0.011	0.0001	0.0009	0.000050	0.005	0.000003	0.0002	0.00005	0.0005	0.036	0.000025	0.0000025	0.00025	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	July	0.130	0.010	0.005	0.001	0.011	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0007	0.027	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	August	0.130	0.010	0.005	0.001	0.011	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0007	0.027	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	September	0.130	0.010	0.005	0.001	0.011	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0007	0.027	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	October	0.120	0.010	0.005	0.001	0.012	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0006	0.055	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	November	0.120	0.010	0.005	0.001	0.012	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0006	0.055	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
	December	0.120	0.010	0.005	0.001	0.012	0.0001	0.0010	0.000050	0.005	0.000003	0.0002	0.00005	0.0006	0.055	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.00001	0.0001	0.00002	0.0003	0.002
Operations	**January**	**0.019**	**0.171**	0.005	**0.002**	**0.009**	**0.0027**	0.0012	0.000050	**0.007**	0.000003	0.0002	**0.00032**	0.0008	0.016	0.000025	**0.0000031**	**0.00032**	0.00027	**0.0003**	0.000027	**0.00003**	**0.0002**	**0.00046**	0.0002	0.002
	February	**0.020**	**0.202**	0.005	**0.002**	**0.010**	**0.0033**	0.0012	0.000050	**0.007**	0.000003	0.0002	**0.00039**	0.0008	0.016	0.000025	**0.0000033**	**0.00035**	0.00027	**0.0003**	0.000028	**0.00003**	**0.0002**	**0.00057**	0.0002	0.002
	March	**0.021**	**0.230**	0.005	**0.002**	**0.011**	**0.0039**	0.0012	0.000050	**0.007**	0.000003	0.0002	**0.00045**	0.0008	0.016	0.000025	**0.0000035**	**0.00038**	0.00027	**0.0004**	**0.000028**	**0.00004**	**0.0003**	**0.00068**	0.0002	0.002
	April	**0.058**	**0.217**	0.005	**0.002**	**0.016**	**0.0045**	0.0009	0.000050	**0.008**	0.000003	0.0002	**0.00050**	0.0005	0.036	0.000025	**0.0000036**	**0.00049**	0.00028	**0.0004**	**0.000009**	**0.00004**	**0.0003**	**0.00077**	0.0002	0.002
	May	0.056	**0.154**	0.005	**0.002**	**0.014**	**0.0031**	0.0009	0.000050	**0.007**	0.000003	0.0002	**0.00036**	0.0005	0.036	0.000025	**0.0000032**	**0.00041**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00054**	0.0002	0.002
	June	0.056	**0.160**	0.005	**0.002**	**0.014**	**0.0032**	0.0009	0.000050	**0.007**	0.000003	0.0002	**0.00038**	0.0005	0.036	0.000025	**0.0000033**	**0.00042**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00056**	0.0002	0.002
	July	0.135	**0.156**	0.005	**0.002**	**0.014**	**0.0032**	0.0010	0.000030	**0.007**	0.000003	0.0002	**0.00037**	0.0007	0.027	0.000025	**0.0000033**	**0.00027**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00054**	0.0002	0.002
	August	0.137	**0.207**	0.005	**0.002**	**0.016**	**0.0043**	0.0010	0.000030	**0.007**	0.000003	0.0002	**0.00048**	0.0007	0.027	0.000025	**0.0000035**	**0.00033**	0.00028	**0.0004**	**0.000009**	**0.00004**	**0.0003**	**0.00073**	0.0002	0.002
	September	0.136	**0.192**	0.005	**0.002**	**0.015**	**0.0039**	0.0010	0.000030	**0.007**	0.000003	0.0002	**0.00045**	0.0007	0.027	0.000025	**0.0000034**	**0.00031**	0.00027	**0.0003**	**0.000009**	**0.00004**	**0.0003**	**0.00067**	0.0002	0.002
	October	0.126	**0.199**	0.005	**0.002**	**0.017**	**0.0041**	0.0010	0.000010	**0.007**	0.000003	0.0002	**0.00046**	0.0006	0.055	0.000025	**0.0000035**	**0.00031**	0.00028	**0.0003**	**0.000009**	**0.00004**	**0.0003**	**0.00070**	0.0002	0.002
	November	0.126	**0.195**	0.005	**0.002**	**0.017**	**0.0040**	0.0010	0.000010	**0.007**	0.000003	0.0002	**0.00046**	0.0006	0.055	0.000025	**0.0000035**	**0.00030**	0.00028	**0.0003**	**0.000009**	**0.00004**	**0.0003**	**0.00068**	0.0002	0.002
	December	0.123	**0.106**	0.005	**0.002**	**0.015**	**0.0021**	0.0010	0.000010	**0.006**	0.000003	0.0002	**0.00026**	0.0006	0.055	0.000025	**0.0000030**	**0.00020**	0.00026	**0.0002**	**0.000007**	**0.00002**	**0.0002**	**0.00036**	0.0002	0.002
Active Closure	**January**	**0.017**	0.049	0.005	0.001	**0.009**	**0.0020**	0.0012	0.000050	**0.006**	0.000003	0.0002	**0.00025**	0.0008	0.016	0.000025	**0.0000030**	**0.00028**	0.00026	**0.0002**	0.000027	**0.00002**	**0.0002**	**0.00036**	0.0002	0.002
	February	**0.018**	0.049	0.005	0.001	**0.009**	**0.0025**	0.0012	0.000050	**0.006**	0.000003	0.0002	**0.00031**	0.0008	0.016	0.000025	**0.0000031**	**0.00031**	0.00027	**0.0003**	0.000027	**0.00002**	**0.0002**	**0.00044**	0.0002	0.002
	March	**0.019**	0.050	0.005	0.001	**0.010**	**0.0030**	0.0012	0.000050	**0.007**	0.000003	0.0002	**0.00035**	0.0008	0.016	0.000025	**0.0000032**	**0.00033**	0.00027	**0.0003**	0.000028	**0.00003**	**0.0002**	**0.00052**	0.0002	0.002
	April	0.056	**0.012**	0.005	0.001	**0.015**	**0.0034**	0.0009	0.000050	**0.007**	0.000003	0.0002	**0.00039**	0.0005	0.036	0.000025	**0.0000033**	**0.00043**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00059**	0.0002	0.002
	May	0.054	**0.011**	0.005	0.001	**0.013**	**0.0024**	0.0009	0.000050	**0.006**	0.000003	0.0002	**0.00029**	0.0005	0.036	0.000025	**0.0000031**	**0.00038**	0.00026	**0.0002**	**0.000007**	**0.00002**	**0.0002**	**0.00042**	0.0002	0.002
	June	0.054	**0.012**	0.005	0.001	**0.013**	**0.0025**	0.0009	0.000050	**0.006**	0.000003	0.0002	**0.00030**	0.0005	0.036	0.000025	**0.0000031**	**0.00038**	0.00027	**0.0002**	**0.000007**	**0.00002**	**0.0002**	**0.00043**	0.0002	0.002
	July	0.133	**0.012**	0.005	0.001	**0.014**	**0.0024**	0.0010	0.000030	**0.006**	0.000003	0.0002	**0.00029**	0.0007	0.027	0.000025	**0.0000031**	**0.00023**	0.00027	**0.0002**	**0.000007**	**0.00002**	**0.0002**	**0.00042**	0.0002	0.002
	August	0.134	**0.012**	0.005	0.001	**0.014**	**0.0032**	0.0010	0.000030	**0.007**	0.000003	0.0002	**0.00038**	0.0007	0.027	0.000025	**0.0000033**	**0.00027**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00056**	0.0002	0.002
	September	0.134	**0.012**	0.005	0.001	**0.014**	**0.0030**	0.0010	0.000030	**0.007**	0.000003	0.0002	**0.00035**	0.0007	0.027	0.000025	**0.0000032**	**0.00026**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00051**	0.0002	0.002
	October	0.124	**0.012**	0.005	0.001	**0.016**	**0.0031**	0.0010	0.000010	**0.007**	0.000003	0.0002	**0.00037**	0.0006	0.055	0.000025	**0.0000033**	**0.00026**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00054**	0.0002	0.002
	November	0.124	**0.012**	0.005	0.001	**0.016**	**0.0031**	0.0010	0.000010	**0.007**	0.000003	0.0002	**0.00036**	0.0006	0.055	0.000025	**0.0000032**	**0.00025**	0.00027	**0.0003**	**0.000008**	**0.00003**	**0.0002**	**0.00052**	0.0002	0.002
	December	0.122	0.011	0.005	0.001	**0.014**	**0.0016**	0.0010	0.000010	**0.006**	0.000003	0.0002	**0.00021**	0.0006	0.055	0.000025	**0.0000029**	**0.00018**	0.00026	**0.0002**	**0.000006**	**0.00002**	**0.0001**	**0.00028**	0.0002	0.002

