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6.9 Local Inland Waterbodies

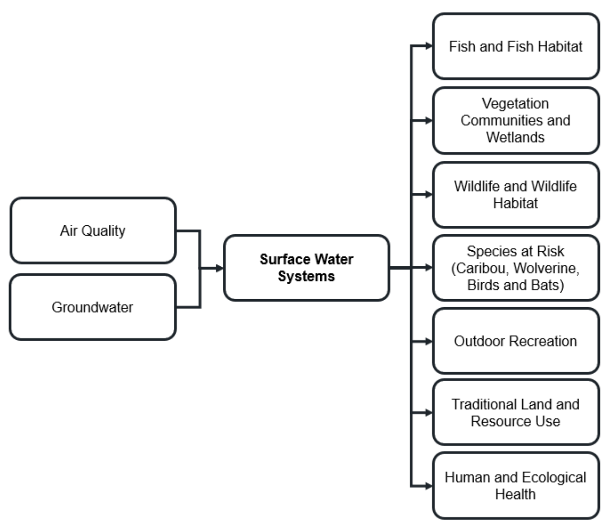
Surface water is selected as a valued component (VC) because it is critical to the life function of human and non-human biota; supports Indigenous, commercial, and recreational uses; and provides cultural value to humans through various uses including as habitat for aquatic resources and as a medium for travel and recreation. 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 to the south of the mine. To support discussion herein, 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);
- Springpole Lake, North Basin System (Section 6.7);
- Springpole Lake, Southeast Arm System (Section 6.8); and
- Local Inland Waterbody Systems (this section).

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 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 phases 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 phases 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 phases 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 of the Project.
- **SAR (Section 6.13 to Section 6.16):** the assessment of potential effects on SAR is informed by the potential to change surface water quantity and quality during construction and operation of the Project as this may affect SAR 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 effects on human and ecological health is informed by the potential changes in water quality during construction and operation of the Project 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 6.9.1.4) and existing conditions (Section 6.9.2). 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 Quality (Appendix N-3).

6.9.1 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 6.9.2), the identification and description of applicable pathways of potential effects on the VC (Section 6.9.3) and a description of applicable mitigation measures for the VC (S Section 6.9.4). 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 6.9.6 and the significance of the residual effects is determined in Section 6.9.7.

6.9.1.1 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 provincial 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 (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.) 34/24: 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. 34/24.

Environmental Protection Act

The *Environmental Protection Act* (EPA; 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 EPA 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 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
- Section 53 of the OWRA requires that an Environmental Compliance Approval (ECA) 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 Guidelines (PWQOs) developed by MECP through its responsibilities under the OWRA and EPA, 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 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 an acting as a dam in a watercourse or lake without written approval.

6.9.1.2 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 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. General comments on water quality and quantity for Birch Lake, Springpole Lake and local inland waterbodies are included in Section 6.6.1.2. The key comments that influenced the assessment of the surface water of local inland waterbodies between the draft and final EIS/EA are provided below:

Baseline Conditions

MECP requested further information on surface water quantity monitoring station (flow and water level) at Unnamed Lake L-20 (L-20) in order to validate the predictions of the water balance assessment. The existing hydrometric baseline monitoring program had established sufficient stations to characterize runoff from both small and larger sub-watersheds within the Springpole Lake watershed. To prepare for permitting and long-term monitoring, two additional lake level monitoring stations were added to the 2023 monitoring program at L-20 and another reference local inland water body with a similar watershed size and characteristics. These allow for monitoring of potential impacts from the open pit drawdown cone on L-20. Flows out of these local inland water bodies are not monitored, as the level of accuracy required to validate water balance flow predictions is not achievable with this size of watershed. Further information is provided in the Baseline Hydrology Report (Appendix M-1, Section 4.6.2).

Mitigation and Monitoring

Mishkeegogamang Ojibway Nation requested clarification on the follow-up monitoring for the conclusions on local inland waterbodies. Section 12.6 includes a description of the follow-up monitoring program for surface water quantity and quality.

