Human and Ecological Health Risk Assessment

Springpole Gold Project

First Mining Gold Corp.

ONS2104

Prepared by:
WSP Canada Inc.

October 2024

Human and Ecological Health Risk Assessment Springpole Gold Project

Red Lake District, Northwest Ontario
Project #ONS2104

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EXECUTIVE SUMMARY

Human and Ecological Health Risk Assessment Objective

The objective of the human and ecological health risk assessment (HEHRA) is to assess the potential health risks to human and ecological receptors as a result of exposure to chemicals associated with the Springpole Gold Project (Project), in accordance with the current regulatory guidance on environmental assessment (EA) and risk assessment to support First Mining Gold Corp. in achieving final Project approval under *Canadian Environmental Assessment Act, 2012* (S.C. 2012, c. 19, s. 52) and the Ontario *Environmental Assessment Act* (R.S.O. 1990, c. E.18).

Any chemical to which humans and ecological receptors are exposed (from both anthropogenic and natural sources) has the potential to cause adverse health effects. However, it is the characteristics of the Receptor (e.g., age, body weight, size), the nature of the hazard (chemical concentration and toxicity) and nature of the exposure (duration and route by which receptors contact a particular chemical) that determines if it may cause harm to their health. If all three components (receptor, hazard and exposure) are present, the possibility of risk exists. If one or more of the three components is missing (e.g., there is no way for the receptor to be exposed to the chemical), then there would be no risk.

The HEHRA is divided into two main components: a human health risk assessment (HHRA), including a country foods assessment, and an ecological risk assessment (ERA). An HHRA is the process of estimating the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future. Similarly, an ERA assesses potential health risk to ecological receptors who may be exposed to chemicals in environmental media.

The HEHRA was conducted according to widely accepted HEHRA methods. The HHRA was completed using Health Canada guidance documents. The ERA follows the framework within the Canadian Council of Ministers of the Environment (CCME) Ecological Risk Assessment Guidance Document (CCME 2020).

For the purposes of the HEHRA, concentrations of chemicals of potential concern (COPCs) in environmental media (including air, soil, surface water, plants and fish) were measured or modelled during baseline studies. Models were then utilized to predict potential changes in chemical concentrations in each media due to the Project. Results of these models were incorporated into the HHRA and ERA models to quantitatively estimate potential hazards and risks to human and ecological health. The estimated hazards and risks predicted in the HEHRA are then compared to widely accepted targets established by regulatory bodies such as Health Canada or Environment Canada.

Due to the conservative nature of the assumptions incorporated into each of these predictive models, an exceedance of the established targets does not indicate that an adverse health affect will occur. Rather, it indicates that consideration of the conservative inputs be provided and that additional assessment and/or monitoring may be required to reduce uncertainty, to verify the accuracy of the results of the predictive models and validate HHRA model risk calculations.

Spatial Boundaries, Temporal Boundaries and Assessment Scenarios

The HEHRA assessed potential risk to human and ecological health at Receptor locations within the Local Study Area (LSA) and Regional Study Area (RSA), chosen to represent the areas where human and ecological receptors may experience chemical exposure during the various phases of the Project. The point of reception (POR) locations assessed for the HEHRA are defined in Table E.1.

Table E.1: Points of Reception Locations in the Risk Assessment

Receptor Location	Description
Maximum Point of Impingement (MPOI)	The MPOI is a theoretical point where maximum air emissions are predicted along the Project property boundaries, in close proximity to the mine site area of the Project Development Area (PDA). This point is not a specific location, but rather varies for various chemicals and emission sources, and is typically used for the human health worst-case scenario and for the ecological health assessment.
Point of Reception (POR) Locations	The POR locations include representative existing cabins, camps and camping areas in addition to locations that represent areas where Traditional Land and Resource Use (TLRU) may be practised outside of the mine site area of the PDA but within the LSA and RSA. These POR locations are considered to conservatively represent areas closest to the mine site area of the PDA where human receptors may spend time. There are no sensitive / community-based receptors, as defined by CCME, within the mine site area of the PDA. It should be noted that there are potential TLRU PORs identified in select areas within the Project property boundaries (but outside the mine site area of the PDA), it is possible that one or more of these locations may represent a point with higher air emissions than at the MPOI.

The assessment considered all phases of the Project: construction phase (Years -3 to -1), operations phase (Years 1 to 10), decommissioning and closure phase (consisting of active closure (Years 11 to 15) and post-closure (Years 16+). The construction, operations, decommissioning and active closure phases (18 years) are deemed suitable to capture all of the environmental effects associated with the Project. The HEHRA evaluation at the post-closure phase will reflect predicted exposures from conditions after active closure is complete. Temporal consideration in the HEHRA also includes the nature of exposure as well as site-specific and receptor-specific durations over which the exposures will occur.

The HEHRA evaluated potential health risks to human receptors (i.e., residents, visitors, land users / harvesters) and ecological receptors (i.e., terrestrial and aquatic wildlife, invertebrate and vegetation communities) associated with chemical concentrations in exposure media for various Assessment Scenarios, including baseline conditions (i.e., Baseline Assessment Scenario), Project alone (Project Alone Assessment Scenario), and a combination of Baseline and Project (Project Assessment Scenario), as per EA guidance. In addition, the assessment evaluated a passive phase of environmental reclamation following closure, referred to as the Post-closure Assessment Scenario.

Chemicals of Potential Concern and Receptors

Chemical parameters related to the Project, including criteria air parameters (CAPs), polycyclic aromatic hydrocarbons (PAHs), diesel particulate matter resulting from diesel combustion and metals, were considered in the assessment of potential adverse effects on human and ecological health. Concentrations of chemicals in environmental media (including air, soil, surface water, sediment, plants, game meat and fish) were measured or modelled during baseline studies. The datasets associated with each media were sufficient to allow for the use of statistical analyses to determine exposure point concentrations (EPC) for each COPC. The EPC of chemicals in the various media were dependent on receptor location, Project phase and Assessment Scenario.

Human receptors who may receive chemical exposure include individuals who spend time at the identified POR locations within the LSA / RSA, including in the residential area at Slate Falls First Nation, at cabins, lodges or camps used for recreational, hunting and fishing purposes and/or in areas where Traditional Land

and Resource Use (TLRU) such as fishing, hunting, harvesting / gathering of plant material and spiritual / cultural practices may take place. The human receptors considered for the assessment of potential adverse effects on human health in the HHRA were assumed to be Residents of nearby Indigenous or non-Indigenous communities who spend part of their time at, cabins and/or who conduct TLRU activities within the LSA / RSA near the PDA. To help ensure a conservative potential human exposure was evaluated, the most sensitive human receptors were assumed to be Indigenous community Residents who spend time near the PDA and are either average or heavy consumers of a variety of country foods (which they are assumed to hunt or harvest year-round, predominantly from the LSA). Due to the nature of evaluating potential non-cancer risk and carcinogenic risks, different exposure considerations are adopted. The following receptor scenarios were assessed in the HHRA:

1) **Indigenous Resident / Cabin receptor:** This receptor is assumed to spend 60 percent (%) of their time in their community and 40% of their time at one of 4 cabins located closest to the PDA (within the LSA), conducting TLRU activities and consuming country foods harvested from the same area. For this receptor scenario, HHRA calculations were completed to assess exposure at four cabins closest to the PDA, considering both average and heavy country foods consumption rates. For non-carcinogenic risks, exposure to this receptor is based on concentrations present at the Cabin. For carcinogenic risks (which is based on lifetime exposure), the exposure is based on time at the residential community (60%) and at the cabin (40%). Both scenarios assume 100% of country foods are sourced from Birch Lake or Springpole Lake.
2) **Indigenous Resident / TLRU receptor:** This receptor is assumed to spend 80% of their time in their community and 20% of their time conducting TLRU activities near the PDA, consuming country foods harvested from the area. For this receptor scenario, HHRA calculations were completed to assess exposure at four TLRU points of reception closest to the PDA, considering both average and heavy country foods consumption rates. For non-carcinogenic risks, exposure to this receptor is based on concentrations present at the TLRU. For carcinogenic risks (which is based on lifetime exposure), the exposure is based on time at the residential community (80%) and at the TLRU (20%). Both scenarios assume 100% of country foods are sourced from Birch Lake or Springpole Lake.

The above receptor exposure scenarios are considered to conservatively represent Indigenous and non-Indigenous exposure within the RSA. Although Indigenous community members in the area of the Project have reported conducting TLRU activities that include overnight visits throughout the RSA, they have not indicated that specific cabins, lodges or camps are used during these visits. Indigenous community members have reported harvesting country foods from the RSA, but their harvest area is not necessarily limited to within the LSA or RSA.

The ERA assessed the potential for adverse effects to terrestrial plants, soil invertebrates, mammals, birds, amphibians and reptiles and aquatic receptors. Mammals and birds were selected to represent various feeding guilds.

Potential Health Effects Assessment

A potential health effect is defined as when the risk for the Project Assessment Scenario (i.e., Project Alone + Baseline) and/or the Post-closure Assessment Scenario (Post-closure + Baseline) via the sum of all pathways, exceeds the applicable risk benchmark and the estimated potential risk for the Baseline Assessment Scenario. The evaluation of potential health effects has focused on the Project Assessment Scenario as a conservative approach, recognizing that receptors cannot be exposed to the Project Alone Assessment Scenario under real world conditions. For human health exposure to CAPs, the only exposure pathway is via the inhalation of air pathway and therefore potential adverse effects were characterized based on the inhalation pathway alone. Whereas, for inorganic metals (and methylmercury) human exposure may

be via inhalation and also via direct contact with soil, water, sediment and ingestion of country foods, therefore potential health effects are characterized based on the sum of all exposure pathways.

The COPCs were selected for further consideration if their predicted maximum concentration exceeded its federal criteria or guideline. In the absence of a federal criteria / guideline, provincial criteria / guidelines / standards were selected. For all COPCs selected, a supplemental screening was conducted specific to human health and ecological receptors, in the HHRA and ERA, respectively. Where the EPC of a COPC exceeded its supplemental screening value protective of human or ecological health it was carried forward into the HHRA or ERA for a quantitative risk assessment and assessment of potential health effects via the sum of all pathways.

The estimated potential risk via the sum of all exposure pathways is based upon predictions that incorporate expected mitigation measures.

Results of the Human Health Risk Assessment

Criteria Air Parameters via Inhalation of Air

Exposures to CAP emitted from the Project results were below their respective guidelines for all exposure scenarios at the MPOI and at the maximum Points of Reception.

Risk characterization results for PAHs and DPM via ambient air inhalation pathway indicated that results for all points of reception considered in the HHRA were within non-carcinogenic and carcinogenic targets.

Chemicals of Concern via all Exposure Pathways

The results of the human health specific screening identified four COPC (arsenic, cobalt, mercury, methylmercury) for further evaluation in the HHRA.

The predicted increases in COPC concentrations between the Baseline Assessment Scenario and the Project and Post Closure Assessment Scenarios were negligible for air, soil, sediment, surface water country foods. Predicted increases in COPC concentrations in surface water did not result in exceedance of applicable human health or aquatic life guidelines.

The HHRA results for predicted non-carcinogenic effects for metals COPC are as follows:

- Arsenic (all media and exposure pathways) – the Total Hazard Quotients (THQ) are at the target of 1 at baseline conditions for the heavy country foods consumer. The change at the selected PORs from Baseline to Project and Post-closure Assessment Scenarios are conservative, as discussed below, representing a negligible increase in predicted human health risk from arsenic exposure. There were no exceedances for the average country foods consumer.
- Cobalt (all media and exposure pathways) – the THQs are below the threshold of 1 for all receptor locations and Assessment Scenarios for both heavy and average consumers, with the exception of a negligible exceedance at POR04 (i.e., a THQ of 1.1 versus a target of 1.0 at the TLRU immediately west of the PDA). The calculations are highly conservative, as discussed below, and potential increases in risk associated with non-carcinogenic effects from cobalt from the Project is not expected.
- Mercury (all media and exposure pathways) - There were no exceedances of the non-carcinogenic targets for exposure to mercury via all exposure pathways combined.
- Methylmercury (all media and exposure pathways) – the THQs exceed the threshold of 1 for the heavy consumer (sensitive individuals and general population) and average country foods consumer at all receptor locations and Assessment Scenarios, including Baseline. The threshold was

not exceeded for the general population for the average consumer. The only exposure pathway contributing to the HHRA results for methylmercury is fish ingestion which accounts for 100% in all exposure Assessment Scenarios (Baseline, Project and Post-closure). This result is not unexpected and is reflected in the fish consumption advisory that has been put in place by the Government of Ontario for Birch Lake and other lakes in Ontario, due to existing mercury concentrations in fish. Concentrations of methylmercury in fish fillets is quite variable amongst fish species and the length of the fish. The Lake Whitefish fish tissue concentrations estimated as occurring during the project are up to 0.143 mg/kg wet weight, within the range of Baseline concentrations measured in 2022 (0.0365 to 0.204 mg/kg wet weight). The Walleye fish tissue concentrations estimated as occurring during the project are up to 0.716 mg/kg wet weight, within the range of Baseline concentrations measured in 2022 (0.112 to 1.94 mg/kg wet weight). As such, changes in fish tissue methyl mercury concentrations from the Baseline Assessment Scenario to the Project and Post-closure Assessment Scenarios are expected to be negligible. The calculations are highly conservative, as discussed below, and potential increases in risk associated with non-carcinogenic effects from methylmercury from the Project is not expected.

A number of assumptions are included in this assessment which are expected to overestimate potential risk. The receptor is assumed to obtain 100% of their country foods in close proximity to the PDA. Additionally, concentrations used in the exposure assessment assume 95% UCLM for baseline soil and country foods quality and maximum 75th percentile over the year for surface water quality. The conservative surface water concentration has a notable effect on the overall risk estimates. In addition, the toxicity reference values used to calculate the THQs are designed to be conservative. Therefore, potential increases in risk associated with non-carcinogenic effects from COPCs from the Project is not expected.

Incremental lifetime cancer risk estimates for arsenic identified negligible exceedances of the target of 0.00001 (ranging from 0.000011 to 0.000023) at some POR locations for the heavy consumers of country foods who are assumed to be harvesting all of their country foods from areas closest to the PDA. If it is assumed that heavy country foods consumer obtain 50% of their country foods from the LSA, calculated risks are reduced with negligible exceedances (0.000011 to 0.000014) at only two TLRU POR locations closest to the PDA. There are no exceedances of the target for average country foods consumers.

The evaluation of potential risk from carcinogenic effects assumes the receptors are exposed to COPCs near the PDA for a portion of every year for their entire lifetime. In addition, the toxicity reference value used to calculate the ILCRs are designed to be conservative. The change in calculated risk levels from the Baseline Assessment Scenario to Project and Post-Closure Assessment Scenarios are negligible considering the conservatism built into the models.

In all cases, the potential risk is driven primarily by the fish consumption exposure pathway. These are conservative estimates as:

1) receptors are assumed to obtain 50 to 100% of their country foods from Birch Lake or Springpole Lake throughout an entire lifetime. These likely over-estimates as the area is remote and although some Indigenous communities in the area report harvesting country foods including fish from within the LSA, they also report harvesting country foods from areas outside the LSA and RSA.
2) Surface water concentrations are based on models which do not account for mixing throughout the water column, resulting in surface water concentrations greater than is likely to occur.
3) Fish concentrations are predicted based on uptake from predicted surface water concentrations that are likely to be over-estimated.

There is a provincial fish consumption advisory currently in effect for Birch Lake and other lakes in Ontario (based on existing mercury concentrations in upper trophic level fish). Following the consumption advisory may act to limit exposure to arsenic, cobalt and methylmercury within the LSA/ RSA for all Assessment Scenarios, including Baseline. It is noted that fish consumption serves as an essential source of nutrition and fish consumption has been linked to many health benefits such as cardiovascular health (Health Canada, 2007).

In general, a high degree of conservatism is incorporated into the models used to predict Project related air emissions, deposition to soil and predicted surface water, sediment and fish concentrations. In addition, the conservative assumptions used in the HHRA model result in overestimation of the predicted risks to human health.

The change in calculated risk levels from the Baseline Assessment Scenario to Project and Post-Closure Assessment Scenarios are negligible and potential risks to human receptors who spend time in cabins and/or practice traditional land use in areas surrounding the Project are not anticipated.

Results of the Ecological Risk Assessment

The results of the ERA screening identified 14 COPCs based on exceedances of their respective criteria / guidelines / standards.

The ERA identified the following:

- Surface water concentrations did not exceed guidelines (Section 3.4.2.3).
- Soil concentrations did not exceed benchmark values for terrestrial receptors (Section 5.6.2).
- Sediment concentrations for some metals exceed benchmark values; however, the Project did not result in an increase the potential risk (Section 5.6.2).
- Multimedia exposure model identified a low potential risk to birds and mammals.

The results of the ERA identified risk estimates exceeding baseline and the benchmark in three instances: manganese for the muskrat, methylmercury for the Bald Eagle and lead for the spotted sandpiper. Due to the conservative assumptions associated with these scenarios, no potential risk to mammals and birds via exposure to chemicals in Project-influenced media within the LSA is anticipated.

Human and Ecological Health Risk Assessment Conclusions

The change in calculated risk levels from the Baseline Assessment Scenario to Project and Post-Closure Assessment Scenarios are negligible considering the conservatism built into the models. Potential risks resulting from the Project to ecological receptors, in addition to human receptors who spend time in cabins and/or practice traditional land use, in areas surrounding the Project are not anticipated. As a result, there are no anticipated residual effects on human or ecological health from the Project.

Monitoring programs, including for surface water and fish, will be implemented to verify the accuracy of the predicted effects, validate the models and 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. 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.

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LIST OF ABBREVIATIONS

AAQC	Ontario Ambient Air Quality Criteria
AO	aesthetic objective
BW	body weight
CAAQS	Canadian Ambient Air Quality Standards
CAP	criteria air parameters
CCME	Canadian Council of Ministers of Environment
CDF	co-disposal facility
CO	carbon monoxide
COPC	chemical of potential concern
DPM	diesel particulate matter
EA	environmental assessment
Eco-SSL	Ecological Soil Screening Level
EHQ	ecological hazard quotient
EIS	Environmental Impact Statement
EPC	exposure point concentration
ERA	ecological risk assessment
FCSAP	Federal Contaminated Sites Action Plan
FEQG	Federal Environmental Quality Guideline
FMG	First Mining Gold Corp.
FNFNES	First Nations Food, Nutrition & Environment Study
HEHRA	human and ecological health risk assessment
HHRA	human health risk assessment
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
LEL	lowest effect level
LOAEL	lowest observable adverse effect level
LOE	lines of evidence
LSA	Local Study Area
MECP	Ministry of the Environment, Conservation and Parks
MOECC	Ministry of Environment and Climate Change
MPOI	maximum point of impingement
NO_2	nitrogen dioxide
NOAEL	no observable adverse effect level
PAH	polycyclic aromatic hydrocarbon
PEL	probable effect level
PM	particulate matter
PM_{10}	particulate matter 10 micrometres or less
$PM_{2.5}$	particulate matter 2.5 micrometres or less
POR	Point of Reception
PQRA	Preliminary Quantitative Risk Assessment
Project	Springpole Gold Project
PWQO	provincial water quality objectives
RAIS	Risk Assessment Information System

RfC	Reference Concentrations
RfD	Reference Doses
ROC	Receptor of Concern
RSA	Regional Study Area
SAR	Species at Risk
SEL	severe effect level
SO_2	sulphur dioxide
SPM	suspended particulate matter
SQG	soil quality guideline
TDI	Tolerable Daily Intake
THQ	total hazard quotient
TLRU	Traditional Land and Resource Use
TRV	toxicity reference value
TSS	total suspended solids
UCLM	upper confidence limit of the mean
US EPA	United States Environmental Protection Agency
WHO	World Health Organization
WOE	weight of evidence
WSP	WSP Canada Inc.

UNITS OF MEASURE

cm^2	square centimetre
g/d	grams per day
g/m^2	grams per square metre
ha	hectare
km	kilometre
m	metre
mg/kg	milligrams per kilogram (equal to ppm)
mg/kg-d	milligrams per kilogram per day
mg/kg-yr	milligrams per kilogram per year
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
µg/g	micrograms per gram (equal to ppm)
$µg/m^3$	micrograms per cubic metre
ppm	parts per million
ppb	parts per billion

1.0 INTRODUCTION

First Mining Gold Corp. (FMG) proposes to develop, operate and eventually decommission and close an open pit gold mine and ore process plant with supporting infrastructure known as the Springpole Gold Project (Project). The Project is located in a remote area of northwestern Ontario, approximately 110 kilometres (km) northeast of the Municipality of Red Lake and 145 km north of the Municipality of Sioux Lookout (Figure 1-1).

An environmental assessment (EA) pursuant to the *Canadian Environmental Assessment Act, 2012* (S.C. 2012, c. 19, s. 52) and the Ontario *Environmental Assessment Act* (R.S.O. 1990, c. E.18) is required to be completed for the Project. This report is one of a series of Technical Support Documents prepared by WSP Canada Inc. (WSP) on behalf of FMG to describe the predicted environmental effects of the Project.

The construction and operation of the Project may increase emissions of criteria air parameters (CAPs), volatile organic compounds, polycyclic aromatic hydrocarbons (PAHs), diesel particulate matter (DPM) and/or metals that could disperse to the adjacent areas through deposition or surface water effluent. Humans and wildlife in the area of the Project could be exposed to these increased chemical of potential concern (COPC) concentrations through inhalation and/or through ingestion of soil, surface water, sediment and food. For humans, this includes Traditional foods (i.e., vegetation, fish and wild game). The human and ecological health risk assessment (HEHRA), which consists of a human health risk assessment (HHRA) and an ecological risk assessment (ERA), will assess exposure to media and food to determine potential health risks from the proposed Project.

1.1 Purpose and Objective of the Report

This Human and Ecological Health Risk Assessment Report has been prepared to:

- Evaluate Project-related health effects on humans and ecological receptors;
- Determine the exposures and associated risks that are predicted to occur from Project-related COPCs under the Baseline Assessment Scenario, Project Assessment Scenario and Post-closure Assessment Scenario; and
- Evaluate and summarize the predicted Project-related changes in human health or ecological health risks between the Baseline Assessment and Project Assessment Scenarios and Post-closure Assessment Scenario.

1.1.1 Project Overview

FMG has focused on designing a compact and highly efficient mine site. With a mine site footprint of only 867 hectares (ha) and a total Project footprint of approximately 1,365 ha when considering the access road and transmission line, the Project achieves being one of the smallest open pit mining projects in the Canadian gold sector for a mine of its production capacity.