Table 6.6-13: Water Quality Model Results, Node 07

Project Phase	Month	Parameter	Ammonia-N	Nitrate-N	Nitrite-N	Total Cyanide	Aluminum	Antimony	Arsenic	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tungsten	Uranium	Vanadium	Zinc
		WQG PAL	**1.8**	**3**	**0.02**	**0.005**	**0.83**	**0.020**	**0.005**	**0.011**	**1.50**	**0.0001**	**0.001**	**0.00078**	**0.005**	**0.3**	**0.00906**	**0.000026**	**0.073**	**0.025**	**0.1**	**0.00025**	**0.0008**	**0.0300**	**0.005**	**0.12**	**0.011**
Post Closure	**January**		**0.053**	**0.063**	0.005	0.001	**0.024**	**0.0004**	**0.0015**	0.000048	**0.006**	0.000003	**0.0003**	**0.00007**	0.0008	0.015	**0.000030**	**0.0000040**	**0.00031**	**0.00034**	**0.0001**	0.000028	0.00001	0.0001	**0.00009**	**0.0005**	**0.002**
	February		**0.062**	**0.066**	0.005	0.001	**0.028**	**0.0005**	**0.0016**	0.000048	**0.006**	**0.000004**	**0.0004**	**0.00008**	0.0008	0.015	**0.000031**	**0.0000043**	**0.00034**	**0.00036**	**0.0001**	0.000029	0.00001	0.0001	**0.00010**	**0.0006**	**0.002**
	March		**0.070**	**0.069**	0.005	0.001	**0.032**	**0.0006**	**0.0016**	0.000047	**0.006**	**0.000004**	**0.0004**	**0.00008**	0.0008	0.015	**0.000032**	**0.0000046**	**0.00036**	**0.00038**	**0.0002**	**0.000029**	0.00001	**0.0002**	**0.00012**	**0.0007**	**0.002**
	April		**0.111**	**0.037**	0.005	0.001	**0.039**	**0.0006**	**0.0014**	0.000047	**0.007**	**0.000004**	**0.0004**	**0.00008**	**0.0006**	0.034	**0.000033**	**0.0000049**	**0.00046**	**0.00039**	**0.0001**	**0.000011**	0.00001	**0.0002**	**0.00013**	**0.0007**	**0.002**
	May		**0.094**	**0.029**	0.005	0.001	**0.031**	**0.0005**	**0.0013**	0.000048	**0.006**	0.000003	**0.0004**	**0.00007**	**0.0006**	0.034	**0.000031**	**0.0000042**	**0.00040**	**0.00035**	**0.0001**	**0.000010**	0.00001	0.0001	**0.00010**	**0.0006**	**0.002**
	June		**0.095**	**0.030**	0.005	0.001	**0.031**	**0.0005**	**0.0013**	0.000048	**0.006**	**0.000003**	**0.0004**	**0.00007**	**0.0006**	0.034	**0.000031**	**0.0000043**	**0.00040**	**0.00035**	**0.0001**	**0.000010**	0.00001	0.0001	**0.00010**	**0.0006**	**0.002**
	July		**0.169**	**0.029**	0.005	0.001	**0.031**	**0.0005**	**0.0014**	0.000029	**0.006**	**0.000003**	**0.0004**	**0.00007**	0.0007	0.026	**0.000031**	**0.0000042**	**0.00026**	**0.00035**	**0.0001**	**0.000010**	0.00001	0.0001	**0.00010**	**0.0006**	**0.002**
	August		**0.182**	**0.036**	0.005	0.001	**0.038**	**0.0006**	**0.0015**	0.000029	**0.007**	**0.000004**	**0.0004**	**0.00008**	0.0008	0.026	**0.000033**	**0.0000048**	**0.00031**	**0.00038**	**0.0001**	**0.000011**	0.00001	**0.0002**	**0.00012**	**0.0007**	**0.002**
	September		**0.178**	**0.034**	0.005	0.001	**0.036**	**0.0006**	**0.0015**	0.000029	**0.006**	**0.000004**	**0.0004**	**0.00008**	0.0008	0.026	**0.000032**	**0.0000046**	**0.00030**	**0.00037**	**0.0001**	**0.000011**	0.00001	**0.0002**	**0.00011**	**0.0007**	**0.002**
	October		**0.171**	**0.035**	0.005	0.001	**0.038**	**0.0006**	**0.0015**	0.000010	**0.006**	**0.000004**	**0.0004**	**0.00008**	0.0007	0.051	**0.000033**	**0.0000047**	**0.00029**	**0.00038**	**0.0001**	**0.000011**	0.00001	**0.0002**	**0.00012**	**0.0007**	**0.002**
	November		**0.170**	**0.034**	0.005	0.001	**0.038**	**0.0006**	**0.0015**	0.000010	**0.006**	**0.000004**	**0.0004**	**0.00008**	0.0007	0.051	**0.000033**	**0.0000046**	**0.00029**	**0.00038**	**0.0001**	**0.000011**	0.00001	**0.0002**	**0.00012**	**0.0007**	**0.002**
	December		**0.147**	**0.023**	0.005	0.001	**0.026**	**0.0003**	**0.0013**	0.000010	**0.006**	0.000003	**0.0003**	**0.00007**	0.0007	0.053	**0.000029**	**0.0000037**	**0.00020**	**0.00032**	**0.0001**	**0.000008**	0.00001	0.0001	**0.00007**	**0.0005**	0.002

All units are mg/L.
Water quality model results summarized in this table are Base Case (Expected Case); results of model sensitivity cases are presented in Appendix N-2.
WQG PAL: Water Quality Guideline for the Protection of Aquatic Life (long-term exposure) identified in Table 6.6-3.
As applicable, numerical guideline values were calculated using the most conservative approach (i.e., 25th percentile baseline values for ameliorating factors, save for zinc, which uses 75th percentile pH for the FEQG calculation). For Birch Lake, these data were as follows:

	25th	75th
pH	7.4	7.6
Hardness (mg/L)	28	
DOC (mg/L)	8.1	
Chloride (mg/L)	0.25	
Alkalinity (mg/L)	28	

Only model results for parameters with WQG PAL are summarized here; results for all modelled parameters are presented in Appendix N-2.
Grey shaded values are greater than water quality guidelines (none).
Bolded purple values are estimated to be measurably different than existing conditions (15% or greater change relative to baseline conditions).