The Northwestern Ontario Métis Community requested further details on the frequency of proposed culvert inspections. Based on past experience, inspections would occur on a regular annual basis and after major storm events. This has been clarified in Section 6.9.4.

6.9.1.3 Spatial and Temporal Boundaries

The spatial boundaries used for the assessment of surface water systems are described in Section 6.6.1.3 and shown in Figure 6.6-3.

6.9.1.4 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.

6.9.1.5 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 and Section 6.6.1.5.

6.9.2 Existing Conditions

A description of 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. Numerous small unnamed inland waterbodies (small lakes and ponds less than or approximately 20 ha) in the vicinity of the Project site and represent the local inland waterbodies. These small waterbodies were surveyed between 2012 and 2023 (Figure 6.6-1, Figure 6.6-2) to establish existing conditions are used to support the assessment of potential effects from the Project. Baseline data collected also support long-term monitoring for the Project. Further 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).

Small inland waterbodies in the vicinity of the Project are characterized as having soft organic sediments and shorelines consisting predominantly of floating vegetation mats with small outcrops of bedrock. The maximum waterbody depth ranges greatly from 1 to 27 m but typical maximum depth is between 5 to 7 m. Water level monitoring has shown that the peak water levels occur slightly earlier in the year (approximately 1 week) than the adjacent large basin lake systems (Birch Lake and Springpole Lake).

A total of 133 water quality samples were collected in small inland waterbodies and tributaries between 2011 and 2023. Baseline surface water quality of inland waterbodies is presented in Table 6.9-1 and is representative of all waterbodies in the Local Study Area.

Similar to other baseline investigation area lakes, surface waters of small area lake have very low levels of total suspended solids (TSS), total dissolved solids (TDS) and turbidity. The pH levels for these small inland waterbodies are circumneutral to alkaline over the period of record, ranging from 6.8 to 8.0 pH units. The alkaline pH values are associated with summer sampling of surface (epilimnion) waters, wherein slightly higher pH values are likely driven by photosynthesis and generally warmer water quality conditions in these shallow systems (relative to large-body lakes). The TSS and TDS are generally low, although are relatively higher than samples collected in the large body lakes. Concentrations of total and dissolved metals in the inland waterbodies are very low, often at or below analytical detection limits and are consistently below available water quality guidelines for the protection of aquatic life. Overall, there are few occasions where measured baseline concentrations are outside the range of available water quality guidelines during the sampling period; these include:

- Phosphorous
- Copper

Phosphorous concentrations ranged from 0.008 mg/L to 0.112 mg/L and were frequently above the WQG PAL of 0.02 mg/L in small inland waterbodies (approximately 27% of all observations). The highest phosphorus concentrations were observed at stations SW-26 and SW-09 and were associated with elevated TSS levels (average TSS = 28 mg/L).

Total copper was greater than WQG PAL value of 0.005 mg/L on September 13, 2020 (0.0083 mg/L) at station SW-26.

6.9.2.1 Traditional Knowledge

As part of the Project, all eight Indigenous communities were contacted to participate in the EA process, and to provide Traditional Knowledge and Traditional Land and Resource Use (TK/TLU) information. To date, six Indigenous communities, Cat Lake First Nation, Lac Seul First Nation, Mishkeegogamang Ojibway Nation, Slate Falls Nation, Wabauskang First Nation and the Northwestern Ontario Métis Community, have provided Traditional Knowledge and Traditional Land and Resource Use information. Specific Traditional Knowledge and Traditional Land and Resource Use information relevant to surface water quality and quantity in Birch Lake, Springpole Lake and local inland waterbodies is described in Section 6.6.2.3.

6.9.3 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, where applicable. Table 6.9-2 includes the potential interactions of the Project with surface water, prior to the application of the mitigation measures. The professional judgement of technical experts experienced with mining projects in Ontario and 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 6.9.3and Table 6.9-3 provide a description of the mitigation measures applied to during all phases of the Project. The residual effects, after the application of the mitigation measures, are then described and further evaluated in Section 6.9.66.9.6, using the criteria and indicators identified in Section 6.9.1.4.