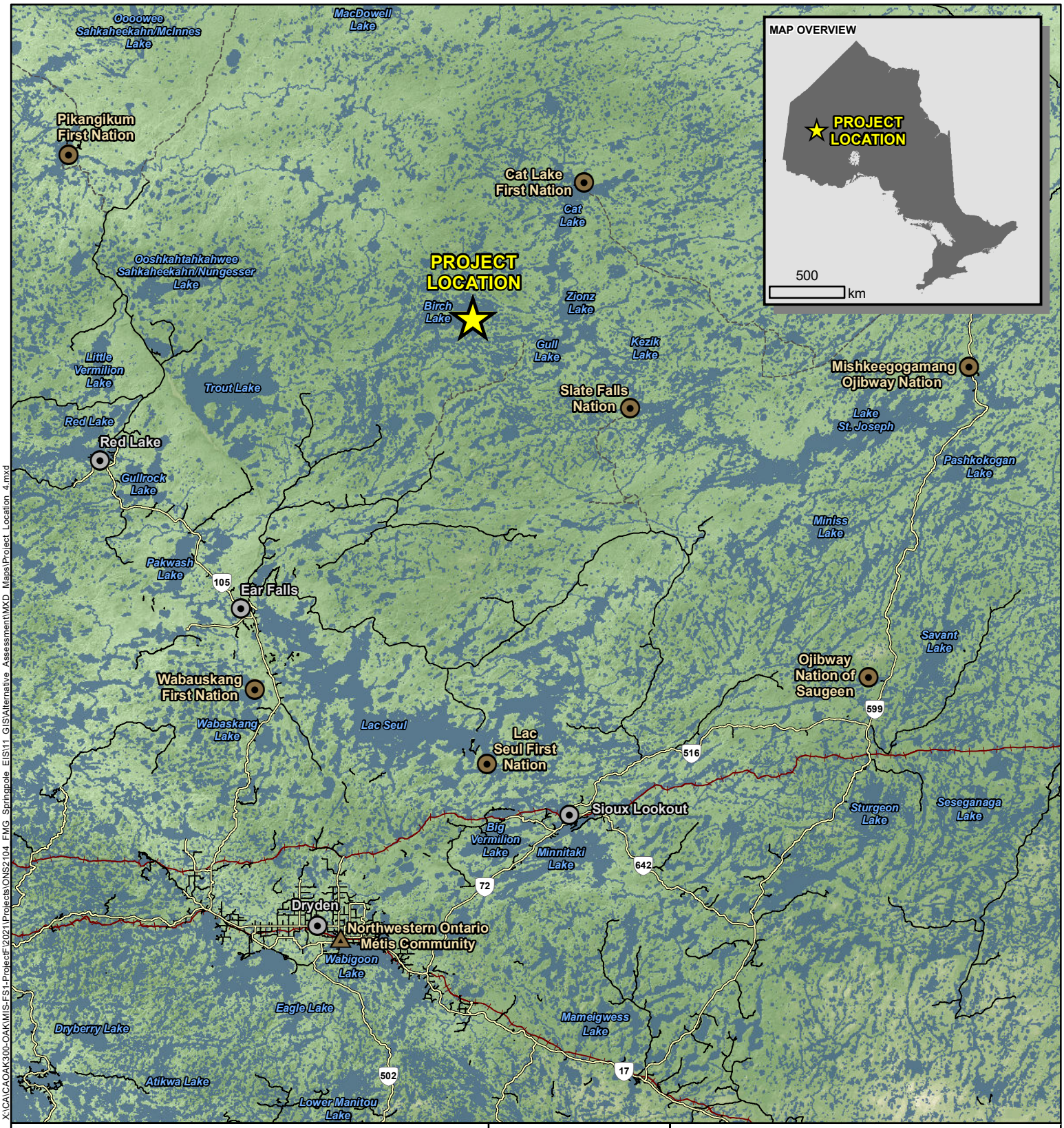
The ore body is located under a small portion of Springpole Lake. To allow the development and safe operation of the open pit mine, dikes will be established to facilitate safe and controlled dewatering of the open pit basin. Ore from the open pit will be processed in an onsite process plant at approximately 30,000 tonnes per day. Tailings resulting from the processing of ore will be stored in a co-disposal facility (CDF).

The main components of the Project include:

- Open pit;
- Dikes;
- CDF for mine rock and tailings (north cell and south cell);
- Surficial soil stockpile;
- Ore stockpiles;
- Process plant complex;
- Buildings and supporting infrastructure;
- Water management and treatment facilities;
- Fish habitat development area;
- Accommodations complex;
- Aggregate operation(s);
- Transmission line; and
- Mine access road and co-located airstrip.

In addition to the mine site footprint, the Project Development Area (PDA) includes a 40 metre (m) wide corridor for the transmission line and a 30 m wide corridor for the mine access road, and conservatively also includes a buffer around the planned mine site footprint to allow flexibility for future detailed engineering optimizations.

The Project is expected to be developed over a two- to three-year construction period (Years -3, -2 and -1) during which the installation of two dikes will be established to isolate a portion of the north basin of Springpole Lake to support the safe and controlled dewatering of the open pit basin. A mine life (operations phase) of approximately 10 years (Years 1 to 10) is anticipated based on the extensive work carried out to define the Springpole ore body. Progressive reclamation will be carried out during operations, and final decommissioning and closure of the site will follow once operations cease. The primary decommissioning and closure period (i.e., active closure during Years 10 to 15) will be followed by a period of post-closure environmental monitoring (Years 16+).



LEGEND

- Project Location
- Town
- First Nation Reserve
- Northwestern Ontario Métis Community
- Highway
- Secondary Road
- Resource / Winter Road
- Railway

0 12.5 25 50 75 100 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

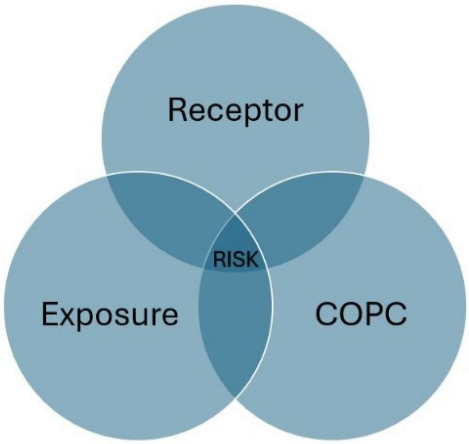
Project Location

PROJECT N°: ONS2104	**FIGURE: 1-1**
SCALE: 1:1,500,000	DATE: September 2024

2.0 OVERVIEW OF THE RISK ASSESSMENT PROCESS

An HHRA is the process of estimating the nature and probability of adverse health effects in humans who may be exposed to COPCs in environmental media, now or in the future. Similarly, an ERA assesses potential health risk to ecological receptors who may be exposed to COPCs in environmental media. All chemicals (from both anthropogenic and natural sources) have the potential to cause adverse effects. However, the magnitude of effect (risk) depends on the receptor being exposed, the route and duration of exposure and the inherent toxicity of the COPC. If all three components (receptor, exposure and hazard) are present (i.e., where the three circles in Figure 2-1 intersect) the possibility of risk exists. If one or more of the three components is missing, then there would be no risk.

Figure 2-1: Risk Assessment Components



The HHRA and ERA process involves the following four fundamental steps, which will be discussed in the sections below:

- Problem formulation;
- Exposure assessment;
- Toxicity / effects assessment; and
- Risk characterization.

2.1 Problem Formulation

The problem formulation includes three key aspects: identification of COPCs, characterization of receptors that could be exposed to the COPCs and characterizing the exposure pathways by which exposure to the COPCs may occur.

The COPCs are identified by comparing the concentrations in the application media (i.e., air, soil, surface water and sediment) to screening values protective of human health and ecological receptors.

Receptors within the HHRA are people in the Local Study Area (LSA) and Regional Study Area (RSA) who have a high potential for exposure to COPCs. Within the ERA, receptors are any non-human individual, species, population, community, habitat or ecosystem that may potentially be exposed to COPCs in the LSA and RSA. These commonly include terrestrial and aquatic plants, invertebrates, birds and mammals.

The problem formulation evaluates which exposure pathways are considered complete to the human or ecological receptors. The exposure pathways may be direct (e.g., ingestion of surface water) or indirect (e.g., ingestion of fish exposed to surface water).

2.2 Exposure Assessment

The exposure assessment is conducted for all relevant chemicals, exposure pathways and receptors identified in the problem formulation. For some pathways, the exposure assessment involves the estimation of the intake of chemicals of concern by human and ecological receptors. The total estimated intake is calculated via the sum of intakes from each exposure pathway identified in the problem formulation. This step involves the determination of exposure point concentrations (EPCs) for each chemical in the various environmental media, either by direct measurement or predictive modelling. The exposure assessment also includes the intake rate of each environmental media by the relevant receptors.

2.3 Toxicity / Effects Assessment

The toxicity / effects assessment is completed for all relevant COPCs identified in the problem formulation and involves the identification of the toxic endpoints for each. It involves the determination of either: a) a maximum dose or concentration of each chemical to which a receptor can be exposed without an appreciable amount of adverse health effect occurring (threshold dose or concentration); or b) the relationship between dose and incidence or severity of adverse effect (dose-response identification). In most cases the toxicity assessment involves the selection of a benchmark or toxicity reference value (TRV) recommended by an appropriate regulatory agency (such as Health Canada, Environment and Climate Change Canada, the Ministry of the Environment, Conservation and Parks [MECP] or the Canadian Council of Ministers of the Environment [CCME]). In cases where a regulatory published TRV is not available, a TRV is identified from an evaluation of the most current state of science, based on a review of peer-reviewed study manuscripts presenting scientific data.

2.4 Risk Characterization

The risk characterization step involves qualitatively and quantitatively evaluating the potential risks to receptors resulting from exposure to each chemical. The risk characterization step is done for all chemicals and exposure pathway / receptor combinations identified in the problem formulation step. The risk characterization involves the following:

- Integration of exposure and toxicity assessments to calculate a risk value; and
- Comparison of the risk value to a regulatory benchmark of risk to determine the level of "acceptability."

Uncertainty is an inherent aspect of the risk assessment process due to necessary assumptions regarding the Project site, receptor characteristics and mathematical modelling. Uncertainties may arise from a number of areas due to some inherent lack of precision about the true value of a parameter (e.g., body weight, inhalation rate, ingestion rate). Uncertainties are accounted for by assuming conservative receptor and exposure scenarios to exaggerate exposures to help ensure that risks are not underestimated.

In the framework for the HEHRA specific to the EA process, potential risks are discussed in the context of the Assessment Scenarios. That is, the potential risks identified for the combination of baseline, Project (i.e., Project Assessment Scenario) and post-closure are evaluated. The risks identified for the Project and post-closure phases, are discussed relative to the baseline conditions (i.e., Baseline Assessment Scenario) that would occur in the absence of the Project, wherever appropriate. A more detailed description of the Assessment Scenarios is provided in Section 3.2.

For human and ecological receptors, a potential adverse effect is defined when the risk for the Project (i.e., Project Alone + Baseline or Post-closure + Baseline) via the sum of all exposure pathways, exceeds the acceptable risk benchmark and the estimated potential risk for the Baseline Assessment Scenario.

Human health exposure to CAPs is only operable via the inhalation of air pathway and therefore potential adverse effects were characterized based on the inhalation pathway alone. Whereas, for parameters that can contribute to increased concentrations in other media through deposition, such as inorganic metals (and methylmercury), human and ecological exposure may be via several pathways, including inhalation, direct contact with soil, and ingestion of water, sediment and food. Therefore, potential adverse effects are characterized based on the sum of all exposure pathways.

2.5 Regulatory Context

The HEHRA has been conducted according to industry accepted risk assessment practices and methodologies and follows guidance published and endorsed by government agencies. This approach is consistent with previous projects in Ontario that have been reviewed by the Impact Assessment Agency of Canada. The following guidance documents were relied upon in the HEHRA:

- *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Human Health Risk Assessment* (Health Canada 2019);
- *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Country Foods* (Health Canada 2018);
- *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality* (Health Canada 2016a);
- *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality* (Health Canada 2016b);
- *Federal Contaminated Site Risk Assessment in Canada: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) Version 4.0* (Health Canada 2024);
- *Federal Contaminated Site Risk Assessment in Canada: Toxicological Reference Values (TRVs) and Chemical-Specific Factors Version 3.0* (Health Canada 2021);
- *Federal Contaminated Site Risk Assessment in Canada: Supplemental Guidance on Human Health Risk Assessment for Oral Bioavailability of Substances in Soil and Soil-Like Media* (Health Canada 2017a);
- *Federal Contaminated Site Risk Assessment in Canada: Supplemental Guidance on Human Health Risk Assessment for Air Quality* (Health Canada 2017b);
- *Federal Contaminated Site Risk Assessment in Canada: Supplemental Guidance on Human Health Risk Assessment of Contaminated Sediments: Direct Contact Pathway* (Health Canada 2017c);
- *Federal Contaminated Site Risk Assessment in Canada: Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals* ($DQRA_{CHEM}$) (Health Canada 2010a);
- *Federal Contaminated Site Risk Assessment in Canada: Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRAFoods)* (Health Canada 2010b);
- *A Framework for Ecological Risk Assessment- Canadian Council of Ministers of the Environment* (CCME 1996);
- CCME *Ecological Risk Assessment Guidance* (CCME 2020); and
- *Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario* (MECP 2011).

2.6 Traditional Knowledge and Traditional Land Use

The Project is located within several Traditional territories and the following Indigenous communities are potentially affected by the Project: Cat Lake First Nation, Slate Falls Nation, Lac Seul First Nation, Mishkeegogamang Ojibway Nation, Ojibway Nation of Saugeen, Pikangikum First Nation, Wabauskang First Nation and the Métis Nation of Ontario – Region 1. The closest Indigenous community to the proposed mine site area of the Project is Cat Lake First Nation, located approximately 40 km northeast of the Project but outside the RSA. The next closest Indigenous community to the mine site area of the Project is Slate Falls First Nation, which is located approximately 45 m southeast of the mine site area and within the LSA and RSA. The proposed transmission line intersects Slate Falls First Nation.

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 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 Use information.

Based on the Traditional Knowledge and Land use information received, members of the local Indigenous communities reported spending time in the LSA and RSA to practise their traditional use of land including fishing, hunting, harvesting / gathering of plant material (such as berries and medicinal plants) and spiritual / cultural practices. Traditional Knowledge and Traditional Land Use information provided by the local Indigenous communities to date has been considered in the identification of potential points of reception (PORs), identification of valued ecological components and important country foods, in the design of the country foods sampling program, as well as in the estimation of receptor characteristics related to the consumption rates of country foods from the area. More detailed information related to the country foods program and assumptions incorporated into the HEHRA are provided in Sections 3.4.2.5 and 4.3.2.1.

3.0 STUDY AREAS AND ASSESSMENT SCENARIOS FOR THE HEHRA

3.1 Spatial and Temporal Boundaries

3.1.1 Spatial Boundaries

The spatial boundaries considered for the assessment of human and ecological health are shown in Figure 3-1 and defined as follows:

- **Project Development Area (PDA):** The footprint of the Project, including the mine site area, mine site access road and the transmission line corridor as currently understood, as well as a buffer of approximately 250 m around the mine site area, 40 m wide corridor for the transmission line and 20 m wide corridor for the mine access road, in order to allow for flexibility for design optimizations. Where the mine access road and transmission line are aligned together, the buffer is included within a 60 m wide corridor.
- **Local Study Area (LSA):** The HEHRA LSA is a combination of both the air quality and surface water system LSAs. The LSA for human and ecological health encompasses the area adjacent to the PDA to capture the maximum predicted ground-level concentrations due to the Project and where air quality can be predicted or measured with a reasonable degree of accuracy. For human and ecological health, the LSA is defined as an area that extends approximately 10 km from the Project emission sources and includes the sub-watershed boundaries of Birch Lake and Springpole Lake.
- **Regional Study Area (RSA):** The RSA for human and ecological health is a combination of both the air quality and surface water system RSAs and is defined as an area that extends approximately 20 km from the Project emissions sources.

3.1.1.1 Receptors

Human receptors who may experience chemical exposure from the Project include Indigenous and non-Indigenous community members who live in residences located in the area of the Project and/or spend part of their time in cabins, lodges or camps located within the LSA / RSA, and/or who visit the area within the LSA / RSA to practise TLRU or recreational land use (including fishing, hunting, Traditional food harvesting and spiritual practices). Ecological receptors may include plants and invertebrates, mammals and birds, and aquatic biota that may reside in the RSA, including areas in close proximity to the PDA boundary. The area assessed as part of the HEHRA is referred to as the LSA and RSA, as illustrated in Figure 3-1.

Based on the land uses in the vicinity of the Project, potential POR locations were chosen for assessment of potential human health risks from air emissions for the purposes of the HEHRA, as indicated in Table 3.1.1-1 and illustrated in Figure 3-2. For assessment of potential human health risks from water emissions for the purposes of the HEHRA, predicted surface water concentrations at various surface water quality modelling nodes (shown in Figure 3-5) were used to estimate surface water concentrations within Birch Lake and Springpole Lake at each of the Project phases. In addition to specific POR locations that represent existing residences, cabins, camps, lodges and TLRU areas located within the RSA, it is standard practice to also assess the MPOI to represent the maximum emissions predicted in close proximity to the PDA.

Table 3.1.1-1: Points of Reception Locations in the Risk Assessment

Location	Description
Maximum point of impingement	The MPOI is a theoretical point where maximum air emissions are predicted along the Project property boundaries, in close proximity to the PDA. This point is not a specific location, but rather varies for various chemicals and emission sources, and is typically used for the human health worst-case scenario and for the ecological health assessment.
Point of reception (POR) locations	The POR locations include representative existing cabins, lodges and camps / camping areas in addition to locations that represent areas where TLRU may be practised outside of the PDA but within the LSA and RSA (Figure 3-2). These POR locations were selected to represent areas outside the PDA where humans may be present and exposed to air emissions from the Project at varying frequencies. There are no sensitive receptor locations, as defined by the CCME, within the mine site area of the PDA boundary. It should be noted that there are three potential TLRU PORs (POR02, POR03 and POR05), identified in selected areas within the Project property boundaries (but outside the mine site area of the PDA).

In addition to the assessment of potential health risks to members of the general Indigenous and non-Indigenous population or common species at the RSA, consideration is also given to receptors of the population who may experience a greater risk given their lifestyle and/or behaviour characteristics. Critical subgroups include the following:

- **Toddlers:** Toddlers are considered to be the more highly exposed human receptors because they eat, drink and breathe more in proportion to body size, and they exhibit behaviours (e.g., hand-to-mouth activity) that increase exposure to media such as soil.
- **Pregnant females:** Assessment of a pregnant female human receptor for chemicals exhibiting developmental affects would be protective of the developmental effect elicited during gestation but might not be protective of any secondary effects of the chemical that could be elicited during exposure as a child.
- **Indigenous community members:** FMG recognizes that Indigenous people live, work, hunt, fish, trap, drink water and gather / harvest throughout their lands and rely on them for their individual as well as their community's overall cultural, social, spiritual, physical and economic well-being. Further to this, FMG recognizes that these Traditional lands are inextricably connected to an Indigenous community's identity and culture, inclusive of ceremonial and spiritual recognition. Members of Indigenous communities may use land and resources for Traditional purposes, and thus may experience higher levels of exposure than members of the general population (e.g., higher rates of country foods ingestion, or more time spent outdoors). An Indigenous community member may also include the other critical subgroups noted (e.g., a toddler and/or pregnant female).
- **Species at risk (SAR):** Federally protected SAR require different levels of protection relative to common species.

3.1.2 Temporal Boundaries

The temporal boundaries used in the HEHRA were selected to be consistent with those used in evaluating the effects of the Project:

- **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; and
- **Decommissioning and Closure Phase:**
  - Active Closure: Preliminary timing of 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 when the filled open pit basin will be reconnected to Springpole Lake.

The construction, operations and active closure phases (estimated duration of 18 years) are deemed suitable to capture all of the environmental effects associated with the Project. The HEHRA evaluation at the post-closure phase will reflect predicted exposures from conditions after active closure is complete.

500000 520000 540000 560000 580000 600000 620000 640000

5720000 5700000 5680000 5660000

Mamakwash Lake
Wavell Lake
Noble Lake
Mink Lake
Little Shabumeni Lake
Shabumeni Lake
Birch Lake
Springpole Lake
Seagrave Lake
Bertha Lake
Washagomis Lake
Narrow Lake
Okanse Lake
Woman Lake
Trout Lake
Joyce Lake
Perrigo Lake
Confederation Lake
Margaret Lake
Little Bear Lake
Uchi Lake
Fly Lake
Jubilee Lake
Slate Lake
Wakeman Lake
Jeanette Lake
Sesikinaga Lake
Carillon Lake
Cat Lake
Kapikik Lake
Jackpine Lake
Zionz Lake
Gull Lake
Fawcett Lake
Kezik Lake
Senior Lake
Lang Lake
Bertrand Lake
Gitche Lake
McVicar Lake
Meen Lake
Wettlaufer Lake
Dobie Lake
Strout Lake
Dorothy Lake
Nabemakoseka Lake
Obaskaka Lake
Wright Lake
Fry Lake
Bamaji Lake
Roadhouse Lake
Gage Lake
Blackstone Lake
Lake St. Joseph

SLATE FALLS NATION

X:\CA\CAOAK300-OAKMIS-FS1-Project\P2021Projects\ONS2104 FMG Springpole EIS\11 GIS\Human Health\Technical Report 2023\MXD\Human Health LSA RSA 1.mxd

LEGEND

- Proposed Mine Feature
- Project Development Area
- Local Study Area for Human and Ecological Health
- Regional Study Area for Human and Ecological Health
- First Nation Reserve
- Existing Road
- Existing Winter Road
- Existing Transmission Line
- Watercourse
- Waterbody

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.

FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

Local and Regional Study Areas for Human and Ecological Health

Datum: NAD83
Projection: UTM Zone 15N

N W E S

0 5 10 20 30 40 50 Kilometres

PROJECT N°: ONS2104

FIGURE: 3-1

SCALE: 1:375,000

DATE: June 2024

500000 520000 540000 560000 580000 600000 620000 640000

5720000 5700000 5680000 5660000

Mamakwash Lake
Wavell Lake
Noble Lake
Little Shabumeni Lake
Shabumeni Lake
Birch Lake
Cat Lake
Carillon Lake
Kapikik Lake
Jackpine Lake
Zionz Lake
Fawcett Lake
Springpole Lake
Gull Lake
Kezik Lake
Bertha Lake
Seagrave Lake
Washagomis Lake
Narrow Lake
Okanse Lake
Woman Lake
Trout Lake
Joyce Lake
Confederation Lake
Perrigo Lake
Sesikinaga Lake
Jeanette Lake
Wakeman Lake
Little Bear Lake
Uchi Lake
Fly Lake
Jubilee Lake
Slate Lake
Lang Lake
McVicar Lake
Bertrand Lake
Gitche Lake
Meen Lake
Dorothy Lake
Nabemakoseka Lake
Obaskaka Lake
Kezik Lake
Gage Lake
Roadhouse Lake
Bamaji Lake
Fry Lake
Wettlaufer Lake
Dobie Lake
Strout Lake
Wright Lake
Blackstone Lake
Lake St. Joseph

POR60 POR37 POR45 POR57 POR01 POR59 POR05 POR06 POR35 POR58 POR04 POR30 POR56 POR24 POR02 POR17 POR18 POR03 POR07 POR38 POR19 POR61 POR22 POR55 POR31 POR23 POR44 POR46 POR50 POR51 POR32 POR47 POR42 POR52 POR20 POR54 POR39 POR21 POR08 POR12 POR15 POR43 POR10 POR09 POR14 POR11 POR16 POR13 POR48 POR40 POR27 POR41 POR53 POR34 POR28 POR49 POR29 POR36 POR33 POR26 POR25

SLATE FALLS NATION

X:\CA\CAOAK300-OAK\MIS-FS1-Project\Project\2021\Projects\ONS2104_FMG_Springpole_EIS\11_GIS\Human_Health\Technical_Report_2023\MXD\Potential_PORs_2.mxd

LEGEND

- Proposed Mine Feature
- Project Development Area
- Local Study Area for Human and Ecological Health
- Regional Study Area for Human and Ecological Health
- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- First Nation Reserve
- Existing Road
- Existing Winter Road
- Existing Transmission Line
- Watercourse
- Waterbody

Potential Points of Reception

- Cabin/Lodge/Camp
- TLRU
- Residential

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

Potential Points of Reception in the HEHRA Regional Study Area

PROJECT N°: ONS2104 | **FIGURE: 3-2**

SCALE: 1:375,000 | DATE: October 2024

3.2 Assessment Scenarios

3.2.1 Baseline Assessment Scenario

The Baseline Assessment Scenario considers potential risk to human and ecological health associated with present, pre-Project conditions, including ambient environmental conditions and existing sources of potential risk (including chemical concentrations in soil, water, air and food). The Baseline Assessment Scenario represents the level of risk that would be experienced in the vicinity of the Project should the Project not proceed.

The Baseline Assessment Scenario incorporates existing chemical concentrations in exposure media (e.g., soil, sediment, water, air, country foods), obtained from the results of baseline sampling completed. The use of existing measured data is supplemented by modelled predictions where data gaps have been identified (e.g., baseline chemical concentrations in country foods and ecological receptors).

3.2.2 Project Assessment Scenario

The Project Assessment Scenario includes the consideration of the anticipated Project Alone Assessment Scenario conditions in combination with the Baseline Assessment Scenario. This Assessment Scenario evaluates the contributions of the Project in addition to baseline conditions for all phases of the Project defined above: construction, operations and active closure. The Project Assessment Scenario represents the levels of exposure that would be experienced in the vicinity of the Project should the Project proceed.