Table 6.6-14: Water Quality Model Results, Node 08

Project Phase	Month (Parameter)	Ammonia-N	Nitrate-N	Nitrite-N	Total Cyanide	Aluminum	Antimony	Arsenic	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tungsten	Uranium	Vanadium	Zinc
	WQG PAL	1.8	3	0.06	0.005	0.83	0.020	0.005	0.011	1.50	0.0001	0.001	0.00078	0.005	0.3	0.00906	0.000026	0.073	0.025	0.1	0.00025	0.0008	0.03000	0.005	0.12	0.011
Existing Condition	January	0.023	0.050	0.005	0.001	0.009	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000050	0.00075	0.034	0.000025	0.0000025	0.00018	0.00038	0.0005	0.000038	0.000015	0.00005	0.00005	0.0003	0.002
	February	0.023	0.050	0.005	0.001	0.009	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000050	0.00075	0.034	0.000025	0.0000025	0.00018	0.00038	0.0005	0.000038	0.000015	0.00005	0.00005	0.0003	0.002
	March	0.023	0.050	0.005	0.001	0.009	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000050	0.00075	0.034	0.000025	0.0000025	0.00018	0.00038	0.0005	0.000038	0.000015	0.00005	0.00005	0.0003	0.002
	April	0.110	0.010	0.005	0.001	0.016	0.00010	0.001	0.00005	0.005	0.000010	0.0002	0.000050	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	May	0.110	0.010	0.005	0.001	0.016	0.00010	0.001	0.00005	0.005	0.000010	0.0002	0.000050	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	June	0.110	0.010	0.005	0.001	0.016	0.00010	0.001	0.00005	0.005	0.000010	0.0002	0.000050	0.00100	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	July	0.023	0.010	0.005	0.001	0.012	0.00010	0.001	0.00005	0.005	0.000002	0.0003	0.000050	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	August	0.023	0.010	0.005	0.001	0.012	0.00010	0.001	0.00005	0.005	0.000002	0.0003	0.000050	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	September	0.023	0.010	0.005	0.001	0.012	0.00010	0.001	0.00005	0.005	0.000002	0.0003	0.000050	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	October	0.104	0.010	0.005	0.001	0.011	0.00010	0.001	0.00001	0.005	0.000002	0.0002	0.000050	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	November	0.104	0.010	0.005	0.001	0.011	0.00010	0.001	0.00001	0.005	0.000002	0.0002	0.000050	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	December	0.104	0.010	0.005	0.001	0.011	0.00010	0.001	0.00001	0.005	0.000002	0.0002	0.000050	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
Construction	January	0.023	0.050	0.005	0.001	0.009	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000050	0.00075	0.034	0.000025	0.0000025	0.00018	0.00037	0.0005	0.000037	0.000015	0.00005	0.00005	0.0003	0.002
	February	0.023	0.050	0.005	0.001	0.009	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000050	0.00075	0.034	0.000025	0.0000025	0.00018	0.00037	0.0005	0.000037	0.000015	0.00005	0.00005	0.0003	0.002
	March	0.023	0.050	0.005	0.001	0.009	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000050	0.00075	0.034	0.000025	0.0000025	0.00018	0.00037	0.0005	0.000037	0.000015	0.00005	0.00005	0.0003	0.002
	April	0.109	0.010	0.005	0.001	0.016	0.00010	0.001	0.00005	0.005	0.000010	0.0002	0.000050	0.00099	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	May	0.109	0.010	0.005	0.001	0.016	0.00010	0.001	0.00005	0.005	0.000010	0.0002	0.000050	0.00099	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	June	0.109	0.010	0.005	0.001	0.016	0.00010	0.001	0.00005	0.005	0.000010	0.0002	0.000050	0.00099	0.050	0.000025	0.0000025	0.00010	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	July	0.024	0.010	0.005	0.001	0.012	0.00010	0.001	0.00005	0.005	0.000002	0.0002	0.000050	0.00065	0.037	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	August	0.024	0.010	0.005	0.001	0.012	0.00010	0.001	0.00005	0.005	0.000002	0.0002	0.000050	0.00065	0.037	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	September	0.024	0.010	0.005	0.001	0.012	0.00010	0.001	0.00005	0.005	0.000002	0.0002	0.000050	0.00065	0.037	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	October	0.104	0.010	0.005	0.001	0.011	0.00010	0.001	0.00001	0.005	0.000002	0.0002	0.000050	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	November	0.104	0.010	0.005	0.001	0.011	0.00010	0.001	0.00001	0.005	0.000002	0.0002	0.000050	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	December	0.104	0.010	0.005	0.001	0.011	0.00010	0.001	0.00001	0.005	0.000002	0.0002	0.000050	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
Operations	January	0.023	0.053	0.005	0.001	0.010	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000057	0.00076	0.035	0.000025	0.0000025	0.00019	0.00038	0.0005	0.000037	0.000015	0.00005	**0.00006**	0.0003	0.002
	February	0.023	0.053	0.005	0.001	0.010	**0.00012**	0.001	0.00005	0.005	0.000004	0.0002	**0.000058**	0.00076	0.035	0.000025	0.0000025	0.00019	0.00038	0.0005	0.000037	0.000015	0.00005	**0.00006**	0.0003	0.002
	March	0.023	0.054	0.005	0.001	0.010	**0.00013**	0.001	0.00005	0.005	0.000004	0.0002	**0.000060**	0.00076	0.035	0.000025	0.0000025	0.00019	0.00038	0.0005	0.000037	0.000016	0.00005	**0.00006**	0.0003	0.002
	April	0.109	**0.015**	0.005	0.001	0.016	**0.00014**	0.001	0.00005	0.005	0.000010	0.0002	**0.000061**	0.00100	0.051	0.000025	0.0000025	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	**0.00003**	0.0003	0.002
	May	0.109	**0.013**	0.005	0.001	0.016	0.00011	0.001	0.00005	0.005	0.000010	0.0002	**0.000058**	0.00100	0.051	0.000025	0.0000025	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	**0.00003**	0.0003	0.002
	June	0.109	**0.013**	0.005	0.001	0.016	0.00011	0.001	0.00005	0.005	0.000010	0.0002	**0.000058**	0.00100	0.051	0.000025	0.0000025	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	**0.00003**	0.0003	0.002
	July	0.025	**0.013**	0.005	0.001	0.012	0.00011	0.001	0.00005	0.005	0.000003	0.0002	**0.000058**	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	**0.00003**	0.0003	0.002
	August	0.025	**0.014**	0.005	0.001	0.012	**0.00013**	0.001	0.00005	0.005	0.000003	0.0002	**0.000061**	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0003	0.002
	September	0.025	**0.014**	0.005	0.001	0.012	**0.00013**	0.001	0.00005	0.005	0.000003	0.0002	**0.000060**	0.00065	0.038	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0003	0.002
	October	0.104	**0.014**	0.005	0.001	0.011	**0.00013**	0.001	0.00001	0.005	0.000003	0.0002	**0.000060**	0.00063	0.039	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0003	0.002
	November	0.104	**0.014**	0.005	0.001	0.011	**0.00013**	0.001	0.00001	0.005	0.000003	0.0002	**0.000060**	0.00063	0.039	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0003	0.002
	December	0.104	**0.012**	0.005	0.001	0.011	0.00009	0.001	0.00001	0.005	0.000003	0.0002	0.000055	0.00063	0.039	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	**0.00003**	0.0003	0.002
Active Closure	January	0.023	0.050	0.005	0.001	0.010	0.00010	0.001	0.00005	0.005	0.000004	0.0002	0.000055	0.00075	0.034	0.000025	0.0000025	0.00019	0.00037	0.0005	0.000037	0.000015	0.00005	**0.00006**	0.0002	0.002
	February	0.023	0.050	0.005	0.001	0.010	0.00011	0.001	0.00005	0.005	0.000004	0.0002	0.000056	0.00075	0.034	0.000025	0.0000025	0.00019	0.00037	0.0005	0.000037	0.000015	0.00005	**0.00006**	0.0002	0.002
	March	0.023	0.050	0.005	0.001	0.010	**0.00012**	0.001	0.00005	0.005	0.000004	0.0002	0.000057	0.00075	0.034	0.000025	0.0000025	0.00019	0.00037	0.0005	0.000037	0.000016	0.00005	**0.00006**	0.0002	0.002
	April	0.109	0.010	0.005	0.001	0.016	**0.00013**	0.001	0.00005	0.005	0.000010	0.0002	**0.000058**	0.00099	0.050	0.000025	0.0000025	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	**0.00003**	0.0002	0.002
	May	0.109	0.010	0.005	0.001	0.016	0.00011	0.001	0.00005	0.005	0.000010	0.0002	0.000056	0.00099	0.050	0.000025	0.0000025	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	**0.00003**	0.0002	0.002
	June	0.109	0.010	0.005	0.001	0.016	0.00011	0.001	0.00005	0.005	0.000010	0.0002	0.000056	0.00099	0.050	0.000025	0.0000025	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	**0.00003**	0.0002	0.002
	July	0.025	0.010	0.005	0.001	0.012	0.00011	0.001	0.00005	0.005	0.000003	0.0002	0.000056	0.00065	0.037	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	**0.00003**	0.0002	0.002
	August	0.025	0.010	0.005	0.001	0.012	**0.00013**	0.001	0.00005	0.005	0.000003	0.0002	**0.000058**	0.00065	0.037	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0002	0.002
	September	0.025	0.010	0.005	0.001	0.012	**0.00012**	0.001	0.00005	0.005	0.000003	0.0002	0.000057	0.00065	0.037	0.000025	0.0000025	0.00011	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0002	0.002
	October	0.104	0.010	0.005	0.001	0.011	**0.00012**	0.001	0.00001	0.005	0.000003	0.0002	**0.000058**	0.00063	0.038	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0002	0.002
	November	0.104	0.010	0.005	0.001	0.011	**0.00012**	0.001	0.00001	0.005	0.000003	0.0002	**0.000058**	0.00063	0.038	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.000006	0.00005	**0.00003**	0.0002	0.002
	December	0.104	0.010	0.005	0.001	0.011	0.00009	0.001	0.00001	0.005	0.000003	0.0002	0.000054	0.00063	0.038	0.000025	0.0000025	0.00009	0.00025	0.0001	0.000005	0.000005	0.00005	**0.00002**	0.0002	0.002