Construction Phase

The construction phase of the Project is expected to be developed 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 inland waterbodies as described below. After mitigation is applied to each pathway, as described in Table 6.9-3, 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 inland waterbodies. These activities result in pathways to potential effects on the surface water of inland waterbodies due to the change in catchment areas required to manage contact and non-contact water, which may affect the quantity of surface water contributing to L-20; 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 of inland waterbodies includes changes in surface water quantity and quality from these pathways.
- The construction of the mine access road, airstrip, onsite haul roads and onsite access roads, including the development and operation of aggregate resource areas interacts with the surface water of inland waterbodies. These activities result in pathways to a potential effect on the surface water of inland waterbodies due to the change in catchment areas required to manage contact and non-contact water, which may affect the quantity of surface water contributing to L-20; 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 includes changes in surface water quality from these pathways.

- The controlled dewatering of the open pit basin interacts with the surface water of inland waterbodies. This activity results in a pathway to a potential effect on the surface water of inland waterbodies due to groundwater management in the open pit basin which may affect surface water quantity in L-20. The assessment of potential effects on surface water of inland waterbodies includes changes in surface water quantity from this pathway.
- The establishment and operation of the water management and treatment facilities interacts with the surface water of the inland waterbodies. These activities result in a pathway to a potential effect on the surface water of the inland waterbodies due to the change in catchment areas required to manage contact water, which may affect the quantity of surface water contributing to L-20. The assessment of potential effects on surface water of the inland waterbodies includes changes in surface water quantity from this pathway.

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, this activity is unlikely to have potential effects on the surface water of the inland waterbodies.

During the construction phase, interactions between the surface waters of local inland waterbodies, the temporary construction camp, buildings, and other ancillary onsite infrastructure, as well as commissioning of the process plant are not anticipated. Once the portion of the north basin of Springpole Lake is isolated and dewatered (Section 6.7), the stripping of lakebed sediment and overburden will have no plausible interaction with surface waters of local inland waterbodies. Waterbodies and watercourses that are altered due to the construction of the central water storage pond and starter embankment of the co-disposal facility (CDF) are Project-affected waterbodies within the PDA and are not part of the surface waters of local inland waterbodies VC. The effects on these features are addressed in the revised Fish Habitat Offsetting and Compensation Plan (Appendix F). There is no plausible interaction between the employment and expenditures activities and local inland waterbodies during any Project phase.

The interaction between the surface water of local inland waterbodies and potential spills are not a planned activity that would occur within the normal operating conditions. However, the risk of an unplanned spill during all phases is fully accessed 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.

Operations Phase

The operations 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 inland waterbodies as described below. After mitigation is applied to each pathway, as described in Table 6.9-3, the residual effects are assessed using the criteria identified for each pathway:

- The operation of the open pit mine interacts with the surface water of inland waterbodies. This activity results in pathways to potential effects on the surface water of inland waterbodies due to the ongoing management of groundwater and surface water in the open pit basin to maintain dry working conditions that requires discharge to the receiving environment, and may affect surface water quality and quantity; 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 of inland waterbodies 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 inland waterbodies. This activity results in a pathway to a potential effect on the surface water of inland waterbodies due to the ongoing management of contact and non-contact water contributing to the north basin, which may affect surface water quantity. The assessment of potential effects on surface water of inland waterbodies includes changes in surface water quantity from this pathway.
- Progressive reclamation activities interact with the surface water of inland waterbodies. These activities result in a pathway to a potential effect on the surface water of inland waterbodies due to ground disturbances that could lead to changes in water quality from erosion and sedimentation. The assessment of potential effects on surface water of inland waterbodies includes the changes in surface water quality from this pathway.

The operation of the process plant, accommodations complex, CDF and the stockpiles are not expected to have a direct interaction with the surface waters of L-20 or other unnamed local inland waterbodies in the Local Study Area.