3.2.3 Post-closure Assessment Scenario

This Assessment Scenario evaluates the contributions of the Project once all activities have ceased, and site reclamation has been achieved. The Post-closure Assessment Scenario represents the levels of exposure that would be experienced in the vicinity of the former Project based on post-closure impacts in combination with the Baseline Assessment Scenario. The objective of this scenario is to help ensure that the combined exposures and potential risk associated with all anticipated sources of chemicals to the regional environment are not underestimated.

3.3 Project Setting

The objective of this section is to provide a platform for describing chemical emissions and releases (i.e., exposure pathways), receptors and risk management measures incorporated into the design of the Project for each of the temporal boundaries of the HEHRA. A more detailed description of exposure pathways and receptors relevant to the HHRA and ERA are discussed within those respective subsections.

3.3.1 Property Information

The Project site is an active mineral exploration area and there are a number of exploration-related facilities and infrastructure components currently present on the site, including a small exploration camp, office, storage facilities and yard areas.

Mineral exploration of the Project property has been carried out during two main periods: from the 1920s to 1940s and from 1985 to the present. During the most recent period, exploration activities have included geological mapping, geophysical surveys, diamond drilling and trenching. In 2015, the property was acquired by what is now FMG.

The Project site is accessible by floatplane to Springpole Lake or Birch Lake during the late spring, summer and early fall. Helicopters are used periodically for field investigations. During the winter, an ice road is periodically used to connect the site to Confederation Lake where all-season road access is available. During lake ice freeze-up in the fall and breakup in spring, the site is only accessible by helicopter. The closest all-season road is the Wenasaga Road, located approximately 18 km from to the Project site.

The location of the Project is:

- **Main Project site:** Universal Transverse Mercator (UTM) 549,183 Northing (N), 5,693,578 Easting (E) (NAD83, Zone 15U);
- **Endpoints of the mine access road:** 568,9216 N, 565,839 E to 569,4468 N, 550,950 E (NAD83, Zone 15U); and
- **Endpoints of the transmission line:** 5,675,100N, 625,423E to 5,694,411N, 550,928E (NAD83, Zone 15U).

3.3.2 Project Description Summary

This section provides an overview of the proposed Project phases, components and undertakings. Additional details are provided in Section 5.0 of the Environmental Impact Statement / Environmental Assessment (EIS/EA).

The Project has an estimated mineral resource of 4.6 million ounces of gold and 24.3 million ounces of silver over an approximate 10-year mine life while providing significant benefits to the local, regional and Indigenous economies of northwestern Ontario. The Project also has important critical mineral potential, hosting considerable tellurium which will be further evaluated during life of mine.

The proposed site layout and infrastructure routing provided in Figure 3-3 and Figure 3-4 has been developed by means of a comprehensive assessment of alternatives (EIS/EA Section 4), guided in part by feedback received from consultation and engagement activities to date (EIS/EA Section 3). The Project is planned and designed to provide flexibility for future design optimizations, avoid/minimize adverse environmental effects through careful configuration and use of best available technology economically achievable. For example, mine-related facilities have been strategically placed near the open pit to the extent practicable to minimize the overall footprint and associated environmental impacts. With a mine site footprint of only 867 hectares (ha) and a total Project footprint of approximately 1,365 ha when considering the access road and transmission line, the Project is one of the smallest open pit mining projects in the Canadian gold sector for a mine of its production capacity. The Project design draws from the extensive experience with other similar projects in Canada. The Project sets out to be designed in a manner compatible with regional land use planning, be respectful of the rights and interest of local Indigenous communities and land users in the area, and to facilitate the eventual reclamation of the site, while providing long-term sustainable infrastructure opportunities for the region.

FMG has focused on designing a compact and highly efficient mine site. The main components of the Project are as follows and as shown in Figure 3-3 and Figure 3-4:

- Open pit, located within a small portion of the north basin of Springpole Lake;
- East and west dikes used to safely isolate the open pit basin during mining;
- CDF for mine rock and tailings (north cell and south cell);
- Surficial soil stockpile, for temporary storage of soil that will be re-used in site restoration;
- Ore stockpiles, for temporary storage of ore to be processed over the life of the mine;
- Process plant and process plant complex;
- Buildings and supporting infrastructure;
- Water management and treatment facilities;
- Fish habitat development area;

- Accommodations complex;
- Aggregate operation(s);
- Transmission line; and
- Mine access road and co-located airstrip.

The area surrounding the Project contains multiple cabins. Most of the properties associated with the Project were previously privately owned (since around 1900) and have been acquired by FMG by means of private purchase agreements. There are no places of permanent residence, permanent hunting cabins, childcare, health care or senior citizens' facilities within the mine site area of the PDA boundary.

546000 547000 548000 549000 550000 551000 552000 553000

5695000 5694000 5693000 5692000

Birch Lake
Birch Lake
Explosive Storage
Low Grade Ore Stockpile
Fresh Water Intake Pipeline
L-1
Process Plant Area
L-19
Dole Lake
Central Water Storage Pond (CWSP)
Plant Site Pond
Phase 1 Pit
Accommodations Complex
High / Mid Grade Ore Stockpile
Fish Habitat Development Area
Surficial Soil Stockpile
L-20
North Cell
Co-Disposed Thickened Tailings and Mine Rock
Main Open Pit
Co-Disposal Facility
Effluent Discharge Pipeline
East Dike
230 kV Transmission Line
Mine Access Road
South Cell
CDF Internal Pond over Slurry Tailings
Air Strip
Springpole Lake (North Basin)
West Dike
Springpole Lake (North Basin)
L-16

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LEGEND

- Watercourse
- Waterbody
- Major Contours (5 m interval)
- Minor Contours (1 m interval)

Proposed Mine Features

- Open Pit
- Open Pit Basin
- Ore Stockpile
- Surficial Soil Stockpile
- Co-Disposal Facility
- Co-Disposed Thickened Tailings and Mine Rock
- Process Plant Area
- Dike
- Pond
- Haul / Access Road
- Explosives Storage
- Air Strip
- Mine Access Road
- Seepage / Runoff Collection System
- 230 kV Transmission Line
- Fresh Water Intake Pipeline
- Effluent Discharge Pipeline
- Tailings Pipeline Corridor
- Fish Habitat Development Area

NOTES:
- Contours extracted from 2020 LiDAR survey.
- 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.

0 0.5 1 2 3 4 5 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

First Mining Gold

wsp

SPRINGPOLE GOLD PROJECT

EIS / EA Site Plan

PROJECT N°: ONS2104

FIGURE: 3-3

SCALE: 1:17,000

DATE: October 2024

547500 550000 552500 555000 557500 560000 562500 565000

5695000 5692500 5690000 5687500 5685000

Birch Lake
Central Water Storage Pond (CWSP)
Ore Stockpile
Process Plant Area
L-1
L-19
Dole Lake
L-20
Birch Lake
North Cell
Co-Disposed Thickened Tailings and Mine Rock
Open Pit
Surficial Soil Stockpile
Co-Disposal Facility
South Cell
CDF Internal Pond over Slurry Tailings
Air Strip
L-16
L-10
L-12
L-11
L-13
L-14
Springpole Lake (North Basin)
Effluent Pipeline
Aggregate Source
Effluent Discharge Location
Durkin Lake
Mine Access Road
230 kV Transmission Line
Birch Lake
Cromarty Lake
Satterly Lake
Springpole Lake (Southest Arm)
Birch River
Wenasaga Forestry Road
Seagrave Lake
Aggregate Source
Seagrave Lake

TRANSMISSION LINE EXTENT OVERVIEW MAP

Birch Lake
ENLARGED AREA
Zionz Lake
Gull Lake
Kezik Lake
Slate Falls Nation
Bamaji Lake
10 km

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LEGEND

- Aggregate Source
- Existing Road
- Watercourse
- Waterbody
- Existing Transmission Line
- Contour (10 m intervals)

Proposed Mine Feature

- Open Pit
- Open Pit Basin
- Ore Stockpile
- Surficial Soil Stockpile
- Co-Disposal Facility
- Co-Disposed Thickened Tailings and Mine Rock
- Process Plant Area
- Dike
- Pond
- Haul / Access Road
- Explosives Storage
- Air Strip
- Mine Access Road
- Seepage / Runoff Collection System
- 230 kV Transmission Line
- Fresh Water Intake Pipeline
- Tailings Pipeline Corridor
- Effluent Discharge Pipeline
- Fish Habitat Development Area
- Effluent Discharge Location

0 1 2 4 6 8 10 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

Extended Site Plan

PROJECT N°: ONS2104 | **FIGURE: 3-4**

SCALE: 1:52,000 | DATE: October 2024

545000 550000 555000 560000 565000

5695000 5690000 5685000

OVERVIEW MAP

Enlarged Area

10 Km

Birch Lake
Node 6
Node 1
L-1
Fresh Water Intake Location
Dole Lake
L-19
Node 2
Node 3
L-20
108
104
107
105
106
103
101
102
East Dike
West Dike
Node 7
L-16
Node 4
Node 11
Springpole Lake (North Basin)
Node 8
Durkin Lake
Effluent Discharge Location
Node 9
Node 5
Springpole Lake (Southeast Arm)
Node 10
Birch River
Cromarty Lake
Satterly Lake
Seagrave Creek
Seagrave Lake
Graydarl Lake
Wenasaga Forestry Road

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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

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

0 1 2 4 6 8 10 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

FIRST MINING GOLD

wsp

SPRINGPOLE GOLD PROJECT

Surface Water Assessment Nodes

PROJECT N°: ONS2104

FIGURE: 3-5

SCALE: 1:70,000

DATE: October 2024

3.3.3 Description of Project Phases

3.3.3.1 Construction Phase

Construction would begin once the EA processes are complete and initial approvals are received. Site preparation and construction of the surface infrastructure to start mining and processing activities is approximately three years. Primary construction phase activities are expected to include:

- Mine access road and airstrip construction;
- Development of temporary construction camp, associated infrastructure and staging areas (primarily on site, but potentially small temporary mobile camps near the transmission line route);
- Site preparation activities including clearing, grubbing, earthworks and construction water management (as needed);
- Aggregate and quarry resource development and operation;
- Dike construction;
- Establishment of the central water storage pond;
- Controlled dewatering of the open pit basin;
- Stripping of lake bed sediments and overburden at the open pit;
- Initiation of pit development in rock;
- Construction of the starter embankments for the CDF;
- Onsite haul and access road construction;
- Construction of a transmission line to the Project site;
- Construction of buildings and onsite infrastructure;
- Establishment and operation of water and waste management and treatment facilities;
- Collection of water for process plant commissioning;
- Stockpiling of ore for start-up;
- Commissioning of the process plant; and
- Environmental monitoring.

3.3.3.2 Operations Phase

The operations phase is anticipated to last approximately 10 years and will include the following primary activities:

- Operation of the process plant;
- Operation of the open pit mine;
- Management of overburden, mine rock, tailings and ore in designated facilities;
- Operation of water and waste management and treatment facilities;
- Operation of the accommodations complex;
- Environmental monitoring; and
- Progressive reclamation activities.

During operations, receptors may be exposed to fugitive dust emissions from the Project. Fugitive dust from the following activities have been considered as part of the air quality modelling.

- Drilling, blasting, material handling and operation of mobile equipment during open pit development;
- Operation of ore stockpiles and the CDF due to material handling and wind erosion;
- Crushing of ore, breaking and/or crushing of mine rock as needed, and the associated material handling;
- Operation of haul trucks resulting in dust emissions (re-entrained dust);
- Fuel combustion for heating of mine site infrastructure;
- Exhaust from the operation of the backup power generation and other diesel equipment; and
- Processing of ore at the process plant.

3.3.3.3 Decommissioning and Closure Phase

The decommissioning and closure phase is anticipated to include an active closure phase and a post-closure maintenance and monitoring phase. Activities to be completed during the active closure phase, where not completed progressively during operation, are anticipated to include:

- Removal of assets that can be salvaged for re-sale or re-use;
- 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 an appropriate cover to facilitate revegetation, if needed, and revegetation (active or passive);
- Filling of open pit to near final water level and, once the water quality meets all regulatory requirements, lowering of the dikes in a controlled manner and reconnection of the reclaimed basin to Springpole Lake; and
- Closure environmental and engineering inspections.

Decommissioning and closure of the Project will be completed in accordance with O. Reg. 35/24: Rehabilitation of Lands. A comprehensive regulatory closure plan will be developed for the Project as required by the *Mining Act* (R.S.O. 1990, c. M.14). Section 5.19 in the EIS/EA provides a conceptual closure strategy for both progressive and final reclamation measures. Feedback gained through ongoing consultation and engagement activities, including on the final EIS/EA, will be fully considered in the regulatory closure plan.

The Project site is located in a remote area in which Traditional pursuits (i.e., hunting, fishing, trapping and recreational use) and forestry are the dominant land use, with some mineral exploration. The overall intent is to restore the site to a self-sustaining ecosystem.

Following final decommissioning and closure, the terrain will be similar to the pre-development conditions with the exception of the rehabilitated CDF. The CDF will resemble a hill raised above the pre-development terrain. The revegetation program for the Project will use a mix of commercially available native species combined with natural revegetation and vegetation succession. Wildlife will re-enter and use the site once vegetation is re-establishing.

Once the open pit basin is reclaimed and reconnected with Springpole Lake, the overall footprint of Springpole Lake will be increased by approximately 100 ha (3.5 percent [%] overall increase in lake area) providing additional recreational water use for local communities. This also results in an increase in the available volume of deep pelagic thermal refuge habitat up to 30 m deep for Lake Trout, Lake Whitefish and other large-body fish species of 16%. The ramp to the former open pit may remain with the purpose of providing a boat ramp, further supporting recreational use of Springpole Lake.

3.4 Selection of Chemicals of Potential Concern

Activities associated with each Project phase are expected to emit CAPs along with inorganic COPCs such as metals, as well as PAHs associated with diesel emissions. Where environmental conditions are suitable (such as in an aquatic environment), the natural biotransformation of mercury to methylmercury may also occur.

Baseline chemical concentrations in environmental media including air, soil, surface water, sediment, fish and some country foods were measured for use in the HEHRA. Baseline conditions in various media were obtained from the various disciplines supporting the EIS/EA, as discussed in the sections below. A summary of all baseline data considered in support of the HEHRA is also included in Attachment A of this report.

Chemical concentrations in Project-specific media, including ore and mine rock were also considered for the HEHRA, by incorporating dustfall chemical concentrations modelled using the Air Quality Assessment Report (Appendix G-2 of the EIA/EA). Maximum predicted concentrations were used in the screening for initial selection of COPCs.

3.4.1 Identification of Chemicals of Potential Concern in Air

Air quality data representative of baseline conditions as well as the Project phases were obtained from the Air Quality Baseline Report (Appendix G-1 of the EIS/EA) and the Air Quality Assessment Report (Appendix G-2 of the EIA/EA), respectively.

The air quality assessment focused, appropriately, on the maximum predicted concentrations at the Project property boundary, as well as potential PORs. In addition, Health Canada in its guidance document for assessing air quality and health for an EA (Health Canada 2016b) requires that "*the predicted or estimated COPC concentrations for the maximally exposed population, for the most sensitive receptors and at the point of maximum impingement*" be provided. For the Project, the MPOI is consistent with the O. Reg. 419/05: Air Pollution – Local Air Quality definition. A "point of impingement" is defined in Section 2 of O. Reg. 419/05 and includes the following:

1) Any point off site; and

2) Any point on site that is on a childcare facility or on a structure that serves primarily as a health care facility, a senior citizens' residence and/or long-term care facility, or an educational facility; and

(3) Any point on the same structure as the source of a contaminant that does not belong to the facility.

Given that there are no childcare, health care or senior citizens' facilities within the Project property boundary, the MPOI was appropriately considered for the identification of COPCs.

The screening criteria applied in the Air Quality Assessment Report includes the Ontario Ambient Air Quality Criteria (AAQC), O. Reg. 419/05 standard (or other air parameter benchmarks) and the Canadian Ambient Air Quality Standards (CAAQS).

The compounds addressed in the Air Quality Assessment Report (Appendix G-2 of the EIS/EA) and the results of the screening (as provided in Table 5-2 to 5-5 in the Air Quality Assessment) include:

- Particulates (suspended particulate matter [SPM], inhalable particulate [PM_{10}], respirable particulate [$PM_{2.5}$]; respirable silica and diesel particulate matter [DPM])
    - Although no exceedances of the screening criteria were identified, these are carried forward in the HHRA.
    - DPM consists of fine and ultrafine particulate matter released directly from fuel combustion in diesel engines or is formed by secondary particulates in the exhaust. $PM_{2.5}$ from combustion processes (including blasting) were considered in the air dispersion modelling as a surrogate for DPM. DPM is specifically assessed for carcinogenic risks from inhalation and is relevant to the HHRA.
- Criteria air parameters (nitrogen dioxide [NO_2], carbon monoxide [CO], sulphur dioxide [SO_2], ozone)
    - Nitrogen dioxide (NO_2), carbon monoxide (CO) and sulphur dioxide (SO_2) are carried forward in the HHERA.
    - Ozone was not quantitatively assessed for effects but was an input in the air dispersion models for nitrogen oxides. There are no sources of ozone associated with the Project. Nitrogen oxides and volatile organic compounds will, however, be released, are known ozone precursors, and react in the presence of heat and sunlight to form ozone. Given these requirements, ozone formation is most likely from May to September, between noon and the early evening. In 2021, Ontario measured ozone at 47 stations where the 90th percentile of one-hour values ranged from 36 to 47 parts per billion (ppb). The health-based AAQC for ozone is 80 ppb and given the range of ozone concentrations from remote to urban locations only varied by 11 ppb, ozone is a regional air quality issue rather than a local issue with no appreciable effects from the Project on the ozone concentrations in the LSA or RSA.
- Inorganics are discussed in Section 3.4.2.1.
- Volatiles (benzene, 1,3-butadiene, formaldehyde, acetaldehyde) and PAHs (benzo(a)pyrene)
    - Volatiles were identified at concentration less than the AAQC and are not addressed further.
    - Benzo(a)pyrene was identified at concentrations exceeding the AAQC and is carried forward for quantitative evaluation in the HHRA for the inhalation pathway.
- Other parameters (hydrogen cyanide [HCN] and calcium oxide [CaO])
    - These parameters were identified at concentration less than the AAQC and O. Reg. 419/05 standards and guidelines and are not addressed further.

3.4.2 Inorganic Chemicals of Potential Concern

Metal concentrations in particulate matter (i.e., SPM) and dustfall were predicted in the air quality model using the upper confidence limit of the mean (UCLM) of the mine rock assay and tailings/ore assay results. The particulate matter and dustfall predictions were based on the modelled receptors described in the air quality modelling in support of the HEHRA, as illustrated in Figure 3-2.

Data from baseline measurements, chemical assays and predictive modelling are provided in the respective technical support document reports and are summarized in Attachment A. However, with respect to the HEHRA, only those chemicals that are currently known or suspected to have potential toxicity to humans or

ecological receptors are presented here and considered for a quantitative and/or qualitative assessment of potential risk.

Inorganic COPCs in air, soil, water and sediment were selected based on an EPC exceeding an applicable environmental quality standard or guideline. Methylmercury, although an organic chemical, was also considered given the biotransformation from inorganic mercury that may occur in aquatic environmental systems. Special consideration was given to chemicals that have the ability to transform or bioaccumulate within organisms (e.g., mercury), or where meaningful engagement activities have identified community interest in specific chemicals (e.g., methylmercury).

Chemical concentrations of selected inorganic COPCs in air, soil, water or sediment were then modelled into plants and soil organisms, mammals and birds, and aquatic receptors, including fish, for use in the country foods component of the human health risk assessment, and for use in the ecological risk assessment. Modelled concentrations are also summarized in Attachment A.

3.4.2.1 Identification of Inorganic Chemicals of Potential Concern in Air

The potential effects of the Project on human health, specifically via the inhalation of inorganic COPCs (specifically metals) associated with the inhalation of suspended particular matter (PM_{10}, $PM_{2.5}$ and SPM) are assessed here. SPM was selected as the most conservative particulate matter group to be used in determining possible chemical exposures to airborne COPCs. The use of the SPM concentration will conservatively include both the PM_{10} and $PM_{2.5}$ fractions of the airborne particulate matter associated with the Project.

The baseline and modelled concentrations in air data were generated by the air quality teams using methodologies included in the Air Quality Baseline Report (Appendix G-1 of the EIS/EA) and Air Quality Assessment Report (Appendix G-2 of the EIS/EA). The MPOI for each chemical parameter was compared to its respective health-based MECP AAQC to identify inorganic air COPCs requiring further assessment as part of the HEHRA.

Table 3.4.2.1-1: Exposure Point Concentration(1) of Metals in Air (Project Assessment Scenario)

Compound	Averaging Time	Ontario Ambient Air Quality Criteria (µg/m³)	MPOI – Maximum Concentration (µg/m³)
Hg	24-Hour	2	0.00001
	Annual	—	0.0000009810
Ag	24-Hour	1	0.00016
	Annual	—	0.000015
Al	24-Hour	120	0.99
	Annual	—	0.095
As	24-Hour	0.3	0.0054
	Annual	—	0.00052
Ba	24-Hour	10	0.0059
	Annual	—	0.00056
Be	24-Hour	0.01	0.000036
	Annual	—	0.0000034
Bi	24-Hour	—	0.000023
	Annual	—	0.0000022
Ca	24-Hour	10	1.76
	Annual	—	0.17
Cd	24-Hour	0.025	0.000051
	Annual	0.005	0.0000048

Table 3.4.2.1-1: Exposure Point Concentration(1) of Metals in Air (Project Assessment Scenario)

Compound	Averaging Time	Ontario Ambient Air Quality Criteria (µg/m³)	MPOI – Maximum Concentration (µg/m³)
Co	24-Hour	0.1	0.0013
	Annual	—	0.00012
Cr	24-Hour	0.5	0.0036
	Annual	—	0.00034
Cu	24-Hour	50	0.0042
	Annual	—	0.00040
Fe	24-Hour	4	2.42
	Annual	—	0.23
K	24-Hour	—	0.60
	Annual	—	0.057
Li	24-Hour	20	0.0032
	Annual	—	0.00031
Mg	24-Hour	35	0.94
	Annual	—	0.090
Mn	24-Hour	0.4	0.060
	Annual	—	0.0057
Mo	24-Hour	120	0.0027
	Annual	—	0.00025
Ni	24-Hour	0.2	0.0028
Ni	Annual	0.04	0.00027
Pb	24-Hour	0.5	0.0039
	Annual	—	0.00037
Sb	24-Hour	25	0.00012
	Annualtim	—	0.000012
Se	24-Hour	10	0.00012
	Annual	—	0.000011
Sn	24-Hour	10	0.000013
	Annual	—	0.0000012
Sr	24-Hour	120	0.014
	Annual	—	0.0013
Ti	24-Hour	34	0.061
	Annual	—	0.0058
Tl	24-Hour	—	0.00013
	Annual	—	0.000012
U	24-Hour	0.3	0.00021
	Annual	0.06	0.000020
V	24-Hour	2	0.0033
	Annual	—	0.00032
Y	24-Hour	—	0.00043
	Annual	—	0.000041
Zn	24-Hour	120	0.0082
	Annual	—	0.00078

Notes:
Values based on SPM. All units in µg/m³.
— No AAQC available
(1) Metallic, divalent and trivalent.

As shown in Table 3.4.2.1-1, none of the modelled concentrations of metals in air exceeded the AAQC. However, the following chemicals did not have MECP ambient air quality criteria available:

- Bismuth;
- Potassium;
- Thallium; and
- Yttrium.

Bismuth is considered to be minimally toxic to human and ecological receptors and pose a negligible amount of potential risk in the environment. As such, no TRVs are available for use in a human or ecological risk assessment of this chemical, and subsequently no risk-based screening criteria have been derived. Based on the current state of science, bismuth is not carried forward as a COPC in the HEHRA.

Potassium is an essential macronutrient for plant growth and is abundant in the environment. It is not considered a COPC to human or ecological receptors and is subsequently not carried forward for further assessment.

An AAQC was not available for thallium. Some air guidelines for thallium are available. In Quebec, the Clean Air Regulation (Q-2, r. 4.1) identifies a yearly air quality standard of 0.25 micrograms per cubic metre (µg/m^3). The New York State Department Annual Guideline Concentration for thallium is 0.048 µg/m^3. Therefore, the concentration of 0.00013 µg/m^3 identified for the Project is not considered a concern and is not carried forward as a COPC in the HEHRA.