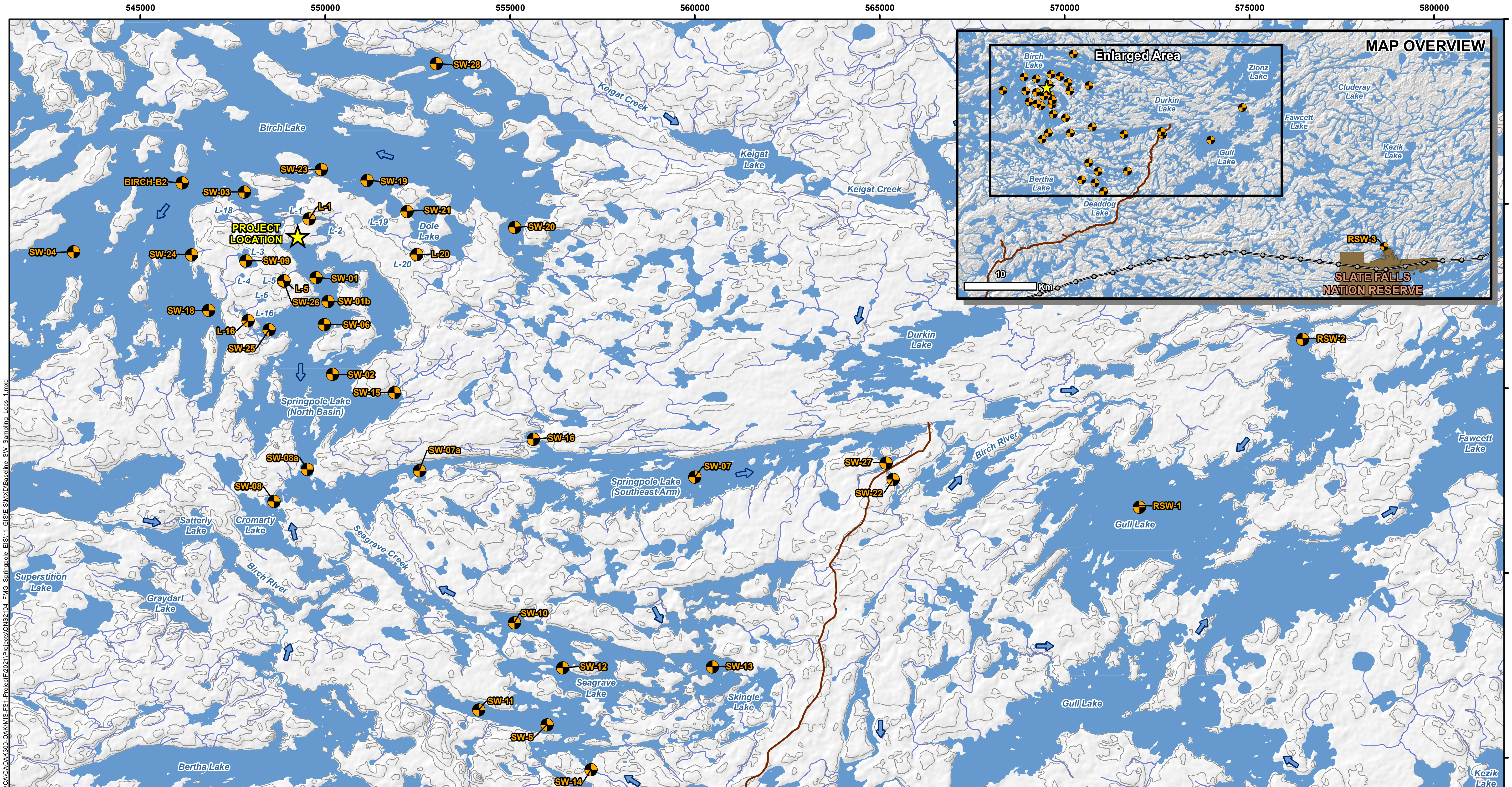
Table 6.6-14: Water Quality Model Results, Node 08

Project Phase	Month / Parameter	Ammonia-N	Nitrate-N	Nitrite-N	Total Cyanide	Aluminum	Antimony	Arsenic	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tungsten	Uranium	Vanadium	Zinc
	WQG PAL	**1.8**	**3**	**0.06**	**0.005**	**0.83**	**0.020**	**0.005**	**0.011**	**1.50**	**0.0001**	**0.001**	**0.00078**	**0.005**	**0.3**	**0.00906**	**0.000026**	**0.073**	**0.025**	**0.1**	**0.00025**	**0.0008**	**0.03000**	**0.005**	**0.12**	**0.011**
Post Closure	January	0.024	0.050	0.005	0.001	0.010	0.00006	0.001	0.00005	0.005	0.000004	0.0002	0.000051	0.00076	0.034	0.000025	0.0000025	0.00019	0.00038	0.0005	0.000037	0.000015	0.00005	0.00005	0.0003	0.002
	February	0.024	0.051	0.005	0.001	0.010	0.00006	0.001	0.00005	0.005	0.000004	0.0002	0.000051	0.00076	0.034	0.000025	0.0000026	0.00019	0.00038	0.0005	0.000038	0.000015	0.00005	0.00005	0.0003	0.002
	March	0.025	0.051	0.005	0.001	0.010	0.00007	0.001	0.00005	0.005	0.000004	0.0002	0.000051	0.00076	0.034	0.000025	0.0000026	0.00019	0.00038	0.0005	0.000038	0.000015	0.00005	0.00005	0.0003	0.002
	April	0.111	0.011	0.005	0.001	0.016	0.00007	0.001	0.00005	0.005	0.000010	0.0002	0.000051	0.00100	0.050	0.000025	0.0000026	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	May	0.111	0.011	0.005	0.001	0.016	0.00006	0.001	0.00005	0.005	0.000010	0.0002	0.000051	0.00100	0.050	0.000025	0.0000026	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	June	0.111	0.011	0.005	0.001	0.016	0.00006	0.001	0.00005	0.005	0.000010	0.0002	0.000051	0.00100	0.050	0.000025	0.0000026	0.00011	0.00050	0.0001	0.000005	0.000025	0.00005	0.00002	0.0003	0.002
	July	0.026	0.011	0.005	0.001	0.013	0.00006	0.001	0.00005	0.005	0.000003	0.0003	0.000051	0.00065	0.037	0.000025	0.0000026	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	August	0.026	0.011	0.005	0.001	0.013	0.00007	0.001	0.00005	0.005	0.000003	0.0003	0.000051	0.00065	0.037	0.000025	0.0000026	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	September	0.026	0.011	0.005	0.001	0.013	0.00007	0.001	0.00005	0.005	0.000003	0.0003	0.000051	0.00065	0.037	0.000025	0.0000026	0.00011	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	October	0.106	0.011	0.005	0.001	0.012	0.00007	0.001	0.00001	0.005	0.000003	0.0002	0.000051	0.00063	0.038	0.000025	0.0000026	0.00010	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	November	0.106	0.011	0.005	0.001	0.012	0.00007	0.001	0.00001	0.005	0.000003	0.0002	0.000051	0.00063	0.038	0.000025	0.0000026	0.00010	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002
	December	0.105	0.010	0.005	0.001	0.012	0.00006	0.001	0.00001	0.005	0.000003	0.0002	0.000051	0.00063	0.038	0.000025	0.0000025	0.00010	0.00025	0.0001	0.000005	0.000005	0.00005	0.00002	0.0003	0.002

Notes:
All units are mg/L.
Water quality model results summarized in this table are Base Case (Expected Case); results of model sensitivity cases are presented in Appendix N-2.
WQG PAL: Water Quality Guideline for the Protection of Aquatic Life (long-term exposure) identified in Table 6.6-3.
As applicable, numerical guideline values were calculated using the most conservative approach (i.e., 25th percentile baseline values for ameliorating factors, save for zinc, which uses 75th percentile pH for the FEQG calculation). For Birch Lake, these data were as follows:

	25th	75th
pH	7.4	7.6
Hardness (mg/L)	28	
DOC (mg/L)	8.1	
Chloride (mg/L)	0.25	
Alkalinity (mg/L)	28	

Only model results for parameters with WQG PAL are summarized here; results for all modelled parameters are presented in Appendix N-2.
Grey shaded values are greater than water quality guidelines (none).
Bolded purple values are estimated to be measurably different than existing conditions (15% or greater change relative to baseline conditions).



X:\CA\CAOAK300-OAKMIS-FS1-ProjectF\2021\Projects\ONS2104 FMG Springpole EIS\11 GIS\EIS\MXD\Baseline SW Sampling Locs 1.mxd

LEGEND

- Project Location
- Baseline Water Quality Monitoring Stations (Labelled with ID)
- First Nation Reserve
- Existing Road
- Existing Transmission Line
- Contour (10 m intervals)
- Watercourse
- Waterbody
- Flow Direction

0 2.5 5 10 15 20 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

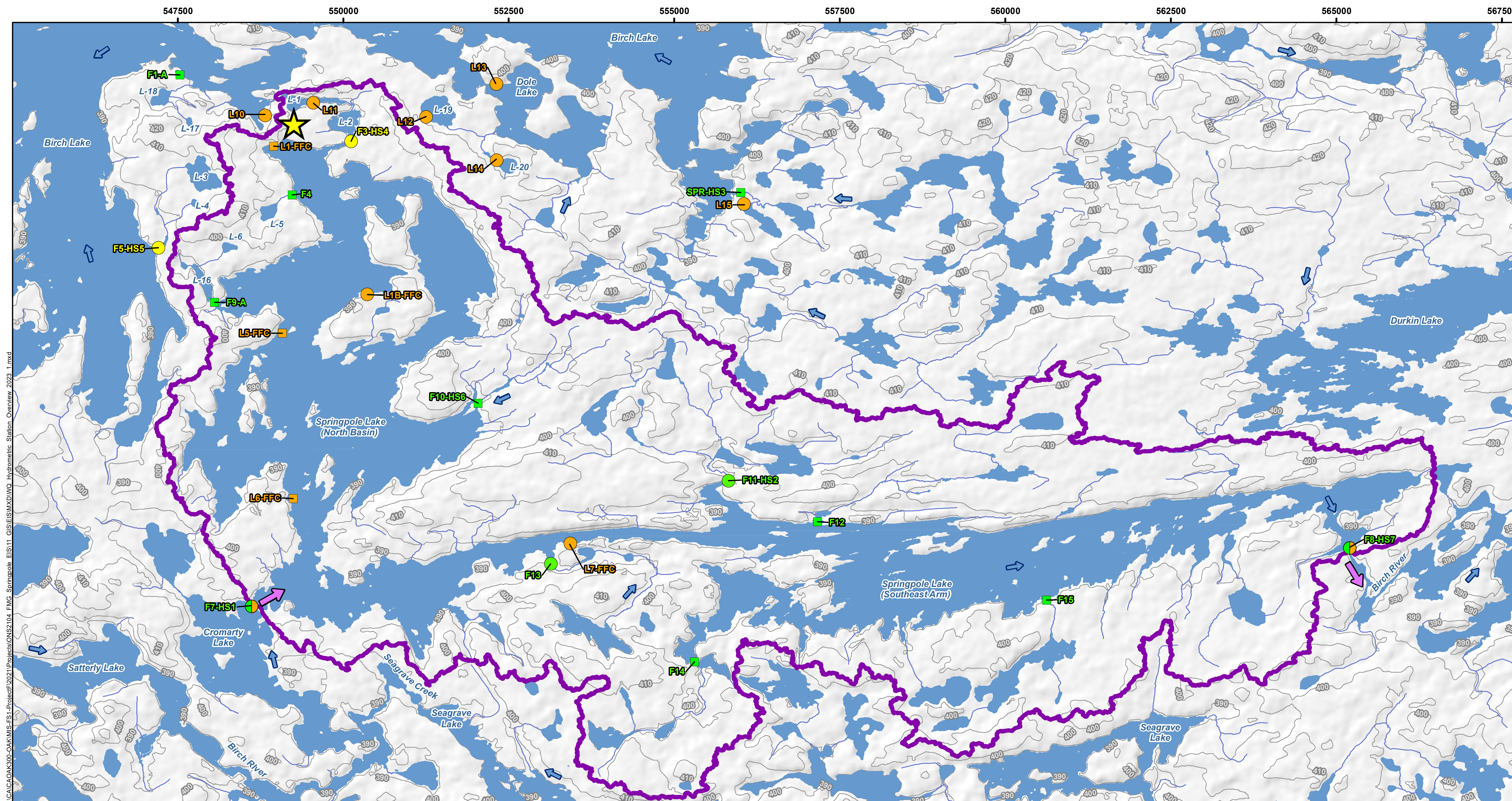
FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