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 inland waterbodies as described below. After mitigation is applied to each pathway, as described in Table 6.9-3, the residual effects are assessed using the criteria identified for each pathway:

- The stabilization of disturbed areas during final reclamation, including re-grading, placement of an appropriate cover to facilitate revegetation, if needed, and revegetation (active or passive) interact with the surface water of inland waterbodies. These activities result in pathways to a potential effect on the surface water of inland waterbodies due to 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 of inland waterbodies includes changes in surface water quantity and quality from these pathways.
- The filling of the open pit basin with water during active closure interacts with the surface water of inland waterbodies. This activity results in a pathway to a potential effect on the surface water of the inland waterbodies due to the discontinuation of ongoing water management in the open pit that will lead to changes in the groundwater levels that may affect surface water quantity in the inland waterbodies. The assessment of potential effects on the surface water of inland waterbodies 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 and monitoring are unlikely to have potential effects on the surface waters of local inland waterbodies.

6.9.4 Mitigation Measures

Measures to be implemented to avoid or minimize the effects of the Project on surface water quality and quantity for local inland waterbodies 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;
- Watercourse crossings will be designed and constructed using best management practices such as appropriately sized structures (e.g., embedded culverts) to maintain hydraulic capacity and connectivity;
- An erosion and sediment control (ESC) plan will be prepared an implemented 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 erosion, sedimentation and stabilization including the use of natural vegetation buffers;
- 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 operations, inspect culverts periodically, and remove accumulated material and debris upstream and downstream of the culverts to prevent erosion, flooding, and mobilization of sediment; and
- Construction of the transmission line during frozen conditions to minimize effects on waterbodies and watercourses within the transmission line corridor.

The application of mitigation measures for the pathways of potential effects is illustrated in Table 6.9-3. 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. 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.

6.9.5 Analytical Methodology

The assessment of the surface water effects for the local inland waterbodies has been completed in accordance with generally accepted assessment methodologies. The prediction and assessment of effects to surface waters 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 6.9.3);
- 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

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

The analytical methodology, including quantitative modelling, used to support the assessment of surface water for the local inland waterbodies is as described in Section 6.6.5 (and Appendices N and M). In summary, the key features of the assessment include:

- A quantitative assessment of surface water was completed using water balance and water quality modelling using industry standard modelling software (GoldSim, Microsoft Excel and PitMod) to support the assessment process;
- Water balance and water quality modelling included predictions for the construction, operations, pit filling / initial closure and final closure phases, including pit water quality modelling; and
- Water balance and water quality modelling includes appropriately defined sensitivity scenarios to support the assessment of Project effects, including: a conservative base case, extreme wet scenario, extreme dry scenario and upper-case geochemistry loading sensitivity scenario (Sensitivity 3).

The receiving environment assessment node for the local inland waterbodies is identified in Figure 6.6-9. To support the quantitative water quality and water balance assessment for waterbodies within the PDA and Regional Study Area, an assessment node is strategically placed in an area where impacts to flow and water quality may be observed as a result of the Project. For local inland waterbodies, these are assessment nodes at L-20, Lake L-19, Lake L-1, Lake L-16 and Dole Lake.

The predictive modelling methods, data inputs and assumptions conducted to support the surface water effects assessment are included in Appendix M (hydrology) and Appendix N (water quality).

The assessment of the potential effects on surface water quality of local inland waterbodies compared model results against relevant provincial and federal criteria. Applicable surface water quality criteria for comparing the predicted water quality concentrations are equivalent to protection of aquatic life water quality guidelines; water quality guidelines for local inland waterbodies are as identified in Section 6.6.

6.9.5.1 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 are described in Section 6.6.5.4.