A risk-based air guideline or standard is not currently available from any regulatory body for yttrium. There are also no soil quality guidelines (SQGs) available. Therefore, no TRVs are available for use in a human or ecological risk assessment of this chemical, and subsequently no risk-based screening criteria have been derived. Based on the current state of science, yttrium is not carried forward as a COPC in the HEHRA.

Based on the screening process, no air COPCs are identified. The concentrations of metals in dust deposited as a result of the Project are considered further as part of the soil COPC selection described below.

3.4.2.2 Identification of Inorganic Chemicals of Potential Concern in Soil

Sampling activities in support of the HEHRA included the collection of soil at co-located media. This is discussed in Attachment A. A total of 25 soil samples were collected. The locations of the soil samples are illustrated in Figure A-1, Attachment A. The dataset is provided in Table A-1, Attachment A.

The maximum concentration in soil was used to represent the baseline soil concentration for the purpose of the soil screening.

The air modelling completed to support the health assessment included modelling of dustfall (airborne particles that are deposited on the surrounding landscape). The incremental increase in soil concentrations as a result of the dustfall was calculated based on the modelled air concentrations at the MPOI. The input values obtained from the air modelling is discussed in Attachment A.

Changes in soil metal concentrations as a result of metals deposited in dustfall are dependent on the concentration calculated in the soils at the end of the previous phase plus the new deposition from dustfall for the current phase.

Soil maximum concentrations (measured baseline and modelled Project and post-closure) are compared to the CCME SQGs for agricultural land use as well as the MECP Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, Agricultural land use (MECP 2011). Although there is no

agricultural land use in the RSA, these land use guidelines are referenced to include protection of birds and mammals.

The screening is provided in Table 3.4.2.2-1. Concentrations for three baseline soil metal parameters for which criteria were available exceeded the respective CCME or MECP guidelines or standards. Therefore, arsenic, cobalt and molybdenum require further assessment as part of the HEHRA. There were no additional metal COPCs identified through the screening of predicted soil concentrations in the Project or Post-closure Assessment Scenarios.

Benzo(a)pyrene (as a surrogate for PAHs) was identified as a COPC in air. Incremental concentrations for each of the carcinogenic PAHs were calculated to assess the potential for impacts to soil. Although baseline concentrations are not available, the incremental concentrations (up to 0.0000604 mg/kg) are notably less than the MECP 2011 background concentrations, which are ≥0.050 mg/kg for each of the PAH. Incremental PAH concentrations are negligible relative to background and guidelines and, as such, PAHs warrant further evaluation in the context of soil exposure pathways.

Table 3.4.2.2-1: Screening of Modelled Project and Post-closure Soil Concentrations (mg/kg)

Metal	MECP Table 2 SCS	CCME SQG	Soil (Maximum)			
	Agricultural or Other Property Use, Coarse Soil	Agricultural, Coarse Soil	Baseline	Incr.	Project	Post-closure
Aluminum	NA	NA	2.22E+04	2.36E+01	2.22E+04	2.22E+04
Antimony	7.5	20	2.66	7.55E-04	2.66	2.66
Arsenic	11	12	**39.3**	2.21E-02	**39.3**	**39.3**
Barium	390	750	125	3.37E-02	125	125
Beryllium	4	4	0.59	8.04E-04	0.59	0.59
Bismuth	NA	NA	0.26	NC	0.26	0.26
Boron (Total)	120	NA	11.1	NC	NC	NC
Calcium	NA	NA	26,200	NC	NC	NC
Cadmium	1	1.4	0.456	4.85E-04	0.456	0.456
Chromium (Total)	160	64	44.3	9.68E-03	44.3	44.3
Cobalt	22	40	**23.6**	8.06E-03	**23.6**	**23.6**
Copper	140	63	40.3	2.05E-02	40.4	40.4
Iron	NA	NA	3.63E+04	8.50E+00	3.63E+04	3.63E+04
Lead	45	70	18	8.98E-02	18.1	18.1
Lithium	NA	NA	22.5	6.07E-02	22.6	22.6
Magnesium	NA	NA	7.80E+03	6.12E-01	7.80E+03	7.80E+03
Manganese	NA	NA	2.71E+03	5.15E-01	2.71E+03	2.71E+03
Mercury	0.25	6.6	0.192	2.32E-04	0.192	0.192
Molybdenum	6.9	5	**21**	7.51E-03	**21**	**21**
Nickel	100	45	33.8	2.40E-02	33.8	33.8
Phosphorous	NA	NA	1,500	NC	NC	NC
Potassium	NA	NA	2,600	4.74E-01	NC	NC
Selenium	2.4	1	0.97	8.62E-05	0.97	0.97
Silver	20	20	0.63	1.91E-04	0.63	0.63
Sodium	NA	NA	300	NC	NC	NC
Strontium	NA	NA	105	6.64E-02	NA	NA
Sulphur	NA	NA	1,500	NC	NC	NC
Thallium	1	1	0.294	1.17E-03	0.295	0.295
Tin	NA	5	2.7	2.69E-04	2.7	2.7
Titanium	NA	NA	1.46E+03	1.40E+00	1.46E+03	1.46E+03
Tungsten	NA	NA	3.34	NC	NC	NC
Uranium	23	23	1.04	4.46E-03	1.04	1.04

Table 3.4.2.2-1: Screening of Modelled Project and Post-closure Soil Concentrations (mg/kg)

Metal	MECP Table 2 SCS	CCME SQG	Soil (Maximum)			
	Agricultural or Other Property Use, Coarse Soil	Agricultural, Coarse Soil	Baseline	Incr.	Project	Post-closure
Vanadium	86	NA	63.1	7.69E-02	63.2	63.2
Zinc	340	250	107	6.77E-02	107	107
Zirconium	NA	NA	13	NC	NC	NC
Benzo(a)anthracene (1)	0.5	See BaP TPE	NV	1.45E-05	NV	NV
Benzo(a)pyrene (1)	0.078	See BaP TPE	NV	2.31E-05	NV	NV
Benzo(b)fluoranthene (1)	0.78	See BaP TPE	NV	5.01E-06	NV	NV
Benzo(g,h,i)perylene (1)	6.6	See BaP TPE	NV	6.04E-05	NV	NV
Benzo(k)fluoranthene (1)	0.78	See BaP TPE	NV	1.15E-05	NV	NV
Chrysene (1)	7	See BaP TPE	NV	2.85E-05	NV	NV
Dibenzo(a,h)anthracene (1)	0.1	See BaP TPE	NV	2.85E-06	NV	NV
Indeno(1,2,3-cd)pyrene (1)	0.38	See BaP TPE	NV	3.69E-06	NV	NV
Benzo(a)pyrene TPE (1)	NV	0.6	NV	4.75E-05	NV	NV

Notes:
Bold font indicates an exceedance of the screening guidelines.
(1) Baseline concentrations not measured. Project value represent incremental concentrations.
NA – Not available
NC – Not calculated
NV – No value
TPE - Total potency equivalents (calculation of TPE discussed in Section 4.2.3)

To support the evaluation in Section 4, the maximum concentrations for each of the identified COPCs was further screened against applicable human health–based guidelines in Table 3.4.2.2-1:

Table 3.4.2.2-2: Supplemental Soil Screening for Human Health

COPC	Human Health Guidelines(1) (mg/kg)	COPC Concentration in Soil(2) (mg/kg)	Rationale
Arsenic	11	**39.3**	Maximum exceeds Human Health Guidelines
Cobalt	22	**23.6**	Maximum exceeds Human Health Guidelines
Molybdenum	110	21	Maximum does not exceed Human Health Guideline.

Notes:
(1) Lowest of MECP or Health Canada human health–based guideline.
(2) Highest maximum value in all three Assessment Scenarios (Baseline, Project and Post-closure).

Soil concentrations exceeding their respective human health–based screening criteria include arsenic and cobalt. Therefore, potential human health risks are assessed for these parameters.

3.4.2.3 Identification of Inorganic Chemicals of Potential Concern in Surface Water

Surface water samples were collected to support the baseline assessment for the Project. The surface water chemistry data are presented and discussed in the Surface Water Quality Baseline Report (Appendix N-1 of the EIS/EA).

As detailed in the Appendix N-2 of the EIS/EA, surface water quality was modelled at various nodes for existing conditions (i.e., Baseline Assessment Scenario); for the effects of the Project (i.e., Project Assessment Scenario), which addresses during construction, operations and active closure; and for the post-closure phase of the Project (Post-closure Assessment Scenario). During operations, surface water releases from the

Project to the environment are from groundwater dewatering activities and site runoff which will be treated in the effluent treatment plant before being discharged to the southeast arm of Springpole Lake. During post-closure, discharge from the open pit occurs. The estimated concentrations at each of the nodes is based on these discharges and represents the maximum 75th percentile concentration (i.e., worst-case water quality prediction).

During operations, surface water may also be impacted from particulate deposition. The estimated surface water concentrations associated with particulate deposition is estimated for Birch Lake, the north basin of Springpole Lake and the southeast arm of Springpole Lake. The calculations used to estimate these concentrations are provided in Attachment A, Section 2.4.

Modelled surface water concentrations were not available for methylmercury. Ultra-low detection total mercury and methylmercury added to the baseline monitoring program in 2021. The concentration of methylmercury was estimated based on the percent of methylmercury versus mercury in the surface water samples (i.e., 4.6% based on data from Birch Lake and Springpole Lake).

The data are compared to screening values protective of human health and ecological receptors.

Screening values for the protection of ecological receptors were selected from the following resources:

- Ontario provincial water quality objectives (PWQOs);
- CCME guideline for the protection of freshwater aquatic life; and
- Federal Environmental Quality Guidelines (FEQG).

For PAHs, some guidelines were available from the CCME. While some additional values were available form the PWQOs, these values were not used as they were identified as interim values. They were set for emergency purposes based on the best information readily available at that time and it is indicated to employ due caution when applying the value. Therefore, the MECP aquatic protective value was used for these PAHs.

A FEQG for surface water was available for some metals and applied, where available, as they are developed more recently than CCME and PWQO values. CCME values were used where the value was developed more recently than a PWQO.

The screening values also include the Health Canada health-based maximum acceptable concentrations guideline for Canadian drinking water quality. Where a Health Canada maximum acceptable concentration was not available, an aesthetic objective (AO) was identified. Where a Health Canada value was not identified, a value was obtained from the MECP which represent the lowest of an Ontario drinking water standard or risk-based value (MECP 2016).

Based on the screening table results presented in Table 3.4.2.3-2, no exceedances of the surface water guidelines were identified.

Benzo(a)pyrene (as a surrogate for PAHs) was identified as a COPC in air. Incremental concentrations were calculated to assess the potential for impacts to surface water. Although baseline concentrations are not available, incremental increases in surface water are negligible and do not warrant further evaluation for this media.

Table 3.4.2.3-1: Screening of Baseline and Modelled Project and Post-closure Surface Water Concentrations (mg/L) – Birch Lake

Parameter	Ecological		Human Health		Baseline	Project (Water)	Post-closure (Water)	Deposition	Project + Deposition	Post closure + Deposition
	Value[1]	Source	Value	Source						
Ammonia-N	1.5	CCME	NA	NA	1.30E-01	1.37E-01	2.50E-01	NC	1.37E-01	2.50E-01
Nitrate-N	3	CCME	NA	NA	5.00E-02	2.30E-01	1.05E-01	NC	2.30E-01	1.05E-01
Nitrite-N	0.06	CCME	NA	NA	5.00E-03	5.44E-03	5.96E-03	NC	5.44E-03	5.96E-03
Phosphorus	0.02 / 0.03	iPWQO	NA	NA	1.41E-02	1.41E-02	3.05E-02	NC	1.41E-02	3.05E-02
Total Cyanide[2]	0.005	PWQO	0.2	HC	1.00E-03	2.24E-03	2.74E-03	NC	2.24E-03	2.74E-03
Aluminum	0.74	FEQG	2.9	HC	1.56E-02	1.96E-02	8.50E-02	1.46E-02	3.42E-02	9.97E-02
Antimony	0.02	PWQO	0.006	HC	1.00E-04	4.46E-03	1.54E-03	3.38E-07	4.46E-03	1.54E-03
Arsenic	0.005	iPWQO/CCME	0.01	HC	1.20E-03	1.20E-03	2.42E-03	1.54E-05	1.22E-03	2.44E-03
Beryllium	0.011	PWQO	4	MECP	5.00E-05	5.00E-05	4.99E-05	3.42E-08	5.00E-05	5.00E-05
Boron	1.5	CCME	5	HC	5.00E-03	7.55E-03	8.95E-03	NC	7.55E-03	8.95E-03
Cadmium	6.00E-05	CCME	0.007	HC	1.00E-05	1.06E-05	1.19E-05	1.34E-07	1.08E-05	1.20E-05
Chromium	0.0089	CCME (CrIII)	0.05	HC	2.50E-04	2.75E-04	8.25E-04	2.35E-04	5.09E-04	1.06E-03
Cobalt	0.00078	FEQG	2.96	MECP	5.00E-05	5.03E-04	1.34E-04	8.40E-05	5.87E-04	2.18E-04
Copper	0.0045	FEQG	2	HC	1.00E-03	1.00E-03	1.18E-03	1.23E-05	1.01E-03	1.19E-03
Iron	0.64	FEQG	0.3 (AO)	HC (AO)	5.50E-02	5.50E-02	5.31E-02	6.85E-03	6.19E-02	6.00E-02
Lead	0.0092	FEQG	0.005	HC	2.50E-05	2.50E-05	4.60E-05	3.58E-06	2.86E-05	4.95E-05
Mercury	2.60E-05	CCME	0.001	HC	2.50E-06	3.58E-06	8.44E-06	4.19E-09	3.58E-06	8.44E-06
Methylmercury	4.00E-06	CCME	0.296	MECP	1.15E-07	1.65E-07	3.88E-07	1.93E-10	1.65E-07	3.88E-07
Molybdenum	0.073	CCME	70	MECP	2.50E-04	4.87E-04	7.20E-04	1.70E-04	6.57E-04	8.89E-04
Nickel	0.025	PWQO	100	MECP	5.00E-04	5.21E-04	8.04E-04	7.59E-06	5.28E-04	8.12E-04
Selenium	0.1	PWQO	0.05	HC	1.00E-03	1.19E-03	9.74E-04	3.42E-07	1.19E-03	9.75E-04
Silver	0.00025	CCME	100	MECP	5.00E-05	5.26E-05	5.65E-05	4.60E-07	5.31E-05	5.70E-05
Thallium	0.0008	CCME	2	MECP	5.00E-05	5.29E-05	4.07E-05	3.40E-07	5.33E-05	4.11E-05
Tungsten	0.03	iPWQO	NA	NA	1.00E-04	2.89E-04	3.44E-04	NC	2.89E-04	3.44E-04
Uranium	0.015	CCME	0.02	HC	5.00E-05	7.66E-04	2.90E-04	5.94E-06	7.72E-04	2.96E-04
Vanadium	0.12	FEQG	6.22	MECP	2.50E-04	2.50E-04	1.39E-03	6.03E-05	3.10E-04	1.45E-03
Zinc	0.012	CCME	5	HC (AO)	2.00E-03	1.51E-03	2.58E-03	2.24E-05	1.53E-03	2.60E-03
Benzo(a)anthracene[3]	1.80E-05	CCME	TPE	HC	NV	NV	NV	1.29E-08	1.29E-08	1.29E-08
Benzo(a)pyrene[3]	1.50E-05	CCME	TPE	HC	NV	NV	NV	4.73E-09	4.73E-09	4.73E-09
Benzo(b)fluoranthene[3]	4.20E-04	MECP	TPE	HC	NV	NV	NV	2.65E-09	2.65E-09	2.65E-09
Benzo(g,h,i)perylene[3]	2.00E-05	MECP	TPE	HC	NV	NV	NV	2.21E-08	2.21E-08	2.21E-08
Benzo(k)fluoranthene[3]	1.40E-04	MECP	TPE	HC	NV	NV	NV	6.11E-09	6.11E-09	6.11E-09
Chrysene[3]	7.00E-05	MECP	TPE	HC	NV	NV	NV	7.99E-09	7.99E-09	7.99E-09
Dibenzo(a,h)anthracene[3]	4.00E-05	MECP	TPE	HC	NV	NV	NV	2.69E-09	2.69E-09	2.69E-09
Indeno(1,2,3-cd)pyrene[3]	1.40E-04	MECP	TPE	HC	NV	NV	NV	3.40E-09	3.40E-09	3.40E-09
B(a)P TPE	NR	NR	4E-05	HC	NV	NV	NV	1.02E-08	1.02E-08	1.02E-08

Notes:
Bold font indicates an exceedance of the screening guidelines.
(1) As applicable, numerical guideline values summarized here were calculated using the following water characteristics. Notably, a hardness of 29.4 mg/L and dissolved organic carbon of 7.8 mg/L. A pH of 7.3, was used except for ammonia and zinc where a pH of 7.6 is used as it is more conservative. For copper, the biotic ligand model was used based on the Boreal Shield ion ratios.
(2) 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.
(3) Carcinogenic PAH used in the calculation of B(a)P TPE
NA – Not Available NC – Not Calculated NR – Not relevant
PWQO: Provincial Water Quality Objectives; iPWQO: Interim Provincial Water Quality Objectives; CCME: Canadian Council of Ministers of the Environment water quality guideline for the Protection of Aquatic Life; FEQG: Federal Environmental Quality Guideline for the Protection of Aquatic Life.
HC: Health Canada; MECP: Ontario Ministry of the Environment and Climate Change
AO – Aesthetic Objective
TPE - Total potency equivalents is used in the assessment of total carcinogenic risks to PAHs (calculation of TPE discussed in Section 4.2.3)

Table 3.4.2.3-2: Screening of Baseline and Modelled Project and Post-closure Surface Water Concentrations (mg/L) – Springpole Lake North Basin

Parameter	Ecological		Human Health		Baseline	Project (Water)	Post-closure (Water)	Deposition	Project + Deposition	Post-closure + Deposition
	Value[1]	Source	Value	Source						
Ammonia-N	1.5	CCME	NA	NA	2.08E-01	2.26E-01	6.23E-01	NC	2.26E-01	6.23E-01
Nitrate-N	3	CCME	NA	NA	5.70E-02	1.07E-01	1.57E+00	NC	1.07E-01	1.57E+00
Nitrite-N	0.06	CCME	NA	NA	5.00E-03	5.12E-03	3.36E-02	NC	5.12E-03	3.36E-02
Phosphorus	0.02 / 0.03	iPWQO	NA	NA	1.38E-02	1.38E-02	2.00E-02	NC	1.38E-02	2.00E-02
Total Cyanide[2]	0.005	PWQO	0.2	HC	1.00E-03	1.34E-03	1.89E-03	NC	1.34E-03	1.89E-03
Aluminum	0.74	FEQG	2.9	HC	1.40E-02	1.52E-02	4.60E-02	2.11E-03	1.73E-02	4.81E-02
Antimony	0.02	PWQO	0.006	HC	1.50E-04	1.25E-03	1.14E-03	8.13E-08	1.25E-03	1.14E-03
Arsenic	0.005	iPWQO/CCME	0.01	HC	6.25E-04	6.27E-04	1.28E-03	3.65E-06	6.30E-04	1.29E-03
Beryllium	0.011	PWQO	4	MECP	1.00E-04	1.00E-04	1.34E-04	1.37E-08	1.00E-04	1.34E-04
Boron	1.5	CCME	5	HC	5.00E-03	5.70E-03	7.22E-03	NC	5.70E-03	7.22E-03
Cadmium	6.00E-05	CCME	0.007	HC	5.80E-06	5.90E-06	2.83E-05	3.26E-08	5.93E-06	2.84E-05
Chromium	0.0089	CCME (CrIII)	0.05	HC	2.00E-04	2.45E-04	6.40E-04	1.49E-05	2.60E-04	6.55E-04
Cobalt	0.00078	FEQG	2.96	MECP	8.00E-05	1.89E-04	3.08E-04	5.31E-06	1.94E-04	3.13E-04
Copper	0.0045	FEQG	2	HC	8.70E-04	8.69E-04	9.84E-04	2.82E-06	8.72E-04	9.87E-04
Iron	0.64	FEQG	0.3 (AO)	HC (AO)	3.45E-02	3.52E-02	4.09E-02	1.63E-03	3.68E-02	4.25E-02
Lead	0.0092	FEQG	0.005	HC	2.50E-05	2.50E-05	1.46E-04	1.48E-06	2.65E-05	1.48E-04
Mercury	2.60E-05	CCME	0.001	HC	2.50E-06	2.79E-06	6.19E-06	1.91E-09	2.80E-06	6.19E-06
Methylmercury	4.00E-06	CCME	0.296	MECP	1.15E-07	1.29E-07	2.85E-07	8.79E-11	1.29E-07	2.85E-07
Molybdenum	0.073	CCME	70	MECP	1.87E-04	2.42E-04	8.05E-04	1.10E-05	2.53E-04	8.16E-04
Nickel	0.025	PWQO	100	MECP	3.75E-04	3.78E-04	4.18E-03	1.83E-06	3.80E-04	4.18E-03
Selenium	0.1	PWQO	0.05	HC	5.49E-04	6.03E-04	2.14E-03	8.08E-08	6.04E-04	2.14E-03
Silver	0.00025	CCME	100	MECP	3.75E-05	3.81E-05	4.07E-05	1.09E-07	3.82E-05	4.08E-05
Thallium	0.0008	CCME	2	MECP	1.50E-05	2.32E-05	2.54E-05	8.23E-08	2.33E-05	2.55E-05
Tungsten	0.03	iPWQO	NA	NA	5.00E-05	1.15E-04	2.50E-04	NC	1.15E-04	2.50E-04
Uranium	0.015	CCME	0.02	HC	3.20E-05	2.14E-04	1.46E-03	5.63E-07	2.15E-04	1.46E-03
Vanadium	0.12	FEQG	6.22	MECP	2.50E-04	2.50E-04	8.25E-04	7.47E-06	2.57E-04	8.32E-04
Zinc	0.012	CCME	5	HC (AO)	1.50E-03	1.50E-03	2.34E-03	5.40E-06	1.51E-03	2.35E-03
Benzo(a)anthracene[3]	1.80E-05	CCME	TPE	HC	NV	NV	NV	5.55E-11	5.55E-11	5.55E-11
Benzo(a)pyrene[3]	1.50E-05	CCME	TPE	HC	NV	NV	NV	3.35E-09	3.35E-09	3.35E-09
Benzo(b)fluoranthene[3]	4.20E-04	MECP	TPE	HC	NV	NV	NV	1.82E-11	1.82E-11	1.82E-11
Benzo(g,h,i)perylene[3]	2.00E-05	MECP	TPE	HC	NV	NV	NV	4.16E-10	4.16E-10	4.16E-10
Benzo(k)fluoranthene[3]	1.40E-04	MECP	TPE	HC	NV	NV	NV	6.67E-11	6.67E-11	6.67E-11
Chrysene[3]	7.00E-05	MECP	TPE	HC	NV	NV	NV	5.89E-11	5.89E-11	5.89E-11
Dibenzo(a,h)anthracene[3]	4.00E-05	MECP	TPE	HC	NV	NV	NV	1.73E-11	1.73E-11	1.73E-11
Indeno(1,2,3-cd)pyrene[3]	1.40E-04	MECP	TPE	HC	NV	NV	NV	1.96E-11	1.96E-11	1.96E-11
B(a)P TPE	NR	NR	4E-05	HC	NV	NV	NV	3.39E-09	3.39E-09	3.39E-09

Notes:
Bold font indicates an exceedance of the screening guidelines.
(1) As applicable, numerical guideline values summarized here were calculated using the following water characteristics. Notably, a hardness of 29.4 mg/L and dissolved organic carbon of 7.8 mg/L. A pH of 7.3, was used except for ammonia and zinc where a pH of 7.6 is used as it is more conservative. For copper, the biotic ligand model was used based on the Boreal Shield ion ratios.
(2) 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.
(3) Carcinogenic PAH used in the calculation of B(a)P TPE
NA – Not Available NC – Not Calculated NR – Not relevant
PWQO: Provincial Water Quality Objectives; iPWQO: Interim Provincial Water Quality Objectives; CCME: Canadian Council of Ministers of the Environment water quality guideline for the Protection of Aquatic Life; FEQG: Federal Environmental Quality Guideline for the Protection of Aquatic Life.
HC: Health Canada; MECP: Ontario Ministry of the Environment and Climate Change
AO – Aesthetic Objective
TPE - Total potency equivalents are used in the assessment of total carcinogenic risks to PAHs (calculation of TPE discussed in Section 4.2.3)