Baseline Water Quality Monitoring Stations

PROJECT N°: ONS2104	**FIGURE: 6.6-1**
SCALE: 1:97,500	DATE: October 2024



LEGEND

- Project Location
- Springpole Lake Subwatershed
- Contour (10 m intervals)
- Watercourse
- Waterbody
- Flow Direction
- Watershed Outlet Flow Direction
- Continuous Open Channel Flow Measurement Station
- Low-Flow Spot Measurement Station
- Continuous Lake Level Monitoring Station
- Decomissioned Flow Station
- Decomissioned Lake Level Station

NOTES:
- Topographic information extracted from LIO, MNRF.

FIRST MINING GOLD

wsp

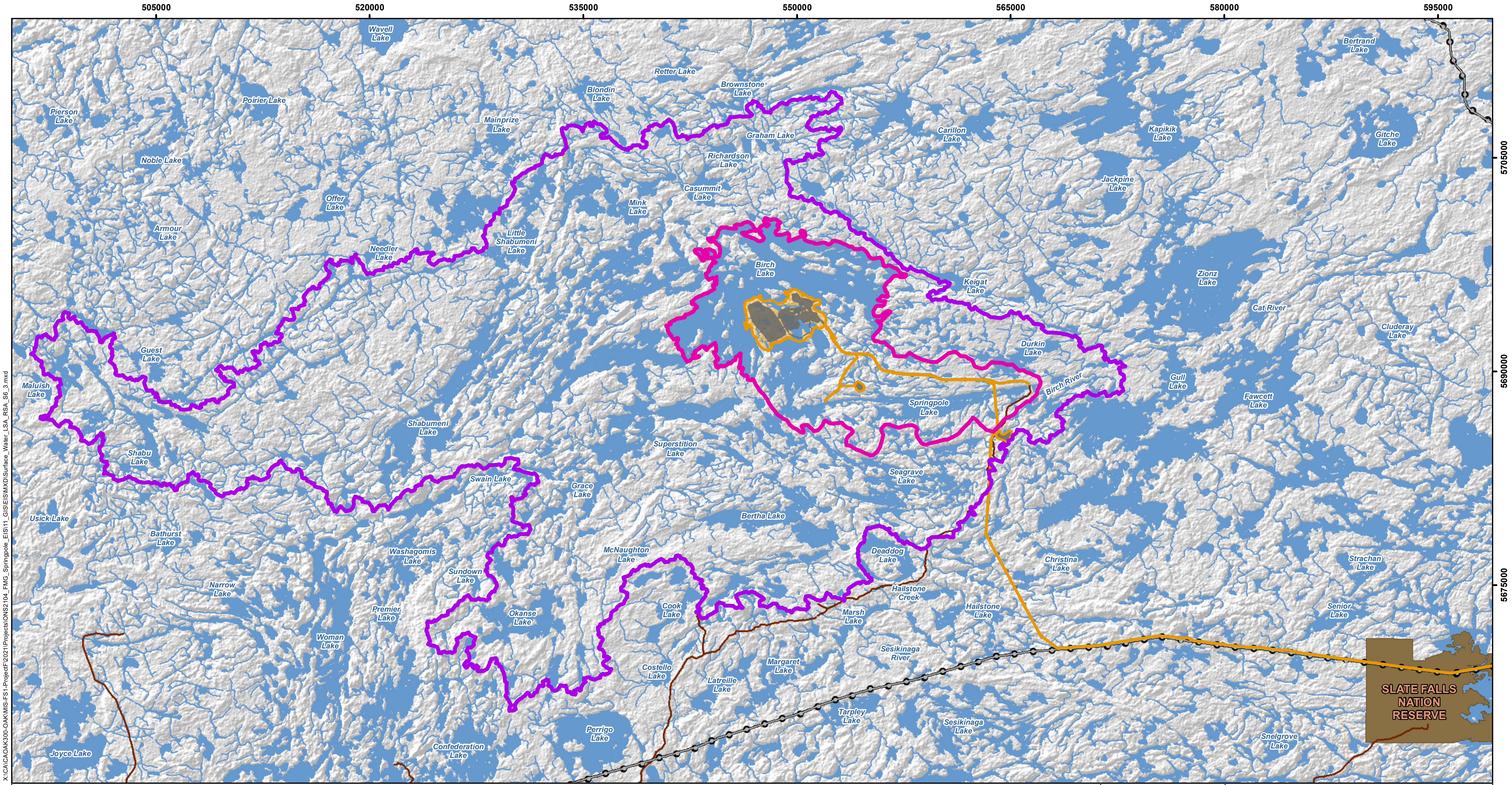
SPRINGPOLE GOLD PROJECT

Hydrometric Monitoring Stations

Datum: NAD83
Projection: UTM Zone 15N

0 1 2 4 6 8 10 Kilometres

PROJECT Nº: ONS2104	**FIGURE: 6.6-2**
SCALE: 1:55,000	DATE: October 2024



LEGEND

- Proposed Mine Feature
- Project Development Area
- Local Study Area for Surface Water Systems
- Regional Study Area for Surface Water Systems
- Existing Road
- Existing Transmission Line
- Watercourse
- Waterbody

0 5 10 20 30 40 50 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

Local and Regional Study Areas for Surface Water Systems

PROJECT Nº: ONS2104	**FIGURE: 6.6-3**
SCALE: 1:250,000	DATE: October 2024

Figure 6.6-4: Temperature and Dissolved Oxygen Profiles – Birch Lake (Basin B1)