6.9.6 Characterization of Potential Residual Effects

The potential residual effects of the Project on the surface water of local inland waterbodies were assessed using both quantitative water balance and water quality modelling (Appendix M-3 and Appendix N-2, respectively) as well as qualitative methods, as discussed below. As identified in Section 6.9.5, model predictions were generated for assessment nodes at L-20, Lake L-19, Lake L-1, Lake L-16 and Dole Lake. Based on site footprint and model results, Lake L-19, Lake L-1 and Lake L-16 have been offset or compensated, as described in the revised Fish Habitat Offsetting and Compensation Plan (Appendix F) and are not assessed further. The local inland waterbodies included in the scope of this assessment of residual effects includes:

- L-20
- Dole Lake; and
- Unnamed waterbodies and watercourses within the mine access road and transmission line corridor of the PDA.

6.9.6.1 Change in Surface Water Quantity

Predicted changes to surface water quantity of the local inland waterbodies are driven by:

- Changes in groundwater contributions as a result of Project development; and
- Changes to local surface water catchment area as a result of water management activities.

The simulated changes groundwater-surface interactions (i.e., water budget) relative to baseline conditions for the local inland waterbodies Lake are:

Feature	Groundwater Contribution Change from Baseline (m^3/day and relative percent) [1,2]	
	Operations	Closure
L-20	-3 (30%)	1 (3%)

Modelling results predict a decrease in baseflow contribution from groundwater to surface water for L-20. During open pit dewatering, most surface water features in the PDA will experience a reduction in groundwater contributions to baseflow, including L-20, as described in Section 6.5. Given the small, predicted change in groundwater contribution to L-20, estimated changes are not expected to make an appreciable contribution to the lake water balance or lake levels of L-20. The effects of changing groundwater-surface water interactions to surface water flows and the lake water balance of L-20 are assessed quantitively in the receiving environment water balance model (Appendix M-3).

During the construction phase, the development of Project infrastructure at the mine site will temporarily remove the catchment area from L-20. However, negligible flow reductions (<1%) are predicted for L-20 relative to background conditions for all Project phases (Appendix M-3). Similarly, local inland waterbodies outside of the PDA, proximate to the mine access road, are outside of the groundwater modelling domain as there are no expected Project interactions with groundwater. With the implementation of best management practices for the installation of watercourse crossings along the mine access road and mine site haul roads, the effects to surface water quantity will be mitigated. As the effects to surface water quantity are predicted to be indistinguishable from baseline conditions, there are no residual effects.

6.9.6.2 Change in Surface Water Quality

For the purposes of the effects assessment, the predicted surface water quality for L-20 and Dole Lake is based on the conservative base case (average climate conditions, average seepage rates, base case geochemical loadings) and the identified upper-case seepage loadings. Water quality results for all sensitivity cases are presented in Appendix N-2. Local unnamed water bodies proximate to the mine access road are outside of the modelling domain for the Project and are assessed qualitatively.

The mine access road and transmission line will cross over small, medium and large watercourses (total approximately 45 crossings) as summarized below:

Section of the PDA	Small (<5 m)	Medium (5 to 20 m)	Large (>20 m)	Total
Mine Access Road	2	-	-	2
Transmission Line	28	4	11	43
Total	**30**	**4**	**11**	**45**

During the construction phase, Project interactions with surface water quality of L-20 and unnamed waterbodies proximate to the mine access road corridor are largely limited to erosion and sedimentation effects, linked to soil disturbance. Potential sedimentation and erosion effects, as indicated by a change in TSS, are assessed qualitatively. With the implementation of effective sedimentation and erosion control measures there are no potential increases to TSS and turbidity in the receiving environment beyond the range of natural variation. Therefore, there are no residual effects predicted for surface water in the local inland waterbodies due to sedimentation.

The transmission line is expected to be constructed primarily in the winter, from temporary winter roads that avoid construction during sensitive periods, as much as practical. The poles used for the transmission line will be located above the high-water mark to avoid in-water works. The maintenance of vegetation within the transmission line corridor will restrict vegetation heights; however, grubbing is not proposed, and riparian vegetation is expected to remain adequate to prevent long-term ground erosion and sedimentation to adjacent waterbodies. As a result, there are no residual effects to surface water quality predicted as a result of the transmission line.