Table 3.4.2.3-3: Screening of Modelled Project and Post-closure Surface Water Concentrations (mg/L) – Springpole Lake Southeast Arm

Parameter	Ecological		Human Health		Baseline	Project (Water)	Post-closure (Water)	Deposition	Project + Deposition	Post-closure + Deposition
	Value[1]	Source	Value	Source						
Ammonia-N	1.5	CCME	NA	NA	4.88E-01	1.41E+00	2.67E-01	NC	1.41E+00	2.67E-01
Nitrate-N	3	CCME	NA	NA	6.70E-02	7.06E-01	6.64E-02	NC	7.06E-01	6.64E-02
Nitrite-N	0.06	CCME	NA	NA	5.00E-03	1.80E-02	6.00E-03	NC	1.80E-02	6.00E-03
Phosphorus	0.02 / 0.03	iPWQO	NA	NA	1.45E-02	1.20E-02	1.11E-02	NC	1.20E-02	1.11E-02
Total Cyanide[2]	0.005	PWQO	0.2	HC	1.00E-03	3.00E-03	1.03E-03	NC	3.00E-03	1.03E-03
Aluminum	0.74	FEQG	2.9	HC	3.16E-02	1.71E-01	1.90E-02	2.06E-03	1.73E-01	2.11E-02
Antimony	0.02	PWQO	0.006	HC	1.50E-04	4.71E-03	1.22E-04	8.49E-07	4.71E-03	1.22E-04
Arsenic	0.005	iPWQO/CCME	0.01	HC	9.15E-04	1.70E-03	1.00E-03	3.84E-05	1.74E-03	1.04E-03
Beryllium	0.011	PWQO	4	MECP	1.30E-04	2.51E-03	6.16E-05	5.58E-08	2.51E-03	6.17E-05
Boron	1.5	CCME	5	HC	5.00E-03	3.52E-01	5.10E-03	NC	3.52E-01	5.10E-03
Cadmium	6.00E-05	CCME	0.007	HC	2.62E-05	2.50E-05	1.28E-05	3.29E-07	2.53E-05	1.31E-05
Chromium	0.0089	CCME (CrIII)	0.05	HC	2.50E-04	2.18E-03	2.52E-04	6.18E-05	2.24E-03	3.14E-04
Cobalt	0.00078	FEQG	2.96	MECP	5.00E-05	2.00E-04	6.00E-05	2.18E-05	2.22E-04	8.18E-05
Copper	0.0045	FEQG	2	HC	8.50E-04	1.85E-03	9.40E-04	2.96E-05	1.88E-03	9.70E-04
Iron	0.64	FEQG	0.3 (AO)	HC (AO)	5.50E-02	1.48E-01	4.95E-02	1.71E-02	1.65E-01	6.67E-02
Lead	0.0092	FEQG	0.005	HC	3.00E-05	2.01E-03	3.00E-05	5.53E-06	2.02E-03	3.55E-05
Mercury	2.60E-05	CCME	0.001	HC	5.00E-06	7.90E-06	2.61E-06	7.59E-09	7.91E-06	2.62E-06
Methylmercury	4.00E-06	CCME	0.296	MECP	2.30E-07	9.20E-07	1.20E-07	3.49E-10	9.20E-07	1.20E-07
Molybdenum	0.073	CCME	70	MECP	2.50E-04	1.73E-02	2.22E-04	4.46E-05	1.73E-02	2.66E-04
Nickel	0.025	PWQO	100	MECP	7.62E-03	6.17E-03	4.90E-04	1.87E-05	6.19E-03	5.09E-04
Selenium	0.1	PWQO	0.05	HC	1.00E-03	8.02E-04	7.42E-04	8.53E-07	8.03E-04	7.42E-04
Silver	0.00025	CCME	100	MECP	5.00E-05	2.20E-04	4.28E-05	1.15E-06	2.21E-04	4.39E-05
Thallium	0.0008	CCME	2	MECP	2.75E-05	1.82E-04	1.94E-05	8.36E-07	1.83E-04	2.02E-05
Tungsten	0.03	iPWQO	NA	NA	2.70E-04	6.65E-03	1.49E-04	NC	6.65E-03	1.49E-04
Uranium	0.015	CCME	0.02	HC	5.00E-05	3.33E-03	6.04E-05	1.23E-06	3.33E-03	6.16E-05
Vanadium	0.12	FEQG	6.22	MECP	8.75E-04	2.83E-02	2.70E-04	9.83E-06	2.83E-02	2.80E-04
Zinc	0.012	CCME	5	HC (AO)	2.00E-03	6.40E-03	1.73E-03	5.54E-05	6.46E-03	1.79E-03
Benzo(a)anthracene[3]	1.80E-05	CCME	TPE	HC	NV	NV	NV	2.82E-09	2.82E-09	2.82E-09
Benzo(a)pyrene[3]	1.50E-05	CCME	TPE	HC	NV	NV	NV	1.01E-09	1.01E-09	1.01E-09
Benzo(b)fluoranthene[3]	4.20E-04	MECP	TPE	HC	NV	NV	NV	6.94E-10	6.94E-10	6.94E-10
Benzo(g,h,i)perylene[3]	2.00E-05	MECP	TPE	HC	NV	NV	NV	4.45E-09	4.45E-09	4.45E-09
Benzo(k)fluoranthene[3]	1.40E-04	MECP	TPE	HC	NV	NV	NV	7.44E-10	7.44E-10	7.44E-10
Chrysene[3]	7.00E-05	MECP	TPE	HC	NV	NV	NV	3.36E-09	3.36E-09	3.36E-09
Dibenzo(a,h)anthracene[3]	4.00E-05	MECP	TPE	HC	NV	NV	NV	2.18E-10	2.18E-10	2.18E-10
Indeno(1,2,3-cd)pyrene[3]	1.40E-04	MECP	TPE	HC	NV	NV	NV	2.74E-10	2.74E-10	2.74E-10
B(a)P TPE	NR	NR	4E-05	HC	NV	NV	NV	1.76E-09	1.76E-09	1.76E-09

Notes:
Bold font indicates an exceedance of the screening guidelines.
(1) As applicable, numerical guideline values summarized here were calculated using the following water characteristics. Notably, a hardness of 29.4 mg/L and dissolved organic carbon of 7.8 mg/L. A pH of 7.3, was used except for ammonia and zinc where a pH of 7.6 is used as it is more conservative. For copper, the biotic ligand model was used based on the Boreal Shield ion ratios.
(2) 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.
(3) Carcinogenic PAH used in the calculation of B(a)P TPE
NA – Not Available NC – Not Calculated NR – Not relevant
PWQO: Provincial Water Quality Objectives; iPWQO: Interim Provincial Water Quality Objectives; CCME: Canadian Council of Ministers of the Environment water quality guideline for the Protection of Aquatic Life; FEQG: Federal Environmental Quality Guideline for the Protection of Aquatic Life.
HC: Health Canada; MECP: Ontario Ministry of the Environment and Climate Change
AO – Aesthetic Objective
TPE - Total potency equivalents is used in the assessment of total carcinogenic risks to PAHs (calculation of TPE discussed in Section 4.2.3)

3.4.2.4 Identification of Inorganic Chemicals of Potential Concern in Sediment

Sediment chemistry data available from 2020, 2021 and 2022 were used in the baseline dataset as obtained from the following reports:

- 2022/2023 Aquatic Baseline (Appendix O-1 of the EIS/EA);
- 2021 Aquatic Baseline (Appendix O-2 of the EIS/EA); and
- 2020 Aquatic Baseline (Appendix O-3 of the EIS/EA).

Sampling locations are as identified within the aquatics baseline reports and in Figure A-2, Attachment A. Sediment samples were collected at locations co-located with aquatic plants. The co-located sample locations are illustrated in Figure A-3, Attachment A. The full sediment dataset is provided in Table A-2, Attachment A.

A summary of the maximum sediment concentrations measured in the baseline investigation area is displayed in Table 3.4.2.4-1, in comparison to applicable guidelines for the protection of human and ecological health.

During operations, surface water may also be impacted from particulate deposition. The estimated surface water concentrations associated with particulate deposition is estimated for Birch Lake, the north basin of Springpole Lake and the southeast arm of Springpole Lake. The calculations used to estimate these concentrations are provided in Attachment A, Section 2.4.

Based on the maximum baseline metals concentrations in sediment in comparison to the ecological screening guidelines, arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, phosphorus and zinc exceed the Ministry of Environment and Climate Change (MOECC) lowest effect level (LEL) and/or CCME interim sediment quality guidelines, while only arsenic and phosphorus exceed the CCME probable effect level (PEL) or MOECC severe effect level (SEL).

Based on the maximum baseline metals concentrations in sediment in comparison to the human health screening guidelines, arsenic and cobalt slightly exceed the MECP or CCME SQG for a residential / parkland land use.

At a maximum sediment concentration of 1.29 mg/kg, cadmium slightly exceeded the MECP Table 2 SCS of 1 but does not exceed the CCME SQG of 1.4 mg/kg. A cadmium sediment concentration greater than the MECP Table 2 SCS was identified at 8 out of 112 sample locations (7%). The 95th UCLM of this dataset is 0.60 mg/kg. Cadmium was not identified as a COPC in any other media. Based on this information, cadmium is not considered a COPC.

Table 3.4.2.4-1: Screening of Modelled Project and Post-closure Sediment Concentrations (mg/kg)

Parameter	Human Health		Ecological Health				Baseline	Maximum Deposition	Baseline + Deposition
	MECP Table 2 SCS	CCME SQG	CCME Sediment Quality Guidelines		MOECC Provincial Sediment Quality Guidelines				
	Residential / Parkland	Residential / Parkland	Interim Sediment Quality Guideline	Probable Effect Level (PEL)	Lowest Effect Level (LEL)	Severe Effect Level (SEL)			
Aluminum	-	-	-	-	-	-	24,800	22	24,822
Antimony	7.5	-	-	-	-	-	0.61	3.82E-05	0.61
Arsenic	11	12	5.9	17	6	33	**64.6**	1.11E-03	**64.6**
Barium	390	6,800	-	-	-	-	366	1.70E-03	366
Beryllium	4	-	-	-	-	-	0.95	4.39E-05	0.95
Bismuth		-	-	-	-	-	0.63	NC	0.63
Boron	120	-	-	-	-	-	11	NC	11
Cadmium	-	-	-	-	-	-	**1.29**	2.47E-05	**1.29**
Calcium							26,000	NC	26,000
Chromium	160	220	37.3	90	26	110	**62.4**	4.46E-03	**62.4**
Cobalt	22	22	-	-	-	-	**27.9**	3.78E-03	**27.9**
Copper	140	1,100	35.7	197	16	110	**53.8**	1.04E-03	**53.8**
Iron	-	-	-	-	20,000	40,000	**85,600**	4.29E-01	**85,600**
Lead	120	140	35	91.3	31	250	**41.2**	4.95E-03	**41.2**
Lithium	-	-	-	-	-	-	19.3	NC	19.3
Magnesium	-	-	-	-	-	-	10,000	2.77E-01	10,000
Manganese	-	-	-	-	460	1,100	**5,380**	2.61E-02	**5,380**
Mercury	0.25	6.6	0.17	0.486	0.2	2	**0.238**	2.26E-05	**0.238**
Molybdenum	6.9	-	-	-	-	-	6.28	4.49E-02	6.32
Nickel	100	200	-	-	16	75	**39.4**	1.22E-03	**39.4**
Phosphorous	-	-	-	-	600	2,000	**4,300**	NC	**4,300**
Potassium	-	-	-	-	-	-	2,190	2.15E-01	2,190
Selenium	2.4	80	-	-	-	-	2.35	4.26E-06	2.35
Silver	20	-	-	-	-	-	0.44	9.51E-06	0.44
Sodium	-	-	-	-	-	-	285	NC	285
Strontium	-	-	-	-	-	-	105	3.35E-03	105
Sulphur (sulphur dioxide)	-	-	-	-	-	-	6,700	NC	6,700
Thallium	1	-	-	-	-	-	0.467	5.93E-05	0.47
Tin	-	-	-	-	-	-	9.4	8.30E-04	9.40
Titanium	-	-	-	-	-	-	694	1.09E+00	695
Tungsten	-	-	-	-	-	-	1.17	NC	1.17
Uranium	23	23	-	-	-	-	2.93	2.66E-03	2.93
Vanadium	86	-	-	-	-	-	77.3	5.98E-02	77.4
Zinc	340	10,000	123	315	120	820	**146**	**3.43E-03**	**146**

Notes:
Bold font indicates an exceedance of the screening guidelines.
– = not applicable.

3.4.2.5 Identification of Inorganic Chemicals of Potential Concern in Country Foods

A baseline assessment of country foods was completed to determine the existing concentrations of metals in fish, aquatic plants, terrestrial plants (berries and labrador tea) and small mammals (i.e., to represent the hare).

The datasets and sampling locations for the country food items are provided in Attachment A. In summary:

- Aquatic plant sampling and co-located sediment sampling was completed in 2021. Aquatic plant results are presented in Table A-4 and locations are shown in Figure A-3, Attachment A.
- Terrestrial plant sampling was completed in 2021 and 2022. Results are presented in Tables A-5 and A-6 and locations are shown in Figure A-4, Attachment A.
- Small mammal sampling and co-located soil sampling was completed in 2022. Small mammal sample results are presented in table A-8 and locations are shown in Figure A-3.4.2.51, Attachment A.
- Fish samples obtained from Springpole Lake used to represent country foods were collected in 2019 (i.e., Northern Pike) and 2022 (i.e., Lake Whitefish, Lake Trout, Walleye and Northern Pike) (Appendix O-1, O-2 and O-3 in the EIS/EA). As sufficient samples were collected in 2019 and 2022 to support statistical evaluation, the older data from 2012 were not used in the dataset. Results for fish fillets are presented in Tables A-9 and A-10 and aquatic resources monitoring stations (including fish) are illustrated in Figure A-2, Attachment A.
- Fish data obtained from Birch Lake from the Ontario government in 2009 (i.e., Lake Trout) and 2014 (i.e., Lake Trout, Walleye, Northern Pike) were considered in the evaluation (MECP 2021a). However, the data were not ultimately used in the evaluation as more recent data collected resulted in more conservative estimates of fish tissue concentrations.

The sampling methodology and metals chemistry data for plants and mammals, collected as part of the HEHRA, are presented in Attachment A.

The aquatic (fish) sampling locations completed in 2019 and 2022 and the methodology are provided in the Aquatic Resources reports (Appendix O-1, O-2 and O-3 of the EIA/EA).

Due to a lack of regulatory screening guidelines for most metals in plants and fish, COPCs in country foods are chosen based on COPCs identified in soil, surface water and/or sediment, where there is a potential for the COPC to be taken up into plants and/or fish from the media. In addition, parameters that are known to be highly bioaccumulative (such as mercury and methylmercury in aquatic organisms) are selected as COPC in country foods, where appropriate.

3.4.2.6 Summary of Chemicals of Potential Concern

The chemical screening in Section 3.4 has identified the following COPCs for further evaluation in the HHERA:

- **Soil:** arsenic, cobalt and molybdenum;
- **Fish:** mercury and methylmercury; and
- **Sediment:** arsenic, cadmium, total chromium; copper, iron, lead, manganese, mercury, nickel, phosphorous and zinc.

In air, PAHs, diesel particulate matter and NO_2 were identified as COPCs. These will be addressed in the human health risk assessment for the inhalation pathway only.

3.5 Human Health and Ecological Risk Assessment Model

To support the interpretation of the large dataset, all data were organized into an HEHRA model referred to as the Project HEHRA Model specifically designed by WSP for use on the Project.

Concentrations of COPCs were modelled from their source media into country foods, where applicable, via the concentration in source media multiplied by an uptake factors (bioaccumulation factors or transfer coefficients / factors), with consideration given to receptor specific inputs required such as ingestion rates and wet:dry conversion factors. The chemical concentration of all COPCs were modelled into the country foods from all media sources regardless of whether there was a criteria exceedance in that media type.

Full details of the modelling of COPC concentrations into country foods is provided in Attachment A. A sample calculation is also provided in Attachment B.

For safety purposes, access to the mine site area of the PDA will be restricted to employees of FMG only during the active phases of the Project (i.e., construction, operations and active closure) and no country foods will be harvested from the mine site PDA during these Project phases

The country foods assessment was considered as an exposure pathway in the HEHRA and was assessed for all Project phases, Assessment Scenarios and receptor locations.

The following country foods were selected as a representative subset of the most commonly consumed species for the country foods assessment, based on the information provided in Section 4.3.2. It is recognized that the listed species are a representative subset of the more comprehensive list of valued country foods and ecological species.

- **Plants:** Blueberries, raspberries and labrador tea (*Ledum groenlandicum*).
- **Meat (wild game):** Moose (*Alces alces*); and Snowshoe Hare (*Lepus americanus*).
- **Fish:** Walleye (*Sander vitreus*) and Lake Whitefish (*Coregonus clupeaformis*)

Additionally, the model calculated concentrations in invertebrates, forage and aquatic plants for as a pathway within country foods rather than a food itself.

The modelled EPCs of COPCs in country foods are provided in Attachment A, Section 1.4 Modelled Concentrations Used in the Assessment.

The model allowed for a systematic quantitative interpretation of the data for Baseline, Project and Post-closure at each of the points of reception. For carcinogenic risks, a Project Alone Assessment Scenario is evaluated. The Project Assessment Scenario includes construction, operations and active closure.

The model was driven by key assumptions with respect to dominant sources of exposure media (i.e., environmental or Project-influenced media) in the terrestrial and aquatic environment for both the HHRA (including country foods assessment) and the ERA.

Exposure equations for the HHRA and ERA were those defined by Health Canada or the CCME Federal Contaminated Sites Action Plan (FCSAP) guidance, respectively. All receptor and exposure scenario characteristics and exposure equations are clearly defined in their respective risk assessment sub-sections. All model inputs are summarized in Attachment A.

4.0 HUMAN HEALTH RISK ASSESSMENT

Human health risk assessment (HHRA) is a process used to assess the potential risk to human receptors resulting from one or more environmental stressors. In so doing, the HHRA takes into account the concentrations of the chemicals to be evaluated, their toxicity and the manner in which receptors may be exposed.

The objective of the HHRA was to assess potential human health risks associated with the identified COPCs in the LSA for all Assessment Scenarios, and also with each Project phase. Potential health risks to human receptors were determined by completing a qualitative or quantitative assessment using site-specific conditions, where available, and generic assumptions provided by Health Canada or the MECP.

The HHRA was conducted according to industry accepted risk assessment practices and methodologies and followed guidance published and endorsed by government agencies. This approach is consistent with previous projects in Ontario that have been reviewed by the Agency. Guidance documents were relied upon in the HHRA are identified in Section 2.5.

4.1 Problem Formulation

The first step of the HHRA (i.e., problem formulation) was to determine whether a particular chemical would be released at levels that could potentially pose an unacceptable risk to human health. Considerations included the fate and behaviour of the chemicals in the environment, and the toxicological potency based on various pathways of exposure (i.e., air, water, soil and food) and routes of exposure (i.e., inhalation, ingestion and dermal) to the human receptor. In addition, the problem formulation evaluated which exposure pathways were considered complete from the source of risk leading directly or indirectly to the sensitive human receptors. Incomplete pathways (i.e., no exposure route, or absence of toxicity, or insufficient concentration) were excluded from the assessment. For example, if a chemical was considered toxic, the risk may still remain nonexistent if the concentration of the chemical in the media was low or there was no possibility that a receptor can be exposed to the chemical.

Where exposure pathways can be reasonably assumed to be complete, a detailed examination of potential risks is conducted via quantitative approach. For COPCs concentrations that exceed their respective human health screening values, they are carried forward for a quantitative assessment of potential risk. The detailed quantitative assessment involves the remaining steps of the HHRA framework, including the exposure assessment, toxicity assessment and risk characterization.

Receptors included in the assessment are conservatively considered to potentially include all human receptor ages defined by Health Canada (i.e., infant, toddler, child, teen and adult) who may spend time in the LSA. All receptors are assumed to include both members of Indigenous communities and members of the general public.

4.1.1 Identification and Characterization of Potential Human Receptors

All people in the human health LSA and RSA were assumed to have the potential to be exposed, particularly to air emissions, particulates and water emissions that may travel beyond the mine site area of the PDA. Two main receptors, as described in Table 4.1.1-1, were identified to represent realistic yet conservative receptors within the LSA/RSA. In order to take into account the fact that Indigenous community members may consume higher amounts of foods from the LSA, it was conservatively assumed that the human receptors considered in the HHRA are also Indigenous community members living in nearby Indigenous communities.

Table 4.1.1-1: Receptors Assessed in the Human Health Risk Assessment

Location	Description
Receptor	**Indigenous Resident / Traditional Land User:** This receptor is conservatively assumed to be an Indigenous community member (infant to elder) who resides full time in an Indigenous community located in the area of the Project and spends 20% of their time conducting TLRU activities within the LSA. This scenario also conservatively represents non-Indigenous residents (infant to adult) living in a community in the area of the Project and spending 20% of their time conducting recreational activities within the LSA. **Indigenous Resident/ Cabin User / Traditional Land User:** This receptor is conservatively assumed to be an Indigenous community member (infant to elder) who resides in an Indigenous community located in the area of the Project and spends 40% of their time residing in a cabin located within the LSA/RSA, conducting TLRU activities in the area of the cabin. This scenario will also conservatively represent a non-Indigenous resident (infant to adult) residing outside the RSA, spending 40% of their time at a cabin located within the LSA / RSA, and conducting recreational activities such as hunting, fishing and trapping in the area of the cabin.

4.1.2 Identification of Exposure Scenarios and Operable Pathways

Exposure scenarios are developed to identify reasonable yet conservative cases that consider how each of the receptors identified for assessment in the HHRA may be exposed to emissions from the Project.

In order to develop the exposure scenarios, several potential Points of Reception (PORs) were identified to represent air emissions at locations where individuals may reasonably be found spending time outside of the mine site area of the PDA, but within the LSA and RSA. While on the Project site, the health of workers is protected by occupational health and safety standards, codes and regulations established by various provincial and federal governments; thus, occupational health and safety is not addressed in the scope of this assessment.

The PORs include 1) representative existing cabins, camps and camping areas 2) areas where TLRU such as hunting, trapping, gathering and spiritual activities may be practised outside and 3) residential land use area. These PORs are outside of the PDA but within the LSA and RSA.

The PORs selected for consideration in the HHRA, are listed in Table 4.1.2-1 and illustrated in Figure 3-2 (PORs) and Figure 3-5 (surface water quality nodes). Additionally, a non-static location called the MPOI was assessed, which represents the highest predicted ground level air concentrations anticipated to occur in close proximity to the mine site area of the PDA. It is noted that human receptors in the LSA are not expected to spend an appreciable amount of time at the MPOI and, therefore, the cabin, TLRU and residential receptor locations more accurately represent potential exposure.

Table 4.1.2-1: Points of Reception Considered in the Human Health Risk Assessment

Study Area	Point of Reception	POR Type	Description
LSA	MPOI	Not applicable	Maximum point of impingement
LSA	POR01	Cabin	Closest cabin to the north of mine (Birch Lake)
LSA	POR05	TLRU	Closest TLRU to the north of mine (Birch Lake)
RSA	POR24	Cabin	Closest cabin to the west of mine (Birch Lake)
LSA	POR04	TLRU	Closest TLRU to the west of mine (Birch Lake)
RSA	POR22	Cabin	Closest cabin to the South of mine (Seagrave Lake)
LSA	POR02	TLRU	Close TLRU to the south of mine (Springpole Lake, north basin)
LSA	POR61	TLRU	TLRU south of mine
LSA	POR07	Cabin	Closest cabin to the southeast of mine (Springpole Lake)
RSA	POR38	Cabin	Cabin southeast of mine (Gull Lake)
LSA	POR16	Residential	Slate Falls Nation

For assessment of potential exposure to water emissions for the purposes of the HEHRA, predicted surface water concentrations at surface water quality modelling nodes (shown in Figure 3-5) were used to estimate surface water concentrations within Birch Lake and Springpole Lake near the PORs that represent receptor areas at each of the Project phases. The surface water quality nodes that were selected to represent concentrations in the waterbodies closest to the POR locations assessed are shown in Table 4.1.2-2.