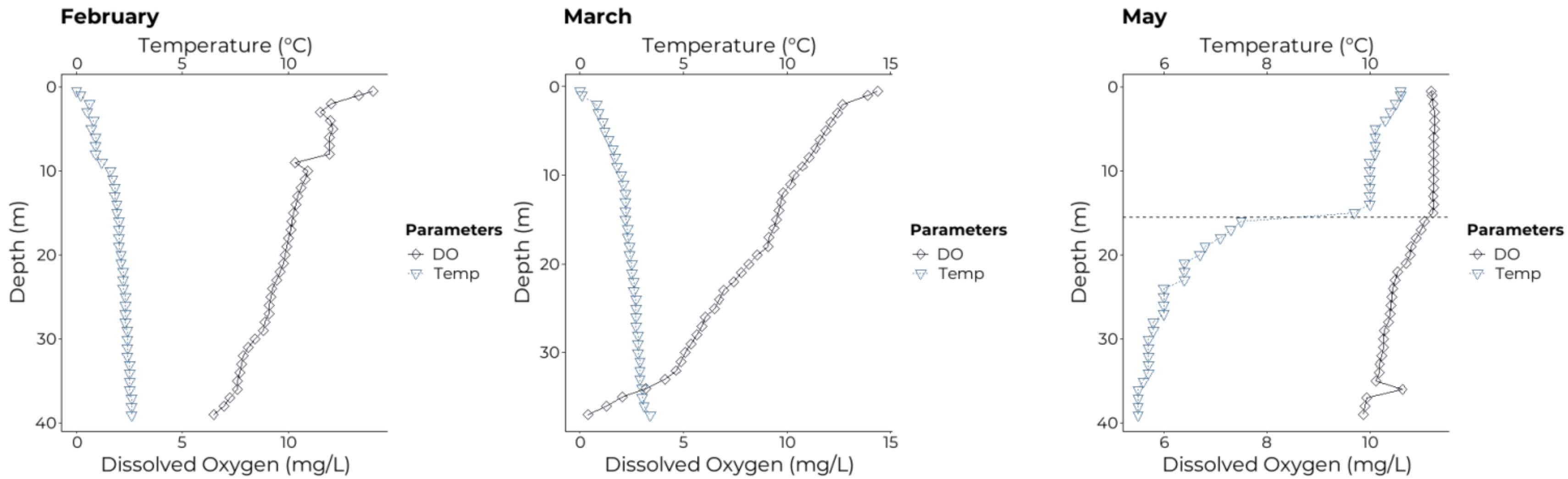
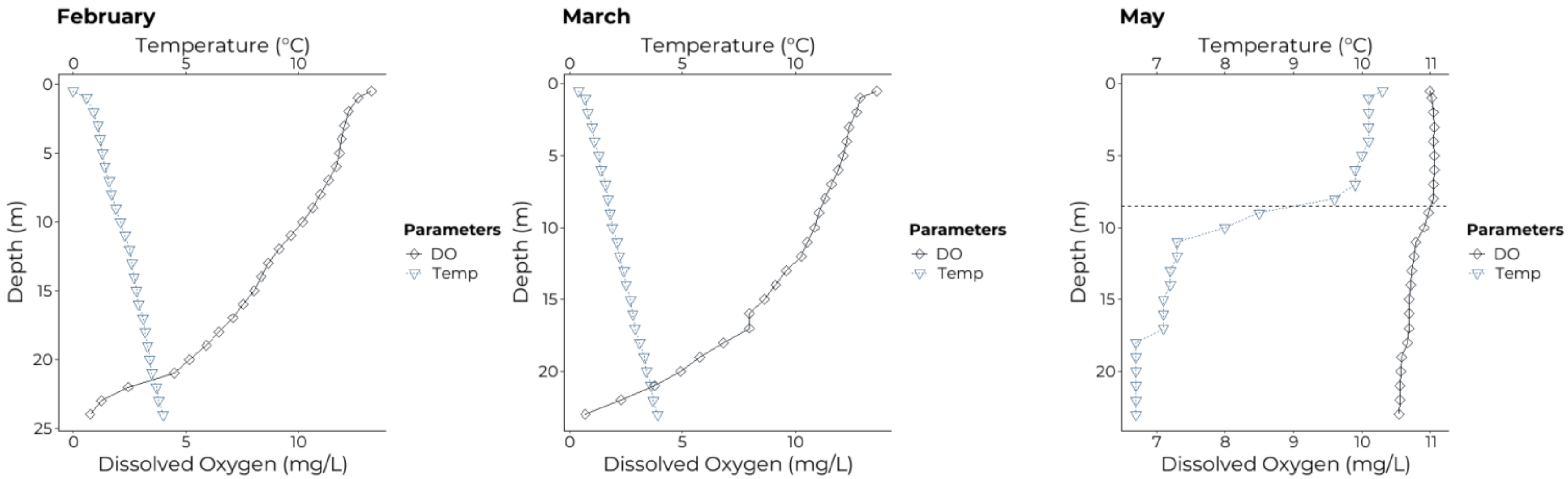
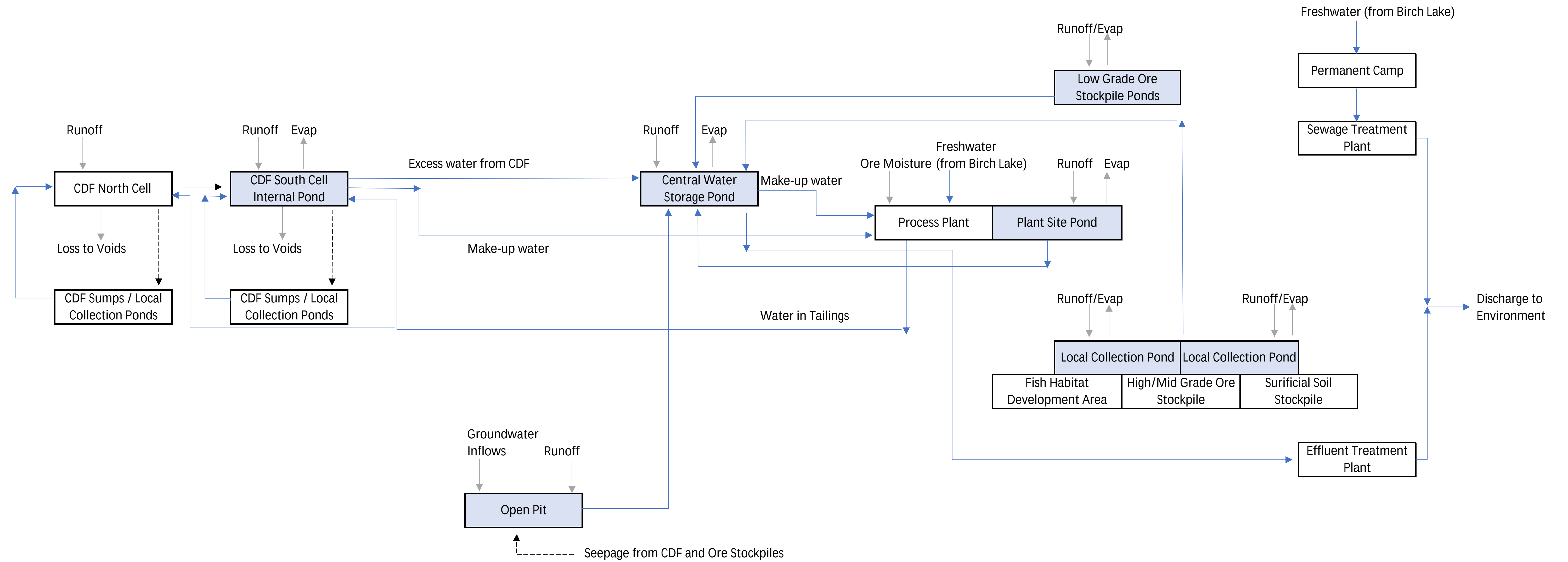


Figure 6.6-5: Temperature and Dissolved Oxygen Profiles – Birch Lake (Basin B2)





LEGEND:
Input/Loss
Pumped Flow
Gravity Flow
Seepage

CLIENT LOGO:

CLIENT:
FIRST MINING GOLD

WSP Canada Inc.
6925 Century Avenue, Suite 600
Mississauga, Ontario, Canada, L5N 7K2

COMPANY LOGO:

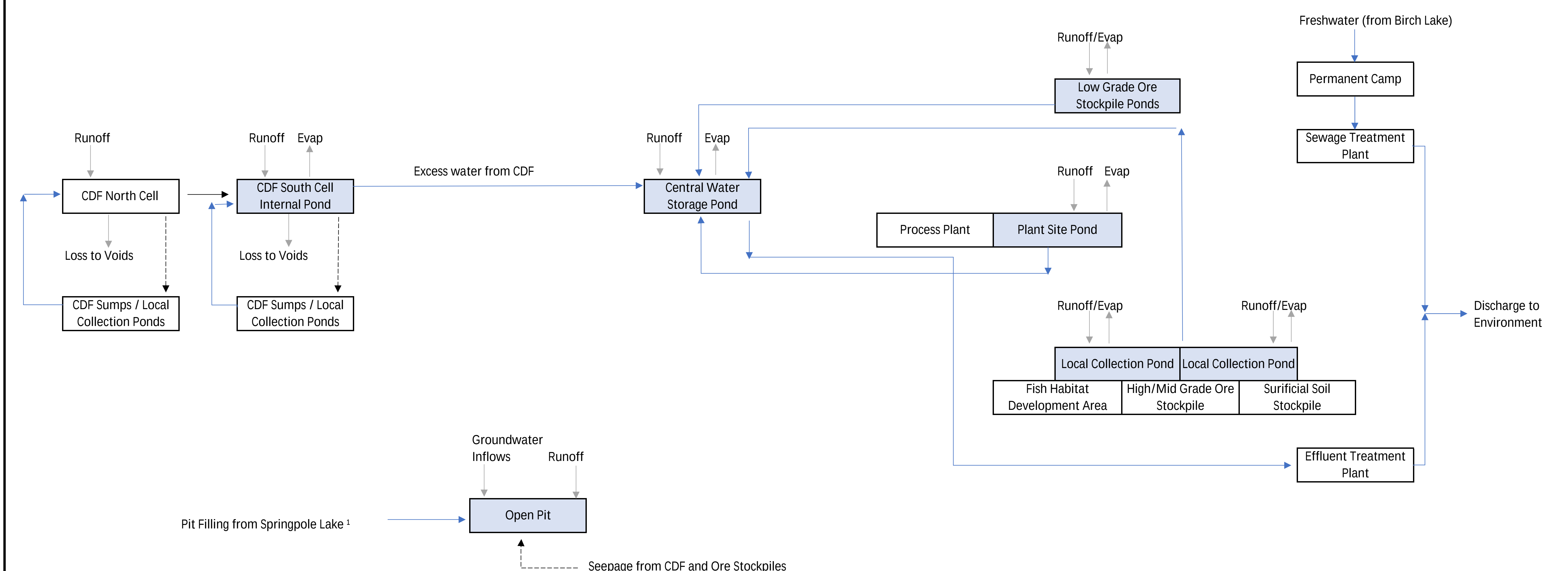
PROJECT TITLE:
SPRINGPOLE GOLD PROJECT
MINE SITE WATER BALANCE

DRAWING TITLE:
OPERATIONS PHASE
FLOW SCHEMATIC

DATE:
DECEMBER 2023

PROJECT NO:
ONS2104

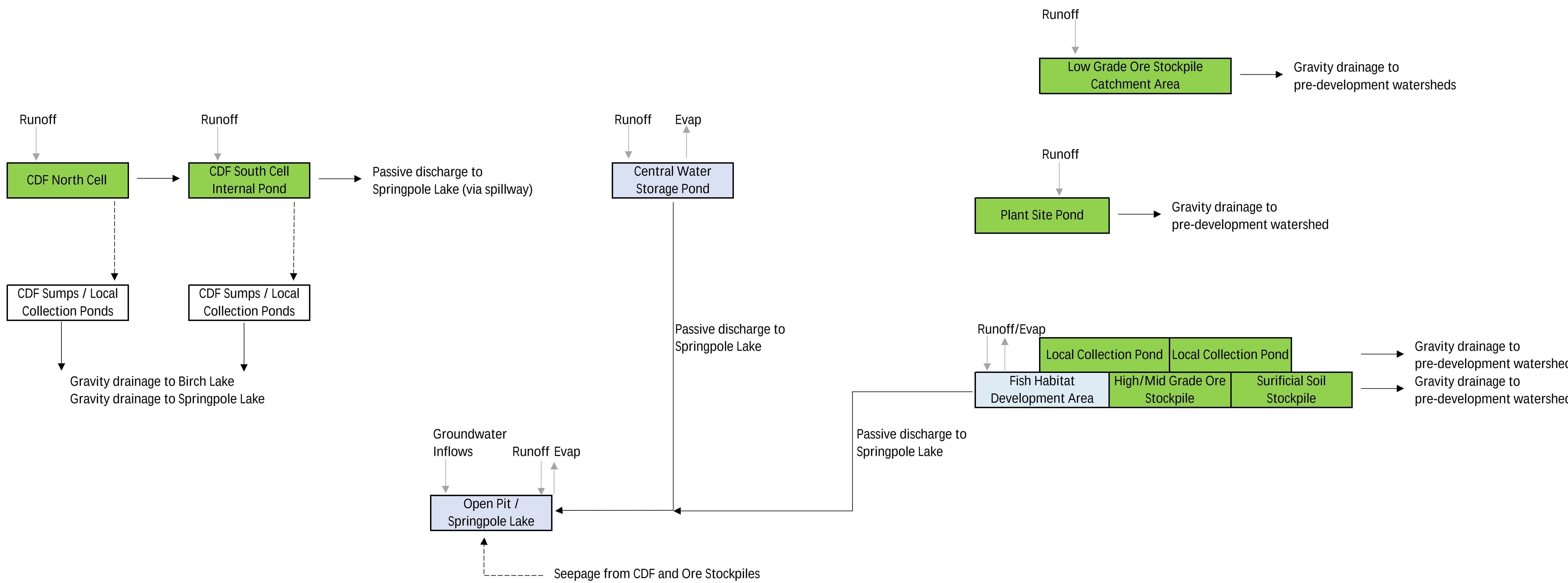
FIGURE NO:
6.6-6



Note

1 - Freshwater taking from Springpole Lake may be used to accelerate pit filling; however this was not incorporated into the mine site water balance.

LEGEND:	CLIENT LOGO:	CLIENT:	COMPANY LOGO:	PROJECT TITLE:	DATE:
Input/Loss Pumped Flow Gravity Flow Seepage		FIRST MINING GOLD WSP Canada Inc. 6925 Century Avenue, Suite 600 Mississauga, Ontario, Canada, L5N 7K2		SPRINGPOLE GOLD PROJECT MINE SITE WATER BALANCE DRAWING TITLE: ACTIVE CLOSURE - PIT FILLING PHASE FLOW SCHEMATIC	DECEMBER 2023 PROJECT NO: ONS2104 FIGURE NO: 6.6-7



Note

1 - Ore stockpiles will not be present at post closure. However, the associated contact water management ponds will still be present to capture runoff from the ore stockpile catchment.

2 - At post closure, the Springpole Lake dikes will be modified to allow natural flow of water between the reclaimed open pit basin and Springpole Lake.

LEGEND:

- Input/Loss
- Pumped Flow
- Gravity Flow
- Seepage
- Closed / Re-vegetated

CLIENT LOGO:

CLIENT:
FIRST MINING GOLD

WSP Canada Inc.
6925 Century Avenue, Suite 600
Mississauga, Ontario, Canada, L5N 7K2

COMPANY LOGO:

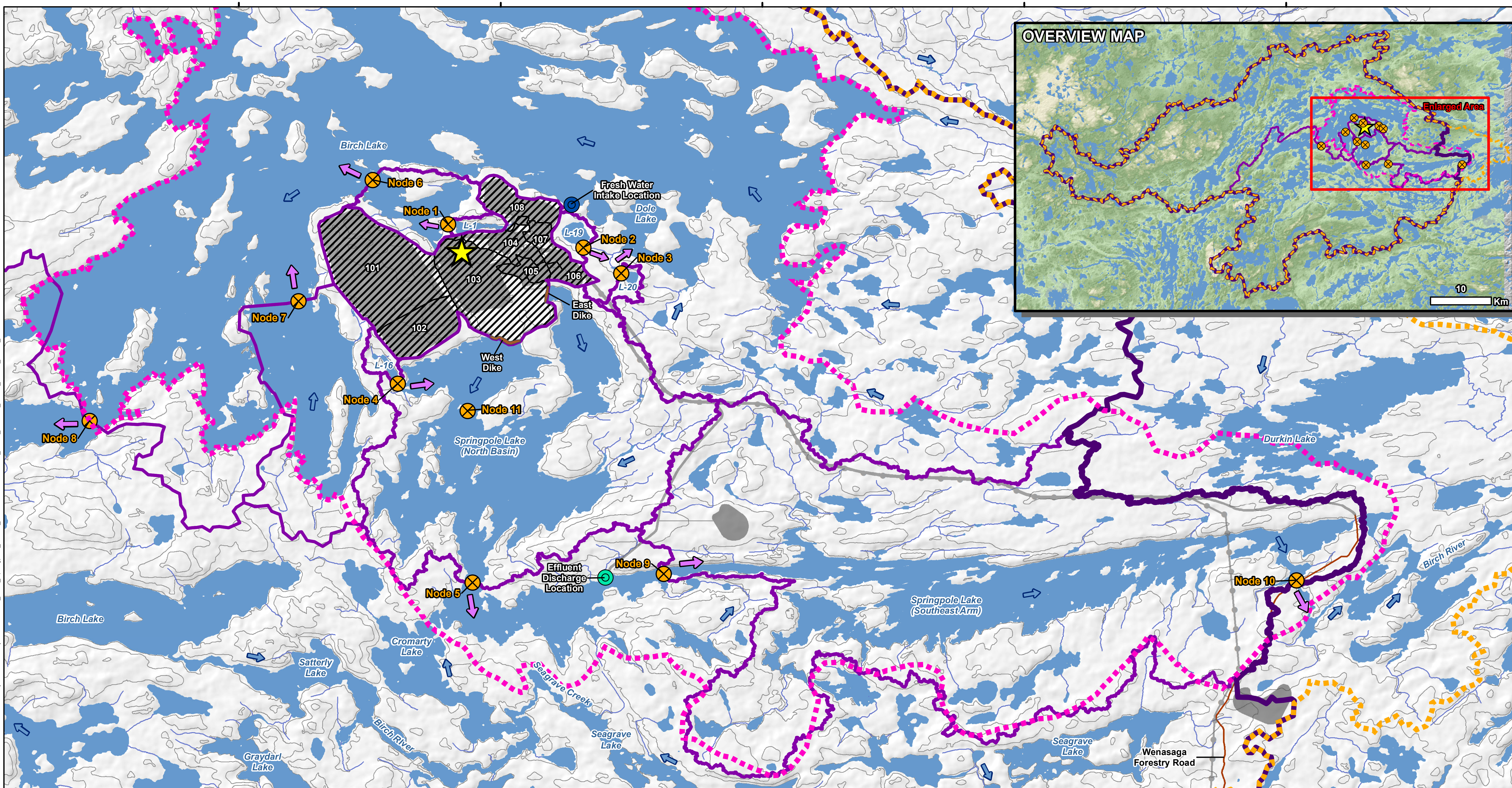
PROJECT TITLE:
SPRINGPOLE GOLD PROJECT
MINE SITE WATER BALANCE

DRAWING TITLE:
POST CLOSURE PHASE
FLOW SCHEMATIC

DATE:
DECEMBER 2023

PROJECT NO:
ONS2104

FIGURE NO:
6.6-8



X:\CA\CAOAK300-OAKMIS-FS1-ProjectF\2021\Projects\ONS2104_FMG_Springpole_EIS\11_GIS\EIS\MXD\Receiver_Water_Balance_Model_Nodes_PostD_1.mxd