Predicted water quality for L-20 conservatively assumed that water quality predictions for the operations phase are equivalent to the final year of operations (i.e., maximum build-out). In contrast, concentrations of water quality parameters in the CDF, central water storage pond and mine water of the open pit are expected to increase over time to these maximum values, coincident with mining of the open pit and expansion of the associated facilities. The predicted concentrations of water quality parameters are based on mass-balance modelling and the predictions for L-20 are presented in Appendix N-2. As the predicted concentrations of surface water quality parameters are indistinguishable from baseline conditions for L-20, there are no residual effects.

During all phases of the 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 in surface waters of Project-generated dust has the potential to affect surface water quality. With the implementation of mitigation measures for dust, the effects of dust deposition on L-20 is predicted to be negligible in the context of total sediment loads in Project surface waterbodies. The effects from atmospheric deposition to water quality are predicted by the water quality model and were not distinguishable from Base Case predictions. As such, potential effects to water quality related to atmospheric dust deposition are not anticipated to result in residual effects.

6.9.7 Significance of Residual Effects

With the proposed design and mitigation measures, residual effects on the surface water quantity and quality of local inland waterbodies are not predicted and therefore a determination of significance is not required.

6.9.8 Confidence Prediction

There is high confidence in the results of these residual effects assessment for surface water of local inland waterbodies. 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 realizations and sensitivity cases that have been 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 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 in the construction, operations and closure phases and will support validation of the surface water predictions.

Table 6.9-1: Baseline Water Quality Characterization of Local Inland Waterbodies

Parameter	Hardness (as CaCO3)	pH (unitless)	Total Suspended Solids	Total Dissolved Solids	Acidity (as $CaCO_3$)	Alkalinity, Total (as $CaCO_3$)	Ammonia, Total (as N)	Ammonia, Un-ionized (as N)	Chloride	Nitrate (as N)	Nitrite (as N)	Nitrate + Nitrite
WQG PAL	**-**	**6.5 to 8.5**	**-**	**-**	**-**	**-**	**2.22**	**0.02**	**128**	**3**	**0.06**	**-**
Count	113	113	113	113	90	113	111	1	38	101	101	9
Minimum	24.9	6.75	1.5	1.5	1	20	0.0025	0.005	0.11	0.01	0.005	0.05
25^{th}	36.2	7.46	1.5	59	1	34.7	0.0296	0.005	0.25	0.01	0.005	0.05
Average	48.4	7.58	19.2	67	2.47	45.6	0.235	0.005	0.488	0.0233	0.00512	0.0556
75^{th}	57.7	7.77	12.7	89	3	55.9	0.232	0.005	0.56	0.01	0.005	0.05
95^{th}	72.4	7.89	95	104	4.84	69	0.936	0.005	0.941	0.092	0.005	0.08

Parameter	Phosphorus, Total	Phosphorus-Dissolved	Sulfate	Dissolved Inorganic Carbon	Dissolved Organic Carbon	Aluminum (Al)	Antimony (Sb)	Arsenic (As)	Beryllium (Be)	Cadmium (Cd)	Cobalt (Co)	Copper (Cu)
WQG PAL	**0.02**	**-**	**-**	**-**	**-**	**1.2**	**0.02**	**0.005**	**0.011**	**0.0001**	**0.0008**	**0.005**
Count	113	46	100	46	81	113	113	113	113	113	113	113
Minimum	0.0037	0.001	0.15	5	2.5	0.0041	0.00005	0.00035	0.00001	0.0000025	0.00005	0.00025
25^{th}	0.0116	0.0105	0.5	7.33	15.8	0.0133	0.00005	0.0005	0.00001	0.0000025	0.00005	0.00025
Average	0.0188	0.0152	1.74	15.6	17.9	0.0336	0.0000735	0.000606	4.69E-05	9.32E-06	0.0001	0.000511
75^{th}	0.021	0.0225	2.6	20.4	20	0.0384	0.00005	0.00068	0.00005	0.0000051	0.00005	0.00052
95^{th}	0.0403	0.025	4.66	23.3	23.4	0.0792	0.00025	0.000872	0.00025	0.00005	0.00025	0.00111