Due to the nature in which potential risks are calculated for non-carcinogenic effects and carcinogenic effects, the approach used to identify surface water concentration varied. The carcinogenic exposure assessment addresses a lifetime of exposure and therefore considered a wider spatial exposure. A surface water concentration representative of an area of the waterbody was identified. In the non-carcinogenic assessment, a surface water value at one node was identified to represent exposure as the spatial extent of exposure during a given season is less variable. The exposure scenarios are designed to consider a variety of conservative exposure conditions associated with Birch Lake and Springpole Lake throughout the project.

Table 4.1.2-2: Surface Water Quality Considered in the Human Health Risk Assessment

Study Area	Selected Point of Reception	Surface Water Quality (SWQ) / Nodes Non-carcinogenic Effects	Surface Water Quality (SWQ) / Nodes Carcinogenic Effects	Surface Waterbody Areas Represented
LSA	MPOI	SWQ at Node 6	NC	Birch Lake at northern PDA boundary
LSA	POR01	SWQ Node 6	Birch Lake North (Node 6 & Background)	Birch Lake near closest cabin to the north of mine (outside influence of surface water quality effects due to flow direction)
LSA	POR05	SWQ at Node 6	Birch Lake North (Node 6 & Background)	Birch Lake at closest TLRU to the north of mine
RSA	POR24	SWQ at Node 8	SWQ at Node 8	Birch Lake at closest cabin to the west of mine
LSA	POR04	SWQ at Node 7	Birch Lake West (Node 7 & 8)	Birch Lake at closest TLRU to the west of mine
RSA	POR22	SWQ at Discharge Location	Springpole Lake (Node 5 & DL)	Seagrave Lake at closest cabin to the south of mine
LSA	POR02	SWQ at Node 11	Springpole Lake North Basin (Node 11 & 5)	Springpole Lake north basin at closest TLRU to the south of mine
LSA	POR61	SWQ at Node 8	SWQ at Node 8	Farther south of PDA in Cromarty Lake (flow from Birch Lake)
LSA	POR07	Modelled SWQ at POR07	Modelled SWQ at POR07	Springpole Lake, southeast arm at closest cabin to the southeast of mine
RSA	POR38	SWQ at Node 10	SWQ at Node 10	Existing Springpole Lake southeast arm to cabin southeast of mine
LSA	POR16	NR	NR	Assumed baseline drinking water quality in residential areas (outside influence of surface water releases)

Notes:
NC = not calculated, as an individual would not spend a lifetime of exposure at the MPOI; NR = not required, as exposure would be negligible relative to the other exposure scenarios.

The selected POR locations and surface water quality nodes were used to develop conservative human receptor exposure scenarios for use in the HHRA. The selected exposure scenarios were developed to represent conservative exposure cases. Highest air and surface water emissions exposures occur at locations within close proximity to the mine site area of the PDA. Therefore, PORs close to the mine, at either a cabin/lodge/camp or TLRU location, were selected for assessment in addition to the residential area located within the LSA (Slate Falls Nation). The HHRA conservatively assesses risk to Indigenous resident receptors who may eat a high amount of country foods from the LSA (heavy consumer). The HHRA also assessed risk to an Indigenous resident receptor who eats an average amount of country foods from the LSA (average consumer), for comparative purposes.

Table 4.1.2-3 lists the exposure scenarios considered in the HHRA, including receptors, POR locations selected to represent exposure due to air emissions and surface water quality nodes and conditions selected to represent exposure due to water emissions from the Project.

Table 4.1.2-3: Exposure Scenarios Assessed in the Human Health Risk Assessment

Exposure Scenario Assessed in the HHRA		Study Area	POR	POR Type
Indigenous resident / TLRU Receptor	• Indigenous community member residing full time in an Indigenous community located in the area of the Project who spends 20% of their time conducting TLRU activities within the LSA. • POR16 (Slate Falls Nation) represents the residential area within the LSA and closest to the PDA. • Assumes 100% of country foods are collected from the area of the selected TLRU POR and are consumed at an average or heavy consumption rate. • The TLRU PORs selected for assessment represent worst case assessment of potential exposure during TLRU activities in the RSA. • Exposures at other TLRU POR locations will result in lower exposures from the Project. • Non-cancer exposure calculations assume exposure from TLRU only. Cabin exposure accounts for time at the TLRU and resident.	LSA	POR05	TLRU
		LSA	POR04	TLRU
		LSA	POR02	TLRU
		LSA	POR61	TLRU
Indigenous resident / Cabin receptor	• Indigenous community member residing in an Indigenous community located in the area of the Project who spends 40% of their time residing in one of the cabins closest to the PDA, conducting TLRU activities in the area of the cabin. • Assumes 100% of country foods are collected from the area of the cabin and are consumed at an average or heavy consumption rate. • It is noted that the selection of these cabin PORs represents worst case assessment of potential exposure to cabin users conducting TLRU activities within the LSA and RSA. Exposures at other cabin / lodge / camp POR locations will result in lower exposures from the Project. • This scenario also conservatively assesses a non-Indigenous resident residing in the area of the Project, spending 40% of their time at a cabin near the PDA and conducting recreational activities such as hunting, fishing and trapping in the area of the cabin and consuming country foods from the area. • POR1 is north of the mine and outside the influence of surface water impacts from releases. Surface water impacts from deposition only for drinking water. Country foods exposed to water are assumed to come from Birch Lake (north end), as noted in Table 4.2.1.2-2. • POR22 is within Seagrave Lake and outside the influence of surface water impacts from releases. Surface water impacts from deposition only for drinking water. Country foods exposed to water are assumed to come from Birch Lake (north end) as noted in Table 4.2.1.2-2. • Non-cancer exposure calculations assume exposure from cabin only. Cancer exposure accounts for time at the cabin and resident.	LSA	POR01	Cabin
		LSA	POR07	Cabin
		RSA	POR24	Cabin
		RSA	POR22	Cabin
		RSA	POR38	Cabin

Exposure pathways refer to the method by which the COPC could reach the various receptors. Pathways could either be direct, in which COPC could travel directly from the source to the receptor, or indirect, in which COPC could be carried through multiple environmental media (e.g., air, soil, water, food) before reaching the human receptor. For example, a chemical released into the air could reach a receptor through a direct pathway if it was directly inhaled. Alternatively, a COPC may travel through an indirect pathway if it deposits from the air onto the soil and, consequently, enters the food chain due to the uptake by plants and animals that might then be ingested by humans.

An exposure pathway must be complete to represent a human health risk. A complete exposure pathway is composed of four elements:

- Source and mechanism of chemical release;
- Transport medium or media;
- Point of potential human contact with the contaminated medium; and
- Exposure route at the contact point.

The potential exposure media in the LSA are ambient air, soil, surface water, groundwater, sediment, vegetation, fish and wildlife. The Project will emit COPC into the air, primarily from fugitive dust emissions, and potentially discharge COPC through effluent directed to surface water. The emission of chemicals may affect the regional and local air quality and water quality. In addition, the deposition of chemicals from the air onto the ground surfaces may affect the regional soil and water quality. Chemicals in the soil could be incidentally ingested by humans or could accumulate in plant tissues and move up the food chain when the plants are consumed by humans or by wild game. The same mechanism applies to surface water that may be consumed by wildlife or uptake in fish tissue from surface water.

The potential exposure pathways for chemicals and their relevance at the Site are summarized in Table 4.1.2-1. Those complete hazard-exposure-receptor combinations considered to have the highest likelihood to contribute to human health risk are carried forward for further quantitative analysis.

Table 4.1.2-1: Potential Exposure Scenarios – Human Receptors

Source Media	Exposure Pathway Description	Pathway Considered?	Assessment Required(1)	Justification
Air	Inhalation of CAPs	Yes	Yes	Carried forward for inhalation pathway.
	Inhalation of inorganics (metals) in fugitive dust	Yes	Yes	No inorganic COPCs were identified in air. Project COPCs were carried forward for multimedia assessment
	Inhalation of volatile COPCs in ambient air	Yes	Yes	PAHs were identified as COPCs in air
Soil	Ingestion	Yes	Yes	Metals were identified as COPCs in soil
	Dermal contact			
	Inhalation of soil particulates (dust)			
	Ingestion of country foods			
Groundwater	Dermal contact	No	No	Groundwater is not available for contact by humans in the LSA
	Ingestion of drinking water	No	No	There are no groundwater wells present in the LSA
Surface water	Dermal contact (recreational use)	Yes	Yes	No COPCs identified but Project COPCs (metals) were carried forward for multimedia assessment
	Ingestion of drinking water	Yes	Yes	No COPCs identified but Project COPCs (metals) were carried forward for multimedia assessment
	Ingestion of country foods	Yes	Yes	No COPCs identified but Project COPCs (metals) were carried forward for multimedia assessment.
Sediment	Incidental ingestion	Yes	Yes	Project COPCs for human health (metals) were carried forward for multimedia assessment.
	Dermal contact	Yes	Yes	Project COPCs for human health (metals) were carried forward for multimedia assessment.
Plants	Ingestion of country foods	Yes	Yes	Project COPCs (metals) were carried forward for multimedia assessment
Fish	Ingestion of country foods	Yes	Yes	Project COPCs (metals) were carried forward for multimedia assessment
Wild game	Ingestion of country foods	Yes	Yes	Project COPCs (metals) were carried forward for multimedia assessment

Note:
(1) Pathways identified as "Yes" were carried forward for assessment in the HHRA.

4.1.3 Chemicals of Potential Concern

In Section 3.4, COPCs were identified based on an exceedance of a regulatory criteria (protective of human and ecological health) in environmental and/or Project-influenced media (such as soil influenced by Project generated dust).

The COPC screening in Section 3.4 has identified the following COPCs for further evaluation in the HHERA:

- **Soil:** arsenic and cobalt;
- **Fish:** mercury and methylmercury; and
- **Sediment:** arsenic and cobalt.

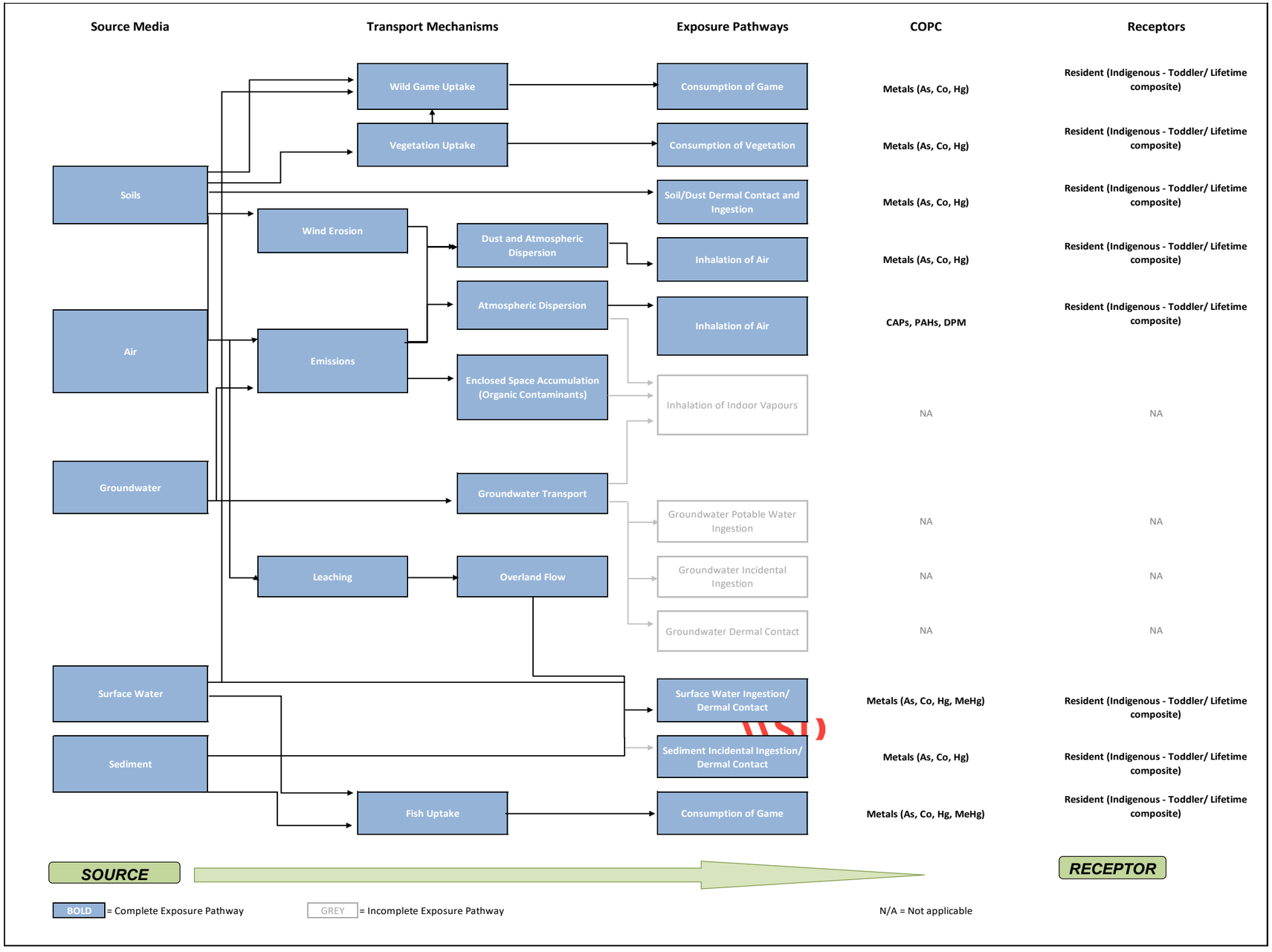
In air, PAHs, diesel particulate matter and NO_2 were identified as COPCs. These will be addressed in the human health risk assessment for the inhalation pathway only.

4.1.4 Human Health Conceptual Site Model

The information collected in the problem formulation is depicted on the human health conceptual site model; it illustrates the source media for COPCs, identifies the receptors at each of the Study Areas and shows operable exposure pathways by which receptors may be exposed to the COPCs.

The overall conceptual site model for human receptors is provided in Figure 4-1.

Figure 4-1: Overall Human Health Conceptual Site Model for the Springpole Gold Project



4.2 Toxicity Assessment

The purpose of the toxicity assessment is to identify the types of adverse effects a COPC may potentially cause as well as the relationship between the magnitude of COPCs to which human receptors may be exposed (dose) and the likelihood of an adverse effect (response).

Toxicity data were compiled for each COPC. This included gauging the potential adverse effect of a COPC on exposed human receptors and quantifying the relationship between an increase in the adverse effect and the amount of exposure. The toxicity assessment addressed the following:

- Hazard identification, which describes the potential adverse effects associated with a chemical and the likelihood of occurrence in humans; and
- Dose-response evaluation, which quantifies the relationship between chemical dose and the incidence of adverse health effects in the exposed human receptors.

Exposure limits are developed by regulatory agencies (e.g., Health Canada, US EPA) based on a technical review by a number of scientists of all of the available scientific information and the application of professional judgment. These limits consider the most sensitive toxicological endpoints in humans and make adjustments according to uncertainty factors. These exposure limits are developed to protect the most sensitive individuals in a population, including sensitive life stages (e.g., elderly, pregnant women) and individuals with compromised health conditions (e.g., people with asthma). Typically, exposures below these limits would not be associated with adverse health effects and, thus, would not represent a concern. As exposures increase to levels above the exposure limit, the probability of health effects occurring would increase accordingly. Adverse health effects are characterized as being carcinogenic (non-threshold chemicals) or non-carcinogenic (threshold chemicals).

For noncarcinogens (threshold chemicals), an oral or inhalation exposure limit is derived by comparing the chemical dose to the appearance of adverse effects. In controlled experiments, the highest dose that did not cause any adverse effects was referred to as the no observable adverse effect level (NOAEL). The lowest dose that resulted in an adverse effect was referred to as the lowest observable adverse effect level (LOAEL). The exposure limit is derived by the application of uncertainty factors to either the NOAEL or LOAEL. The exposure limit represents an oral or inhalation threshold or "safe dose" for exposure to a chemical averaged over a lifetime. These exposure limits are used as the TRVs for the assessment of oral / dermal and inhalation exposures for non-carcinogenic effects.

For the purposes of this HHRA, TRVs from Health Canada (called TDI [Tolerable Daily Intake]) were applied, where available, followed by TRVs provided by the MECP.

For carcinogens (non-threshold chemicals), the exposure limit is called a slope factor or unit risk, which is an upper-bound estimate of the probability of a carcinogenic response per unit intake of a constituent over a lifetime. According to the US EPA (2011), either central or upper-bound estimates may be appropriate for evaluation of the carcinogenic risk. The selection of the estimate to be used is dependent on the type of assessment that may be required. Central estimates are applicable for characterizing a typical individual's risk while upper-bound estimates conservatively exaggerate the risk to help ensure that the risk is not underestimated. Central estimates are useful for assessing aggregate risk across a population and for comparing or ranking environmental hazards. Upper-bound estimates provide information about the precision of the comparison or ranking. Slope factors or unit risks (upper-bound estimates) from Health Canada (2021a), US EPA, California EPA and Risk Assessment Information System (RAIS) were used in this HHRA.

In the absence of published carcinogenic or non-carcinogenic TRVs for the air CAPs (i.e., SO_2, NO_2, CO and PM), the exposure limits from the AAQC from Ontario (MECP 2020), as summarized in Table 4.2-1. Non-carcinogenic TRVs selected for the human health COPC are presented in Table 4.2-2 and carcinogenic TRVs selected for the human health COPC are presented in Table 4.2-3.

Table 4.2-1: Exposure Limits for Criteria Air Parameters Assessment

CAP	Averaging Period	Criteria (µg/m³)	Reference
NO_2	1 hour	400	MECP 2020
	24 hour	200	MEC 2020
	Annual	23	CAAQS
SO_2	10 minutes	178	MECP 2020
	1 hour	100	MECP 2020
	Annual	10	MECP 2020
CO	1 hour	36,200	MECP 2020
	8 hour	15,700	MECP 2020
$PM_{2.5}$	24 hour	27	MECP 2020
	Annual	8.8	MECP 2020
PM_{10}	24 hour	50	MECP 2020
Total suspended particulate	24 hour	120	MECP 2020
	Annual	60	MECP 2020

Table 4.2-2: Non-carcinogenic Toxicological Reference Values for Human Health Risk Assessment

Chemical of Concern	Inhalation Reference Concentration (RfC)			Oral Chronic - Non-cancer		
	RfC (mg/m^3)	Critical Effect(s)	Reference	TRV Selected (mg/kg/d)	Critical Effect(s)	Reference
Arsenic	1.05×10^{-3}	Skin lesions and possible vascular complication	MECP (2017)(1)	3×10^{-4}	Skin lesions and possible vascular complication	MECP (ATSDR 2007; US EPA 1991)
Cobalt	5×10^{-4}	Cardiomyopathy (Heart Disease)	MECP (RIVM 2001)	1×10^{-3}	Hematological (Increase in Red Blood Cells)	MECP (Modified ATSDR 2004)
Mercury	9×10^{-5}	Hand tremors; memory disturbances; neurobehavioural & autonomic dysfunction	MECP (CalEPA 2000)	3×10^{-4}	Immunotoxicity (autoimmune glomerulonephritis)	Health Canada (2021b)
Methylmercury	Not Relevant			2×10^{-4}	Neuro-developmental toxicity Sensitive Population(2)	Health Canada (2021b)
				$4.7E \times 10^{-4}$	General Population(3)	Health Canada (2021b)
Benzo(a)pyrene	2.0×10^{-6}	Developmental toxicity (decreased embryo/foetal survival)	Health Canada (2021b)	Not Relevant		
Diesel Particulate Matter	5×10^{-3}	Respiratory inflammation, functional changes	Health Canada (2016)	Not Relevant		

Note:
(1) Route to route extrapolation.
Not Relevant – Not assessed through this exposure pathway
(2) Women of child-bearing age, infants and children <12 years
(3) Non-sensitive adults

Table 4.2-3: Carcinogenic Toxicological Reference Values for Human Health Risk Assessment

Chemical of Concern	Inhalation Unit Risk - Cancer			Oral Slope Factor - Cancer		
	IUR	Critical Effect(s)	Reference	TRV Selected $(mg/kg/d)^{-1}$	Critical Effect(s)	Reference
Arsenic	6.4 $(mg/m^3)^{-1}$ 27 $(mg/kg/day)^{-1}$	Cancer (lung)	Health Canada (2021b)	1.8	Cancer (bladder, lung, liver)	Health Canada (2021b)
Cobalt	None-Selected			None-Selected		
Mercury	None-Selected			None-Selected		
Methylmercury	Not Relevant			Not Relevant		
Benzo(a)pyrene	0.6 $(mg/m^3)^{-1}$	Cancer (tumours of the upper gastrointestinal tract and upper respiratory tract [squamous cell neoplasia in the larynx, pharynx, trachea, nasal cavity esophagus and forestomach])	Health Canada (2021b)	Not Relevant		
Diesel Particulate Matter	0.3 $(mg/m^3)^{-1}$	Cancer (lung)	CalEPA (2016)	Not Relevant		

Not Relevant – Not assessed through this exposure pathway

4.2.1 Non-carcinogens

Compounds that have non-carcinogenic effects are assumed to have a dose below which no adverse effect occurs, or conversely, above which an effect may be observed. This dose is called the threshold dose. In laboratory experiments, this dose is known as the NOAEL. The lowest dose at which an adverse effect is observed is called a LOAEL. The NOAEL or LOAEL is often used by regulatory agencies as the point of departure when deriving threshold-based TRVs (e.g., Reference Dose [RfD], TDI, Reference Concentration [RfC], Tolerable Concentration [TC]). The TRV provides reasonable certainty that if the specified exposure dose is below the threshold, then specific health outcomes associate with that TRV are not expected to occur even if daily exposure were to occur for a lifetime. TRVs are typically expressed in terms of milligrams of compound per kilogram of body weight (mg/kg-d) for oral / dermal exposure (i.e., RfD, TDI), and micrograms of compound per cubic metre of inhaled air (µg/m^3) (i.e., RfC, TC).

Oral references doses are adopted for the dermal pathway.

The following COPCs are assessed as non-carcinogens.

- CAPs;
- Arsenic;
- Cobalt;
- Mercury;
- Methylmercury;
- Benzo(a)pyrene; and
- DPM.

The TRVs used in this risk assessment, as summarized in Table 4.2-1, Table 4.2-2 and Table 4.2-3, represent chronic TRVs that are considered to be most scientifically defensible based on a review of the available data. The TRVs used in this assessment were primarily obtained from Health Canada (2021a) and the MECP (2011) unless otherwise noted.

4.2.2 Carcinogens

The underlying assumption of regulatory risk assessment for compounds with known or assumed potential carcinogenic effects is that no threshold dose exists. In other words, it is assumed that a finite level of risk is associated with any dose above zero, theoretically even a single molecule could cause some level of risk. For carcinogenic effects, a two-step evaluation is used, in which the chemical is assigned a weight-of evidence classification, and then a cancer slope factor (CSF) is calculated. The weight-of-evidence classification is based on the likelihood of the compound being a human carcinogen. In the second part of the evaluation, CSFs are calculated for compounds that are known or probable human carcinogens. Different models are used by regulatory agencies that extrapolate observed responses at high doses used in animal studies to predicted responses in humans at the low doses encountered in environmental situations. The models used typically assume no threshold and use animal as well as human data to develop an estimate of the carcinogenic potency of a compound. This numerical estimate is referred to as the cancer slope factor. The CSF is expressed as the rate of cancer per unit of dose $(mg/kg/day)^{-1}$ or as an inhalation unit risk factor (IUR), as the rate of cancer per unit of concentration of inhaled air $(mg/m^3)^{-1}$.

Oral slope factors are adopted for the dermal pathway.

The following COPCs identified in soil or water are known or suspected carcinogens:

- Arsenic;
- PAHs; and
- DPM.

The TRVs for the carcinogenic effects of these COPCs are provided in Table 4.2-3.