LEGEND

- Project Location
- Local Study Area for Surface Water Systems
- Regional Study Area for Surface Water Systems
- Fresh Water Intake Location
- Effluent Discharge Location
- Proposed Mine Feature
- Existing Road
- Contour (10 m intervals)
- Watercourse
- Waterbody
- Flow Direction
- Watershed Outlet Flow Direction
- Model Nodes (Labelled with ID)
- Watershed to Springpole Lake Oulet (Node 10)*
- Subwatershed*
- Project Watersheds (Labelled with ID)
- Dike

Node Watershed Areas
(natural/undisturbed watershed areas, excluding the Project footprint)

ID	Area (km^2)
Node 1	0.3
Node 2	0.5
Node 3	0.3
Node 4	0.4
Node 5	24.9
Node 6	2.8
Node 7	9.1
Node 8	758.3
Node 9	1308.7
Node 10	1361.7

0 1 2 4 6 8 10 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.
- Watershed delineations based on data provided by Aquaspheara, data obtained through the Ontario Flow Assessment Tool (OFAT) and LiDAR provided by First Mining Gold, 2020.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.
* Natural/undisturbed watershed areas, excluding the Project footprint

Datum: NAD83
Projection: UTM Zone 15N

N S W E

FIRST MINING GOLD | WSP

SPRINGPOLE GOLD PROJECT

Surface Water Assessment Nodes

PROJECT N°: ONS2104 | FIGURE: 6.6-9

SCALE: 1:70,000 | DATE: October 2024

Figure 6.6-10: Birch Lake Water Quality, Node 6 Base Case

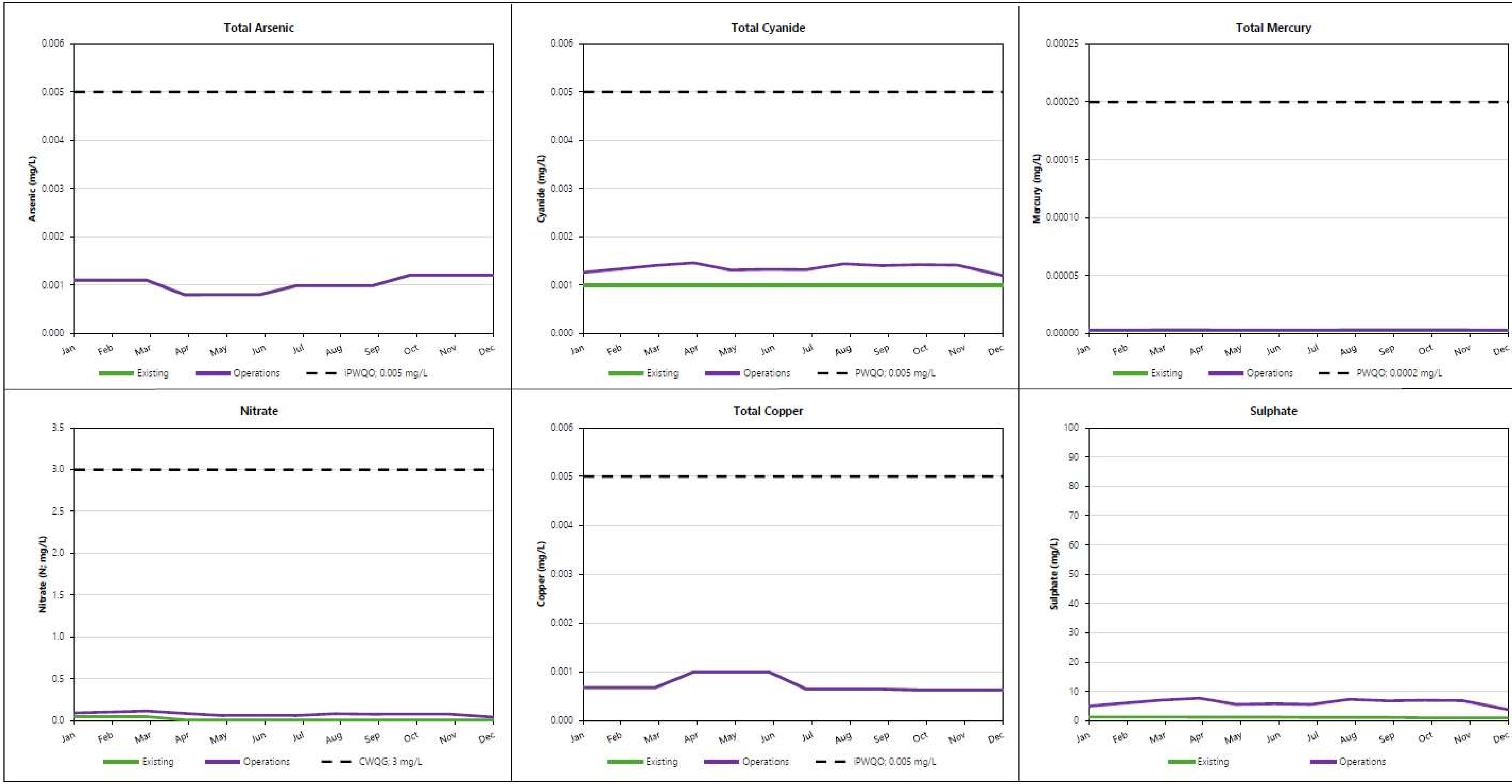


Figure 6.6-11: Birch Lake Water Quality, Node 7 Base Case

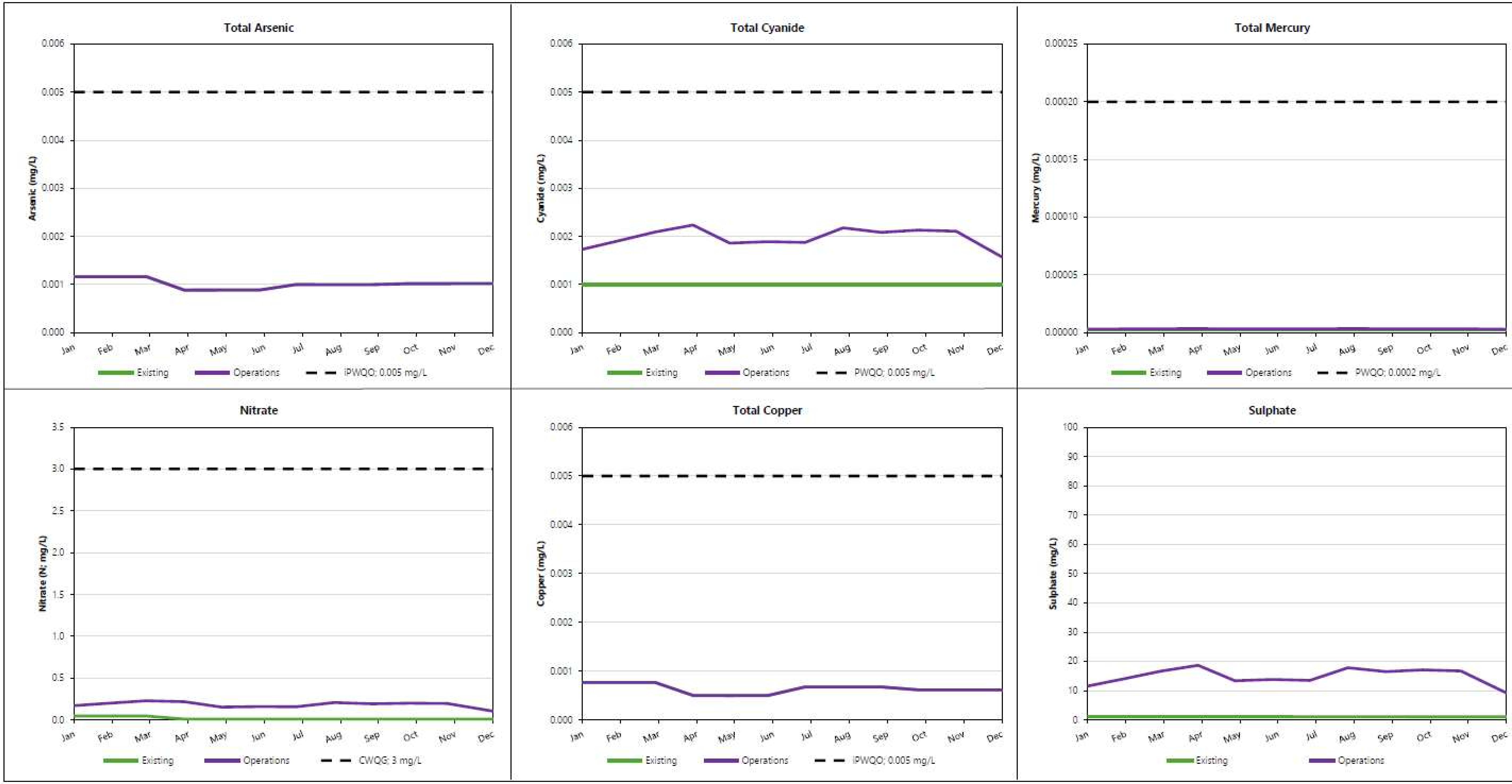


Figure 6.6-12: Birch Lake Water Quality, Node 8 Base Case