Parameter	Iron (Fe)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Uranium (U)	Vanadium (V)	Zinc (Zn)	Zirconium (Zr)
WQG PAL	**1**	**0.013**	**0.000026**	**0.073**	**0.025**	**0.1**	**0.0001**	**0.00025**	**0.005**	**0.006**	**0.02**	**0.004**
Count	113	113	101	108	113	113	113	113	113	113	113	113
Minimum	0.034	0.000025	0.0000025	0.000025	0.00025	0.000025	0.000005	0.000005	0.000005	0.00025	0.0015	0.00003
25^{th}	0.065	0.000025	0.0000025	0.000025	0.00025	0.000071	0.000005	0.000005	0.000005	0.00025	0.0015	0.0001
Average	0.159	0.0000869	0.00000304	0.000105	0.000283	0.000189	0.0000122	0.0000076	1.29E-05	0.000257	0.00184	0.000143
75^{th}	0.15	0.000065	0.0000025	0.000178	0.00025	0.0001	0.000005	0.000005	0.000013	0.00025	0.0015	0.0001
95^{th}	0.497	0.00025	0.0000053	0.00025	0.0005	0.001	0.00005	0.000025	0.00005	0.00025	0.0034	0.0005

Notes:

WQG PAL: Water Quality Guideline for the Protection of Aquatic Life (long-term exposure), refer to Table 6.6-6

- = indicates value is not available

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)

- = indicates value is not available

Grey shaded values are greater than identified WQG

Table 6.9-2: Potential Interactions of Project Components on Local Inland Waterbodies

Project Component / Activity	Local Inland Waterbodies
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 the aggregate resource areas	Yes
Development of temporary construction 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 central water storage pond	
Controlled dewatering of the open pit basin	Yes
Construction of the starter embankments for the CDF	-
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	-
Establishment and operation of water management and treatment facilities	Yes
Commissioning of the process plant	-
Employment and expenditures	-
Operations Phase	
Operation of the process plant	-
Operation of open pit mine	Yes
Management of overburden, mine rock, tailings and ore in designated facilities	-
Operation of water management and treatment facilities	Yes
Accommodations complex operations	-
Operation and maintenance of mine site infrastructure	-
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 dewatered open pit basin with water	Yes
Monitoring and maintenance	-
Employment and expenditures	-

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

Table 6.9-3: Proposed Mitigation Measures for Potential Local Inland Waterbodies Effects

Pathways to Potential Effect / Criteria	Phase Con.	Phase Op.	Phase 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.
	•	–	–	Watercourse crossings will be designed and constructed using best management practices such as appropriately sized structures (e.g., embedded culverts) to maintain hydraulic capacity and connectivity.
	–	•	–	Inspect culverts periodically and remove accumulated material and debris upstream and downstream of the culverts to prevent erosion, flooding, and mobilization of sediment.
	•	–	–	Construction of the transmission line during frozen conditions to minimize effects on waterbodies and watercourses within the PDA of the transmission line corridor.
Change in water quality	•	•	•	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.

Table 6.9-3: Proposed Mitigation Measures for Potential Local Inland Waterbodies Effects

Pathways to Potential Effect / Criteria	Phase			Proposed Mitigation Measure
	Con.	Op.	Cl.	
	●	–	–	An erosion and sediment control (ESC) plan will be prepared an implemented 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 erosion, sedimentation and stabilization including the use of natural vegetation buffers.
	●	●	–	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.
	–	●	–	Inspect culverts periodically and remove accumulated material and debris upstream and downstream of the culverts to prevent erosion, flooding, and mobilization of sediment.
	●	–	–	Construction of the transmission line during frozen conditions to minimize effects on waterbodies and watercourses within the PDA of the transmission line corridor.

Notes:
Con. = construction; Op. = operations; Cl. = closure; ● = mitigation is applicable; – = mitigation is not applicable.