4.2.3 Nature of Toxicity (Hazard Assessment)

The hazard assessment describes the nature of the potential adverse health effects associated with exposure to each of the identified COPCs. As mentioned previously, the effects associated with exposure are characterized as either non-carcinogenic (threshold) or carcinogenic (non-threshold). To provide context to the relative toxicity of each chemical in the environment, details are also provided regarding if the chemical is naturally occurring, or naturally elevated in the HEHRA LSA. Details regarding the rationale for the selection for each of the TRV and the associated effects are provided in the human health toxicological profiles in Attachment D-1A and Attachment D-1B.

4.3 Exposure Assessment

The exposure assessment component of the HHRA is intended to estimate potential exposures for the receptors that could be expected to come into contact with COPCs at the Site. It describes the receptors and the exposure pathways that could contribute to exposure and uses this information to estimate the potential exposure for each type of receptor. The exposure assessment can be summarized by these basic components:

- Characterization of COPC exposure concentrations in each relevant media;
- Characterization of potential receptors;
- Characterization of potential exposure pathways specific to each of the receptor locations;
- Quantitative exposure estimates for each chemical exposure media and receptor combination; and
- Total exposure from all exposure pathways, routes and media for which determination of potential adverse effects may be based.

The exposure assessment is considered for the Baseline Assessment Scenario, Project Assessment Scenario (which includes construction, operations and active closure) and Post-closure Assessment Scenario. A quantitative estimation of exposure is only calculated for those pathways determined to be complete as per the HEHRA problem formulation described in the previous section.

Each of the components of the exposure assessment is detailed below.

4.3.1 Exposure Point Concentrations

EPCs are concentrations in each relevant media to which receptors were assumed to be exposed. The baseline EPC selected for each media type are the 95th UCLM (with the exception of surface water).

The surface water modelling (Appendix N-1 and N-2) of the EIS/EA) provides 75th percentile values for the baseline, construction, project, active closure and post-closure phases for each month over the first year of the phase. The average of the concentrations over the given year of each phase was chosen to represent the concentration of that phase. For the non-cancer exposure assessment, the highest concentration identified during one phase of the Project Assessment Scenario (i.e., construction, project or active closure) was used to represent this scenario.

For the carcinogenic assessment, the incremental lifetime of exposure requires consideration. Due to the change in surface water concentrations over the Project, one of two approaches was taken. Where the post-closure concentration was greater than any other concentration during the project, exposure was assumed to occur to the post-closure concentration for the entire lifetime. Where a higher concentration was

identified during the project stage, exposure was assumed to occur to each of the Project Assessment Scenario stages and post-closure.

Where one surface water concentration was used (i.e., post-closure) each life-stage was exposed to this concentration for the life-stage duration, as identified in Table 4.3.2-9. When different surface water concentrations were used to represent the different stages of the Project, the life-stage duration at each project stage was used as provided in Table 4.3.2-10.

The EPCs used in the multi-media assessment are provided in Attachment B-1.

COPCs that require evaluation from inhalation exposure only include PAHs, DPM and CAPs. The CAPs were evaluated based on the concentration at the MPOI and the maximum concentration at a point of reception. These EPCs are provided in Table 4.4.1.1-1.

For PAHs and DPM, the EPC used in the assessment are provided in Table 4.3.1-1.

Table 4.3.1-1: PAH and DPM Air Concentrations (mg/m^3)

Receptor ID	Diesel Particulate Matter	Benzo(a)pyrene (TPE)
POR01	5.69E-05	5.60E-10
POR02	1.36E-04	1.37E-09
POR04	3.16E-05	3.62E-10
POR05	2.40E-04	2.34E-09
POR07	2.11E-05	2.21E-10
POR16	2.16E-06	2.08E-11
POR22	1.58E-05	1.64E-10
POR24	1.02E-05	1.01E-10
POR38	8.51E-06	8.49E-11
POR61	3.29E-05	3.61E-10
MPOI	2.40E-04	2.37E-09

4.3.2 Characterization of Potential Human Receptors, Exposure Frequency and Duration

The human receptors chosen for the assessment of potential risk in the HHRA are representative of those who are anticipated to experience the highest chemical concentration (magnitude), frequency and duration of chemical exposure representative of the various phases of the Project. Human receptors who experience chemical exposure may be those who live seasonally in the vicinity of the Project and/or who visit the area surrounding the Project to practise TLRU, including fishing, hunting and harvesting.

The human receptors are theoretical, however are chosen to be representative of a site-specific approach to the assessment of potential risk and be inclusive of the most sensitive members of the populations. Sensitive members of the population include toddlers who have a higher soil ingestion rate relative to body weight, pregnant females whose developing fetuses may experience developmental effects when exposed to certain chemicals, or members of Indigenous communities who may ingest higher rates of country foods. Receptor characteristics were chosen primarily, as those are described in Health Canada's PQRA or Detailed Quantitative Risk Assessment guidance documents unless otherwise stated.

4.3.2.1 Rationale for Selection of Country Foods Species and Ingestion Rates Considered in the Human and Ecological Health Risk Assessment

Health Canada (2010b) guidance on the assessment of country foods identifies five points for consideration when developing country foods studies:

1) Question. Does a site represent a significant source of chemical contamination to potentially harvestable plant or animal species?
    - Answer. Based on Traditional Land Use studies and land use plans received from Indigenous communities (PFN 2006; CLFN SFN 2011; ArrowBlade 2014; Know History 2021, Firelight Research Inc. (2024a), Firelight Research Inc. (2024b) 4, Slate Falls First Nation (2024)) and other regional studies (Chan et al. 2014, 2019), there are reports of harvesting of country foods in the area of the Project. Therefore, it is conservatively assumed that some harvesting of country foods will occur in the vicinity of the Project (within the LSA and RSA but outside the mine site area of the PDA).
2) Question. Is there a transport mechanism for COPCs from the contaminated soil, groundwater, surface water and/or sediment at the site to reach potential harvestable species on site or off site?
    - Answer. Yes, it is assumed that transport mechanisms are complete for COPC from air, surface water and/or sediment to reach potential harvestable species in the vicinity of the Project (within the LSA and RSA but outside the mine site area of the PDA).
3) Question. Can the COPCs bioaccumulate or bioconcentrate in the edible tissue of harvestable species?
    - Answer. Metals are known to bioaccumulate in biota.
4) Question. Are local plants and animals being harvested? If so, what tissues are being consumed?
    - Answer. Various studies that have been conducted in Ontario to identify the types of tissue typically consumed in the region were consulted, including the Traditional Land Use studies available to date from local Indigenous communities (for Wabauskang First Nation, Métis Nation of Ontario, Cat Lake First Nation, Slate Falls First Nation and Lac Seul First Nation). This section presents a rationale for the selection of typical country food species which are used in the HEHRA.
5) Question. What are the consumption patterns and characteristics of the consumers (people), with respect to those harvested plants or animals?
    - Answer. In addition to the information available in the Traditional Land Use studies for the Indigenous communicates in the area, studies conducted by the University of Ottawa and other consultants can be helpful to understand representative consumption patterns, based on 24-hour recall studies and food frequency studies which have been conducted in the region. This section presents a rationale for the selection of representative country food consumption rates for both heavy consumers (conservative) and average consumers, which are used in the HEHRA.

Traditional (country) foods and consumption rates can vary widely depending on the geographical location of a community, particularly for Aboriginal peoples (Health Canada 2021a). Generic food consumption rates are typically derived for large communities and are not applicable for populations that are not well represented in the data summarized by Richardson (2013). This may include rural, remote communities or Indigenous communities where geographical locations influence dietary habits. A review of the country foods studies which have been conducted for the region where the Project is located are described below.

For the purposes of this assessment, preferred country foods and ingestion rates by members of Indigenous communities in the region were selected based on a comparative analysis from several sources including those noted below.:

- Firelight Research Inc. (2024a). *Cat Lake First Nation Indigenous Knowledge and Use Study: Kita-Ki-Nan Indigenous-Led Assessment of the Springpole Project*, Firelight Research Inc. with the Cat Lake First Nation, Draft Report, Prepared by Firelight Research Inc., April 15, 2024;
- Firelight Research Inc. (2024b) *Lac Seul First Nation Indigenous Knowledge and Use Study: Kita-Ki-Nan Indigenous-Led Assessment of the Springpole Project,* Firelight Research Inc. with the Lac Seul First Nation, Draft Report, Prepared by Firelight Research Inc., April 15, 2024;
- Slate Falls First Nation, (2024). *Slate Falls Nation Health, Socio-economic, Indigenous Knowledge and Land Use Baseline Study, Slate Falls Nation*, Prepare by Slate Falls First Nation, May 2, 2024;
- Mishkeegogamang Ojibway Nation (Traditional Land Use and Occupancy and Traditional Ecological Knowledge Study Report for Springpole Gold Mining Project, Mishkeegogamang Ojibway Nation, Nov. 2023;
- ArrowBlade (2014). *Wabauskang Traditional Knowledge and Use in the area of the Springpole Gold Access Corridor Project.* Prepared by ArrowBlade Consulting Services. August 2014;
- Know History (2021). *Traditional Knowledge and Land Use Study for the First Mining Fold (FMG) Springpole Mine Project*. Prepared by Know History Inc for the Northwest Ontario Metis Community, October 8, 2021;
- Chan et al. (2014). In the report entitled "*First Nations Food, Nutrition and Environment Study (FNFNES): Results from Ontario (2011/2012)*". Ecozone number 1, "Boreal Shield/ Subarctic" (Table 10b) from the study was chosen to be potentially representative of the Indigenous communities in the vicinity of the Project given the geographical location;
- Chan et al. (2019). In the report entitled "*First Nations Food, Nutrition and Environment Study: results 2008-2018*". Boreal Shield (Figure 3.22) from the study was chosen to be potentially representative of the Indigenous communities in the vicinity of the Project given the geographical location;
- CanNorth. (2016). *Nokiiwin Tribal Council Country Foods Study* (Table 4.2.8.) from the study was chosen to be potentially representative of the Indigenous communities in the vicinity of the Project given the geographical location;
- Health Canada (2007). *Human Health Risk Assessment of Mercury in Fish and Health Benefits of Fish Consumption* (Table i and Table ii in Appendix IV;).
- Health Canada (2010b). *Federal Contaminated Site Risk Assessment in Canada: Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRA$_{Foods}$).*

A summary of the estimated adult average consumer consumption rates presented in the various sources listed above is displayed in Table 4.3.2-1. A summary of the estimated adult heavy consumer (i.e., 95th percentile) from the various sources listed above is displayed in Table 4.3.2-2.

Table 4.3.2-1: Indigenous Adult Average Consumer Consumption Rates (consumers only) (g/day)

Traditional Food	Fish	Wild Game	Plants	Birds
Chan et. al. (2014) - Ecozone 1[2]	34.86	29.0[1] (14.76 meat + 14.24 organs)	6.39	13.4
Chan et. al. (2019) [2]	18	39	3	4
CanNorth (2016) [3]	52.4	27.6	15.8	8.9
Health Canada (2007) [3]	22.0	NA	NA	NA
ArrowBlade (2014) [4]	NA	NA	NA	NA
Know History (2021) [5]	2.8-14	31.2	2.8-28.3	NA
Firelight Research Inc. (2024a) [4]	NA	NA	NA	NA
Firelight Research Inc. (2024b) [4]	NA	NA	NA	NA
Slate Falls First Nation (2024) [4]	NA	NA	NA	NA
Mishkeegogamang Ojibway Nation	NA	NA	NA	NA

Notes:

(1) The consumption rate for Wild Game is the sum of the consumption rates for game meat and organ meat presented in Chan et al. 2014 (not separated in Chan et al. 2019).

(2) Results are statistically representative of Indigenous country foods consumption rates in the Ecozone 1 Region, based on a large 24-hour dietary recall study.

(3) Estimated by a food frequency survey.

(4) Country foods consumption information not sufficient to estimate consumption rates.

(5) Conservative estimate by WSP for the HEHRA assuming a portion size of 3 ounces (85 grams), based on the reported results of the food frequency survey in Know History (2021).

NA - Not Available.

Table 4.3.2-2: Adult Heavy Consumer Consumption Rates (95th percentile, consumers only) (g/day)

Traditional Food	Fish	Wild Game	Plants	Birds
Chan et al (2014) - Ecozone 1[2]	179.81	131.39[1] (63.01 meat + 68.38 organs)	27.62	42.62
Chan et al. (2019)[2]	NA	NA	NA	NA
CanNorth 2016[3]	NA	NA	NA	NA
Health Canada (2007)[3]	40	NA	NA	NA
ArrowBlade (2014)[4]	NA	NA	NA	NA
Know History (2021)[5]	17-42.5	85	31.6-95	NA
Firelight Research Inc. (2024a) [4]	NA	NA	NA	NA
Firelight Research Inc. (2024b) [4]	NA	NA	NA	NA
Slate Falls First Nation (2024) [4]	NA	NA	NA	NA
Mishkeegogamang First Nation (2023)	NA	NA	NA	NA

Notes:
(1) The consumption rate for Wild Game is the sum of the consumption rates for game meat and organ meat presented in Chan et al. 2014 (not separated in Chan et al. 2019).
(2) Results are statistically representative of consumption rates in the Ecozone 1 Region, based on a large 24-hour dietary recall study.
(3) Estimated by a food frequency survey.
(4) Country foods consumption information not sufficient to estimate consumption rates.
(5) Conservative estimate by WSP for the HEHRA assuming a portion size of 3 ounces (85 grams), based on the reported results of the food frequency survey in Know History (2021).
NA - Not Available.

Although some information on country food consumption is provided in ArrowBlade (2014) (Wabauskang), Firelight Research Inc. (2024a) (Cat Lake First Nation), Firelight Research Inc. (2024b) (Lac Seul First Nation) and Slate Falls First Nation (2024) and Mishkeegogamang First Nation (2023), the information is not sufficiently detailed to include reliable estimates of consumption rates in Table 4.3.2-1 and Table 4.3.2-2. Consumption rate estimates for Know History, (2021) (Métis Nation of Ontario noted in Table 4.3.2-1 and 4.3.2-2 were derived using the frequency of consumption ranges reported in Know History (2021) and the assumption that a portion is 3 ounces (85 grams). The information provided in Know History (2021) was not sufficient to calculate 95th percentile consumption rates. It is noted that Chan et al. (2014, 2019) conducted detailed 24-hour dietary recalls which are considered more accurate and statistically representative than developing consumption rates from food frequency studies. The Chan et al. (2014) consumption rates are conservative for game and fish consumption when compared to the Know History (2021) estimates, although vegetation consumption rates in Chan et al. (2014) may underestimate consumption by some heavy consumers based on frequencies reported in the Know History (2021).

Based on the values included in Table 4.3.2-1 and Table 4.3.2-2 and the discussion above, the values identified from Chan et al. (2014) were selected as the consumption rates used in the HHRA. These values were selected since the values from all studies are numerically similar but the Chan et al. (2014) study

provides values specific to Ecozone 1 (Boreal Shield / Subarctic), which is considered to be representative of the area of the Project. In addition, Chan et al. (2014) provide consumption rates for both an average consumer and a heavy consumer (i.e., 95th percentile), and can therefore be used to evaluate exposure scenarios for both average and high consumers of Traditional country foods.

A limitation of the data presented in the Chan et al. studies is that consumption rates were provided for adults only. To evaluate different receptor age classes, it is necessary to estimate their consumption rates as a proportion of the adult rates. To complete this, a review of consumption rates is presented from Health Canada (2007, 2012).

Health Canada (2007) conducted a review of the various different life stages and based on 24-hour recall data, identified the recommended consumption rates for finfish, as displayed in Table 4.3.2-3. The finfish consumption rates for the various age groups can be compared to the consumption rate presented for adults (20+) to obtain a proportion or fraction of the adult consumption rate for each age group, as presented in parentheses in Table 4.3.2-3.

Table 4.3.2-3: Finfish Consumption by Age-Group

Age Group	Eaters Only Commercial[(1)] (g/d)	Sport / Subsistence[(1)(2)] (g/d)
1 to 4 years - toddler	10 (0.45)	20 (0.5)
5 to 11 years - child	14 (0.63)	33 (0.825)
20+ years - adult	22	40

Notes:
(1) Values in parentheses ( ) are the fraction of consumption for the toddler and child age groups in comparison to the adult (20+) consumption rate.
(2) The fractions calculated for the sport / subsistence fishers are selected as representative of the Springpole Project Indigenous communities.

Richardson (1997) presents Table 4.3.2-4 wild game and vegetation consumption rates for various age groups. The wild game and vegetation consumption rates for the various age groups can be compared to the consumption rate presented for adults to obtain a proportion or fraction of the adult consumption rate for each age group, presented in parentheses in Table 4.3.2-4.

Table 4.3.2-4: Richardson 1997 Food Consumption Rates (g/day)

Age Class	Infant	Toddler	Child	Teen	Adult
Age	0 to 6 months	7 months to 4 years	5 to 11 years	12 to 19 years	More than 20 years
Wild game	0	85 (0.31)	125 (0.46)	175 (0.64)	270
Root vegetation	83 (0.44)	105 (0.55)	161 (0.85)	227 (1.2)	188
Other vegetation	72 (0.52)	67 (0.48)	98 (0.71)	120 (0.88)	137

Notes:
Values in parentheses ( ) are the fraction of age group consumption compared to adult (20+) consumption.
Consumption rates are in g/day, based on consumers only, arithmetic average. Wild game consumption rates shown were for Canadian Aboriginal populations.

The proportions (fractions) identified in Table 4.3.2-3 and Table 4.3.2-4 were applied to the adult consumption rates selected from Chan et al. 2014 (Ecozone 1) to develop the consumption rates for each age class, as displayed in Table 4.3.2-5 and Table 4.3.2-6.

Table 4.3.2-5: Springpole Gold Project Country Foods Average Daily Consumption Rates - Average Consumer

Age Class	Infant (g/d)	Toddler (g/d)	Child (g/d)	Teen (g/d)	Adult (g/d)
Fish[1]	0.00	17.43	28.76	34.86[2]	34.86
Wild game	0.00	8.99	13.34	18.56	29
Vegetation[3]	3.32	3.07	4.54	5.62	6.39
Birds[4]	0.00	4.15	6.16	8.58	13.4

Notes:

(1) The consumption rates of fish for infant to child age classes were calculated by multiplying the adult consumption rate (from Chan et al. 2014) by the fractions presented in Table 3 for Sport/subsistence fishers (calculated from consumption rates presented in Health Canada 2007).

(2) The consumption rate of fish for teens was assumed equal to adults since Health Canada (2007) do not present a rate for teens and therefore a fraction of the adult rate could not be calculated.

(3) The consumption rates of vegetation for infant to toddler age classes were calculated by multiplying the adult consumption rate (from Chan et al. 2014) by the fractions presented in Table 4.3.2-4 for Other veg (calculated from consumption rates presented in Richardson 1997), since the top species of consumed vegetation (reported in Table 4.3.2-7, below) are not considered root veg.

(4) In the absence of age category fractions of adult consumption for birds, the fractions for wild game were applied to calculate consumption rates for toddler, child and teen.

Table 4.3.2-6: Springpole Gold Project Country Foods Average Daily Consumption Rates - Heavy Consumer

Age Class	Infant (g/d)	Toddler (g/d)	Child (g/d)	Teen (g/d)	Adult (g/d)
Fish[1]	0.00	89.55	147.76	179.10[2]	179.10
Wild game	0.00	40.73	60.44	84.10	131.40
Vegetation[3]	14.36	13.26	19.61	24.31	27.60
Birds[4]	0.00	13.2	19.6	27.3	42.6

Notes:

(1) The consumption rates of fish for infant to child age classes were calculated by multiplying the adult consumption rate (from Chan et al. 2014) by the fractions presented in Table 4.3.2-3 for sport / subsistence fishers (calculated from consumption rates presented in Health Canada 2007).

(2) The consumption rate of fish for teens was assumed equal to adults since Health Canada (2007) does not present a rate for teens and therefore a fraction of the adult rate could not be calculated.

(3) The consumption rates of vegetation for infant to toddler age classes were calculated by multiplying the adult consumption rate (from Chan et al. 2014) by the fractions presented in Table 4.3.2-4 for other veg (calculated from consumption rates presented in Richardson 1997), since the top species of consumed vegetation (reported in Table 4.3.2-7, below) are not considered root veg.

(4) In the absence of age category fractions of adult consumption for birds, the fractions for wild game were applied to calculate consumption rates for toddler, child and teen.

A comparative analysis of food preferences from each food group from the various studies was also completed to help develop surrogates for use in assessing potential risk from consumption of country foods from each of the above food categories (i.e., fish, wild game, vegetation and birds), as presented in Table 4.3.2-7. In most cases, food items in Table 4.3.2-7 are the top 3 species per food group category, ranked by preference (i.e., first item in the table is the preference. The exceptions are the food species reported in the Firelight Research where no specific order of preference was identified). In these cases, the species listed are the first three species appearing is the list of foods indicated as being important to the Cat Lake First Nation and Lac Seul First Nation.

Table 4.3.2-7: Comparison of Traditional Food Preferences from Relevant Studies in the Region

Food Category	Chan et al. 2014 Ecozone 1 (Table 10b)	Chan et al. 2019 – Boreal Shield	CanNorth 2016	Arrowblade 2014	Know History 2021	Mishkeegogamang First Nation (2023)	Firelight Research Inc. 2024a (Cat Lake First Nation)	Firelight Research Inc. 2024b (Lac Seul First Nation)	Slate Falls First Nation 2024
Fish	Walleye	Walleye	Walleye	Sturgeon	Walleye	Fish (species not specified)	Trout	Walleye (Pickerel)	Walleye
	Lake Whitefish	Lake Whitefish	Lake Whitefish	Walleye	Northern Pike	Not specified	Northern Pike	Lake Whitefish	Lake Whitefish
	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Trout	Not specified	Lake Whitefish	Lake Trout	Suckers
Wild game	Moose meat	Moose meat	Moose meat	Moose meat	Moose meat	Moose	Moose	Moose	Moose
	Deer meat	Caribou meat	Rabbit meat	Deer meat	Deer meat	Caribou	Caribou	Deer	Caribou
	Rabbit meat	Deer meat	White-tailed deer	Mink	Caribou	Deer	Beaver	Muskrat	Rabbit
Vegetation	Blueberries	Blueberries	Blueberries	Blueberries	Blueberries	Wild rice	Bear root	Wild rice	Blueberries
	Raspberries	Wild strawberries	Raspberries	Raspberries	Raspberries	Raspberries	Rat root (weekay)	Cedar	Strawberries
	Wild rice	Raspberry	Wild strawberries	Wild rice	Wild rice	Other berries	Blueberries	Rat root (weekay/ sweet flag)	Blackberries
	Wild strawberries	Wild rice	Wild rice	Cherries	Cherries	Not specified	Mint	Not specified	Saskatoon berries
Birds	Wild goose	Geese	Grouse	Partridge	Partridge	Goose	Goose	Duck	Duck
	Ducks	Ducks	Duck	Ducks	Grouse	Not specified	Duck	Not specified	Geese
	Partridge	Grouse	Partridge	NA	Ducks	Not specified	Partridge	Not specified	Partridge

Note:
Food items in Table 4.3.2-7 are the top 3 species per food category, in order of preference where available (i.e., first item in the table is the preference). The Firelight Research Inc reports did not specify preferred species, but rather provided a list of important species to the communities. In this case, the first three species listed are included, where available.

Based on the information provided in Table 4.3.2-7, in combination with a review of the baseline fish concentration results reported in the aquatic resources studies, Walleye and Lake Whitefish were selected for inclusion in the fish consumption exposure assessment for most COPC. For most COPC, concentrations in Walleye or Lake Whitefish are approximately equal to or exceed concentrations reported in Northern Pike and Lake Trout. Where a COPC was not detected in Walleye or Lake Whitefish, concentrations of that COPC in Northern Pike or Lake Trout were used in the exposure calculations. In general, the food preferences identified in Chan et al. 2014 for Ecozone 1 (Boreal Shield / Sub-arctic) are considered representative of the Indigenous communities associated with the Project for the HEHRA, as they are generally in alignment with other studies in the region. Of note is the following from the Slate Falls First Nation "The most common fish harvested by our members for personal and commercial use is Walleye. Walleye is a staple in our members' diets. Fishing for personal and community consumption occurs throughout the year, apart from times when seasonal ice cover is too thin to safely ice fish. Lake Whitefish is also commonly fished for consumption."

4.3.2.2 Receptor Characteristics

A receptor is assumed to be all ages from birth through adult (i.e., Infant, Toddler, Child, Teen and Adult), who may reside within the HEHRA LSA. The results of the Human Health Supplemental Screening presented in Section 4.1.3, indicated that a quantitative assessment of potential risks are required via ingestion of country foods, soil exposure (ingestion, dermal, inhalation) and ingestion of surface water as drinking water / recreational use.

Exposure within the RSA is assumed to be exposed for 24 hours per day, 7 days per week, for 52 weeks per year. The following exposure scenarios are addressed:

- Exposure full-time (52 weeks per year) under a residential scenario (i.e., Slate Falls First Nation);
- Exposure at a cabin 40% of the year, with the remainder of the year under a residential scenario; and
- Exposure at a TLRU for 20% of the year, with the remainder of the year under a residential scenario.

When calculating exposure and potential risk from carcinogenic compounds, the lifestage age for each Resident receptor was considered and a life expectancy of 80 years has been assumed, consistent with Health Canada assumptions. For conservatism in the assessment of potential risk via the ingestion of country foods, all Residents were conservatively assumed to be members of an Indigenous community who may ingest country foods at higher rates that the general public (heavy consumer). For comparative purposes, a Resident Indigenous community member who consumes an average amount of country foods is also assessed. A Resident is conservatively assumed to consume country foods exclusively from the RSA 365 days per year.

The chemical concentrations in the various country food species analysed and concentrations modelled via uptake were also assumed to represent concentrations present in all country foods ingested by receptors.

The generic assumptions provided for the ingestion of country foods are considered to represent the most conservative approach to the assessment of this pathway. However, it is likely that the ingestion rates of country foods may differ among each community and be higher for elders in the communities (i.e., 40+ years) relative to younger members of the communities due to evolving changes to the Traditional lifestyle. For the purposes of the current study, the default values are considered to represent a conservative approach and thereby avoid any potential under-estimation of potential risks.

The receptor characteristics for an Infant, Toddler, Child, Teen and Adult are described in Table 4.3.2-8. The exposure characteristics for a Resident exposure scenario are described in Table 4.3.2-9.

Table 4.3.2-8: Characteristics of Human Receptors

Receptor Characteristic	Receptors					Reference
	Infant	Toddler	Child	Teen	Adult	
Age	0 - 6 mo.	7 mo. - 4 yr	5 - 11 yr	12 - 19 yr	≥20 yr	Health Canada 2024
Lifestage Length (yr)	0.5	4.5	7	8	60	Health Canada 2024
Age Dependent Adjustment Factor (3)	10	5	3	2	1	Health Canada 2013
Body weight (kg)	8.2	16.5	32.9	59.7	70.7	Health Canada 2024
Soil ingestion rate (kg/d)	2.00×10^{-5}	8.00×10^{-5}	2.00×10^{-5}	2.00×10^{-5}	2.00×10^{-5}	Health Canada 2024
Inhalation rate (m^3/d)	2.2	8.3	14.5	15.6	16.6	Health Canada 2024
Water ingestion rate (L/d)	0.3	0.6	0.8	1	1.5	Health Canada 2024
Skin surface area (cm^2)						
- hands	320	430	590	800	890	Health Canada 2024
- arms	550	890	1,480	2,230	2,500	Health Canada 2024
- legs	910	1,690	3,070	4,970	5,720	Health Canada 2024
- exposed area, not hands	1,460	2,580	4,550	7,200	8,220	Calculated
- feet	250	430	720	1080	1190	Health Canada 2024
- total	3,620	6,130	10,140	15,470	17,640	Health Canada 2024
Soil loading to exposed skin (g/cm^2 per event)						
- hands	1.0×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	Health Canada 2021a
- surfaces other than hands	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	Health Canada 2021a

Table 4.3.2-8: Characteristics of Human Receptors

Receptor Characteristic	Receptors					Reference
	Infant	Toddler	Child	Teen	Adult	
Heavy Consumer Food ingestion (kg/d):						
Total Plants Consumption Rate	0.01436	0.01326	0.01961	0.02431	0.0276	Chan et al. 2014
– consumption of berries	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption
– consumption of medicinal plants (Labrador Tea)	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption
Consumption rate of higher tropic level fish	0	0.08991	0.14834	0.17981	0.17891	Chan et al. 2014
Consumption rate of Game Meat (1)	0	0.4073	0.6044	0.8409	0.13139	Chan et al. 2014
- consumption rate of Moose	0	0.0266	0.0390	0.0546	0.0843	Chan et al. 2014
- consumption rate of Deer	0	0.0113	0.0165	0.0232	0.03573	Chan et al. 2014
- consumption rate of Snowshoe Hare	0	0.0036	0.0052	0.0073	0.0113	Chan et al. 2014
Consumption rate of Grouse	0	0.0132	0.0196	0.0273	0.0426	Chan et al. 2014
Average Consumer Food ingestion (kg/d):						
Total Plants Consumption	0.00332	0.00307	0.00454	0.00562	0.00639	
– consumption of berries	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption
– consumption of medicinal plants (Labrador Tea)	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption
Consumption rate of higher tropic level fish	0	0.01743	0.02876	0.03486	0.03486	Chan et al. 2014
Consumption rate of Game Meat (2)	0	0.00914	0.0134	0.0188	0.029	Chan et al. 2014

Table 4.3.2-8: Characteristics of Human Receptors

Receptor Characteristic	Receptors					Reference
	Infant	Toddler	Child	Teen	Adult	
- consumption rate of Moose	0	0.0052	0.0076	0.0106	0.01638	Chan et al. 2014
- consumption rate of Deer	0	0.0033	0.0048	0.0068	0.01043	Chan et al. 2014
- consumption rate of Snowshoe Hare	0	0.0007	0.0010	0.0014	0.0022	Chan et al. 2014
Consumption rate of Grouse	0	0.0042	0.0062	0.0087	0.0134	Chan et al. 2014

(1) Consumption rates used in calculation are 64% moose (meat and organs), 9% hare and 27% deer (which includes deer meat and caribou liver) for heavy consumer.
(2) Consumption rates used in calculation are 56% moose (meat and organs), 8% hare and 36% deer (which includes deer meat and caribou liver) for average consumer.
(3) Only applicable for COPC with mutagenic mode of action.

Table 4.3.2-9: Exposure Frequency and Duration

Exposure Characteristic	Receptor					
	Infant	Toddler	Child	Teen	Adult	Reference
Resident Receptor (1)						
Hours per day exposed (hours)/ 24 hours	24	24	24	24	24	Health Canada 2024
Days per week exposed (days)/ 7 days	7	7	7	7	7	Health Canada 2024
Weeks per year exposed (weeks)/ 52 weeks	52	52	52	52	52	Health Canada 2024
Dermal exposure events per day (events per day)	1	1	1	1	1	Health Canada 2024
Duration of water contact per day (hours)	1	1	1	1	1	Assumed
Days per year of country food ingestion (days)	365	365	365	365	365	Assumed
Exposure Duration (years)	0.5	4.5	7	8	60	Health Canada 2024
Life expectancy (years) – Used only in assessment of carcinogens	80					Health Canada 2024

Notes:
(1) Health Canada PQRA (2024) Guidance for Residential Exposure Scenario Applied.
— - indicates not applicable.

Table 4.3.2-10: Exposure Duration for Carcinogenic Assessment

Project Stage	Duration of Project Stage	Lifestage				
		Infant	Toddler	Child	Teen	Adult
Construction-Existing	3	0.5	3.0			
Operations - Existing	10		1.5	7.0	1.5	
Active Closure - Existing	5				5.0	
Post Closure - Existing					1.5	60
Total Years Exposed		0.5	4.5	7	8	60

4.3.3 Exposure Estimates

Exposure to COPCs in environmental and Project-specific media may occur through inhalation, direct contact (incidental ingestion and dermal contact) and via ingestion of country foods. The exposure estimates are presented on a pathway-specific basis in this section; however, the exposure via the sum of all exposure pathways is considered as part of the determination of potential adverse effects (Section 4.6 of the HEHRA).

The following summarizes the COPC selection process and HHRA supplemental screening and therefore defines the requirements of selecting exposure equations:

- A quantitative assessment including exposure assessment for the inhalation of fugitive dust pathway is required. Inhalation of fugitive dust was considered as part of the total exposure from all pathways for determination of potential adverse effects. The exposure equation for inhalation of fugitive dust is provided as Equation 4.3.3-1.
- No COPCs were identified in surface water. Although a quantitative assessment for the direct contact with surface water pathway is not required, it was considered as part of the total exposure from all pathways for determination of potential adverse effects. The exposure equation for ingestion of water and dermal contact are provided as Equation 4.3.3-2 and Equation 4.3.3-3, respectively.
- Arsenic and cobalt in soil exceeded their screening criteria protective of the direct contact pathway, therefore, direct dermal contact and incidental ingestion exposure equations are required. The exposure equation for incidental ingestion of soil as Equation 4.3.3-4 and the direct dermal contact with soil exposure equation is provided as Equation 4.3.3-5.
- Mercury and methylmercury were identified as COPCs for further evaluation in fish. Arsenic and cobalt in fish were evaluated as part of the multimedia assessment. The exposure equation for the ingestion of country foods is provided as Equation 4.3.3-6.

In the assessment of exposure, a relative absorption factor (RAF) is applied, which accounts for the bioavailability of each COPC (i.e., the amount of chemical absorbed into the body). The relative absorption factor has been assumed to be 1 for the ingestion exposure route, with the exception of arsenic as discussed in the Human Health Toxicological Profile for arsenic in Attachment D-1A. A value of 1 represents 100% of the delivered dose as being absorbed.

In the assessment of exposure to soil, application of a RAF for the dermal exposure is warranted as the TRVs are based on oral exposure. The application of the RAF adjusts the exposure to take into account the difference in the bioavailability of COPC through dermal exposure to that of oral exposure. Dermal RAFs for soil were required for arsenic and cobalt. The arsenic dermal RAF was obtained from Health Canada (2021b). A dermal RAF for cobalt was not available from Health Canada (2021b) and was obtained from the MECP (2011).

Example calculations are provided in Attachment B, HHRA Output.

4.3.3.1 Inhalation of Particulate Matter

The exposure dose equation for the inhalation of particulate matter in air are those provided by Health Canada in their PQRA guidance document (2024).

Equation 4.3.3-1: Inhalation of Suspended Particulate Matter in Air from Contaminated Soils – with TRV Expressed as an Oral Tolerable Daily Intake (TDI):

$$Dose = \frac{(C_s \times Pair) \times InhR \times RAF_i \times D_1 \times D_2 \times D_3 \times D_4}{BW \times LE}$$

Where: Dose = Average Daily Dose (mg/kg/day) (non-carcinogens) or

Lifetime Average Daily Dose (mg/kg/day) (carcinogens)

C_s= Chemical Concentration in Soil (Section 3.5.3.2) (mg/kg)

P_{air} = Particulate concentration in air (0.00076 mg/m^3)

InhR = Inhalation Rate (m^3/day)

RAF_i = Relative Inhalation Absorption Factor (unitless)

D_1 = Hours per day exposed / 24 days

D_2 = Days per week exposed / 7 days

D_3 = Weeks per year exposed / 52 weeks

D_4 = Total years exposed (years) (carcinogens only)

BW = Body Weight (kg)

LE = Life Expectancy (years) (carcinogens only)

Equation 4.3.3-2: Inhalation of Suspended Particulate Matter in Air– with TRV Expressed as a Tolerable Concentration (TC)

$$TDC = C_{air} \times RAF \times D_1 \times D_2 \times D_3$$

Where: TDC = time-adjusted average daily air concentration (mg/m^3) (non-carcinogens)

C_{air} = concentration of contaminant in air (mg/m3);

RAF_i = Relative Inhalation Absorption Factor (unitless)

D_1 = Hours per day exposed / 24 days

D_2 = Days per week exposed / 7 days

D_3 = Weeks per year exposed / 52 weeks

The method used to assess exposure to carcinogenic parameters in air, expressed as an inhalation unit risk is as follows:

$$LTDC = \sum_{i}^{n} (Air\ Concentration)\ x\ TR\ x\ ADAF$$

Where:

Where: LTDC = lifetime-adjusted average daily air concentration (mg/m^3) (non-carcinogens)

TR = Fraction of time exposed (yr/80 yr)

ADAF = Age Dependent Adjustment Factor

4.3.3.2 Dermal Contact and Ingestion of Water

The exposure equation for the ingestion of impacted water is that provided by Health Canada in their PQRA guidance document.

For the ingestion pathway surface water was conservatively assumed to be drinking water as represented by a drinking water ingestion rate. Exposure via the ingestion pathway is dependent on the COPC concentration in water, the water intake rate of the receptor, and the number of days per year that exposures are likely to occur (i.e., the frequency and duration of exposure).

Health Canada guidance directs the risk assessor to the US EPA document entitled *Dermal Exposure Assessment: Principals and Applications* dated January 1992 for the equation for calculating dermal contact with water. The permeability from water coefficients (K_p) applied in this HHRA were obtained from the US EPA guidance document.

The general equation used to calculate the dose due to water ingestion and dermal contact are as follows:

Equation 4.3.3-3: Water Ingestion:

$$Dose = \frac{C_W \times IR_W \times RAF_o \times D_2 \times D_3 \times D_4}{BW \times LE}$$

Where: Dose = Average Daily Dose (mg/kg/day) (non-carcinogens) or

Lifetime Average Daily Dose (mg/kg/day) (carcinogens)

C_W = Chemical Concentration in Water EPC (mg/L)

IR_W = Ingestion Rate (L/day)

RAF_o = Relative Oral Absorption Factor (unitless)

D_2 = Days per week exposed / 7 days

D_3 = Weeks per year exposed / 52 weeks

D_4 = Total years exposed (years) (carcinogens only)

BW = Body Weight (kg)

LE = Life Expectancy (years) (carcinogens only)

Equation 4.3.3-4: Water Dermal Contact:

A) Dermal Exposure per Event

$$Dermal\ Exposure\ per\ Event = C_W \times CF \times K_\rho \times Duration$$

Where:

Dermal Contact per Event = mg/cm^2- event

C_w = Chemical Concentration in Water, EPC (mg/L)

CF = Conversion Factor (L/cm^3)

Kρ = Permeability coefficient (cm/hr) (arsenic = 1E-03 cm/hr; cobalt = 4E-04; mercury and methylmercury = 1E-03 cm/hr, US EPA 2004)

Duration = Duration of water exposure event (hr/event)

B) Dose of Water Dermal Exposure

$$Dose = \frac{(Dermal\ Exposure\ per\ Event\ \times Events\ per\ Day \times\ SA_T) \times\ D_2 \times D_3 \times D_4}{BW\ \times LE}$$

Where: Dose = Average Daily Dose (mg/kg/day) (non-carcinogens) or

Lifetime Average Daily Dose (mg/kg/day) (carcinogens)

SA_T = Total surface area exposed (cm^2) (sum of SA of hands, arms, legs, exposed area not hands for each receptor, i.e., assumes submerged)

D_2 = Days per week exposed / 7 days

D_3 = Weeks per year exposed / 52 weeks

D_4 = Total years exposed (years) (carcinogens only)

BW = Body Weight (kg)

LE = Life Expectancy (years) (carcinogens only)

4.3.3.3 Dermal Contact and Incidental Ingestion of Soil

In this assessment, dermal exposures were summed with oral exposures. In general, for the incidental ingestion pathway, the exposure to COPCs in soil depends on the COPC concentration, amount of soil ingested on a daily basis (in mg/day), and the number of days per year that exposures are likely to occur (i.e., the frequency and duration of exposure). For the dermal exposure pathway, exposure to COPCs in soil depends on the COPC concentration, skin surface area exposed and the number of days per year that exposures are likely to occur.

The general equation used to calculate the dose due to soil ingestion and dermal contact are as follows:

Equation 4.3.3-5 Soil Ingestion:

$$Dose = \frac{C_s\ \times IR_s \times RAF_o \times D_2 \times D_3 \times D_4}{BW\ \times LE}$$

Where: Dose = Average Daily Dose (mg/kg/day) (non-carcinogens) or

Lifetime Average Daily Dose (mg/kg/day) (carcinogens)

C_s = Chemical Concentration in Soil, EPC (mg/kg or micrograms per gram [µg/g])

IR_s = Ingestion Rate (mg/day)

RAF_o = Relative Oral Absorption Factor (unitless)

D_2 = Days per week exposed / 7 days

D_3 = Weeks per year exposed / 52 weeks

D_4 = Total years exposed (years) (carcinogens only)

BW = Body Weight (kg)

LE = Life Expectancy (years) (carcinogens only)

Equation 4.3.3-6 Soil Dermal Contact:

$$Dose = \frac{((C_s \times SA_H \times SL_H) + (C_s \times SA_o \times SL_o)) \times RAF_D \times D_2 \times D_3 \times D_4}{BW \times LE}$$

Where: Dose = Average Daily Dose (mg/kg/day) (non-carcinogens) or

Lifetime Average Daily Dose (mg/kg/day) (carcinogens)

C_s = Chemical Concentration in Soil, EPC (mg/kg or µg/g)

SA_H = Surface area of hands exposed for loading (cm^2)

SL_H = Loading rate to exposed skin of hands (kg/cm^2-event)

SA_o = Surface area exposed other than hands (cm^2)

SL_o = Loading rate to exposed skin other than hands (kg/cm^2-event)

RAF_D = Relative Dermal Absorption Factor (unitless)

D_2 = Days per week exposed/ 7 days

D_3 = Weeks per year exposed/ 52 weeks

D_4 = Total years exposed (years) (carcinogens only)

BW = Body Weight (kg)

LE = Life Expectancy (years) (carcinogens only)

4.3.3.4 Ingestion of Country Foods

Exposure via ingestion of country foods is dependant on the food ingestion rate of the specific receptor, the body weight of that receptor and the proportion of the diet from each country food. Ingestion rates of the nine country foods were obtained from Health Canada (2021a) or Chan et al. (2014) and were specific to ingestion rates of members of Indigenous communities in the region.

For arsenic, the concentration of country food is adjusted to account for the percent of inorganic arsenic, as discussed in the Human Health Toxicological Profile for arsenic in Attachment D-1A.

The equation used to calculate the dose due to ingestion of country foods is as follows:

Equation 4.3.3-7 Country Foods Ingestion:

$$Dose = \frac{(\sum(C_{Foodi} \times IR_{Foodi} \times RAF_{Orali} \times D_i)) \times D_4}{BW \times 365 \times LE}$$

Where: Dose = Average Daily Dose (mg/kg/day) (non-carcinogens) or

Lifetime Average Daily Dose (mg/kg/day) (carcinogens)

C_{Food} = Chemical Concentration in $Food_i$, EPC (mg/kg or µg/g)

IR_{Food} = Food Ingestion Rate (mg/day)

RAF_o = Relative Oral Absorption Factor (unitless)

D_i = Days per year during which $Food_i$ is consumed

D_4 = Total years exposed (for carcinogens only)

365 = Total days per year (constant)

BW = Body Weight (kg)

LE = Life Expectancy (years) (carcinogens only)

4.3.4 Calculation of Average Daily Dose - Non-carcinogens

A quantitative estimation of exposure for non-carcinogens is referred to in this section as the average daily dose. For pathways determined to require a quantitative estimate of exposure as per the HHRA problem formulation, exposure estimates were generated for all Assessment Scenarios (i.e., Base Case, Project Case and Post-closure Case). Regardless of individual pathways requiring quantitative assessment, the total exposure from the sum of all pathways was also included for determination of potential adverse effects in Section 4.7.

The following pathways required a quantitative exposure estimate based on the HHRA problem formulation:

1) Ingestion and Dermal Contact with Soil
2) Ingestion of Country Foods
3) Ingestion and Dermal Contact with Surface Water
4) Ingestion and Dermal Contact with Sediment
5) Inhalation of Fugitive DustThe Project HHRA model was employed to calculate the non-cancer average daily exposure dose for each COPC and associated pathway requiring quantitative assessment. This calculation assumes continuous exposure in the LSA/RSA. A summary of average daily doses for the toddler for the various exposure scenarios requiring quantitative assessment is provided in Attachment B, HHRA Model Outputs – Non-Carcinogenic Dose Calculation Results.

4.3.4.1 Calculation of Lifetime Average Daily Dose - Carcinogens

For non-threshold chemicals lifetime estimates of risk, referred to as the lifetime average daily dose, are calculated. These are based on an assumed lifetime exposure in the LSA/RSA. Chemical toxicity is discussed in the previous section of this report (Section 4.2). The lifetime average daily dose is calculated for a Composite Cancer Receptor assumed to have an 80-year life expectancy. The receptor in the Study Area is assumed to be present for all life stages (i.e., infant through adulthood, or 80 years). The model was used to estimate lifetime average daily dose.

A summary of lifetime average daily doses for the Composite Cancer Receptor for the various exposure pathways requiring quantitative assessment has been provided in Attachment B-1, Carcinogenic HHRA Dose Calculation Results.

4.4 Risk Characterization

Risk characterization is the last step in the risk assessment process that combines the results of the exposure assessment and the toxicity assessment for each COPC to estimate the potential for non-carcinogenic and carcinogenic human health effect(s), from exposure to that compound.

Provincial regulatory agencies across Canada offer differing guidance on the risk characterization process. The risk characterization methods for human health are adopted from Health Canada. For non-carcinogens (i.e., threshold chemicals), potential risk is estimated by calculating the ratio of the estimated exposure to the TRV, which is referred to the hazard quotient (HQ) as follows:

$$Hazard\ Quotient\ (HQ) = \frac{Estimated\ Exposure}{TRV}$$

It is important to note that the magnitude of the HQ does not necessarily correspond to the magnitude of expected health effects, therefore the results of the risk characterization will be stated as potential risk and negligible potential risk.

Health Canada, in its Detailed Quantitative Risk Assessment guidance document (Health Canada 2010b), states that in cases where both on-site and background exposures from all exposure media are combined (i.e., total exposure is being assessed), an HQ ≤ 1.0 will be deemed to represent an acceptable or negligible risk. This is the equivalent of the Project and Post-closure Assessment Scenarios (Baseline+Project and Baseline+Post-closure) presented in the current HHRA for the determination of potential adverse effects. Therefore, the target HQ for COPC exposure in the multimedia assessment of the Project Assessment Scenario will be an HQ of 1.

When addressing the inhalation pathway for air emissions (i.e., CAPs, PAHs and DPM and metals), a concentration ratio is calculated as follows:

$$Concentration\ Ratio\ (CR) = \frac{Air\ Concentration}{TC}$$

A concentration ratio of less than 1 is considered to represent a negligible potential risk.

For chemicals with carcinogenic endpoints (i.e., non-threshold chemicals) the estimated exposure (amortized as appropriate) is multiplied by the appropriate oral slope factor or unit risk (TRV) to derive a conservative estimate of the potential incremental lifetime cancer risk (ILCR) associated with that exposure. The ILCR is derived as:

$$Incremental\ Lifetime\ Cancer\ Risk\ (ILCR) = Sum\ of\ Age\ Adjusted\ Exposure\ \times TRV$$

The equation to calculate the ILCR from inhalation of carcinogens from air emissions is as follows:

$$ILCR = LTDC\ (mg/m^3)\ x\ Inhalation\ Unit\ Risk\ (mg/m)^{-1}$$

Where:

LTDC = Lifetime Adjusted Average Daily Air Concentration

The equation to calculate the ILCR from inhalation of carcinogens from soil particulates is as follows:

$$ILCR = LADD\ (mg/kg/day)\ x\ Inhalation\ Unit\ Risk\ (mg/kg/day)^{-1}$$

Health Canada indicates that cancer risks will be deemed to be 'essentially negligible' where the estimated ILCR is ≤ 1 in 100,000 ($\leq 1 \times 10^{-5}$) and has been applied in the assessment of carcinogenic effects in the HHRA for the Project.

This section summarizes the results of the risk characterization for each receptor evaluated in the risk assessment.

4.4.1 Results of Risk Characterization - Non-carcinogens

For the following chemicals, which are considered to exhibit non-carcinogenic effects based on the nature of their toxicity, risk is characterized by a HQ for each relevant exposure pathway-receptor combination:

- Inhalation pathway – CAPs and PAHs
- Multimedia exposure assessment – Arsenic, cobalt, mercury and methylmercury

4.4.1.1 Inhalation Risks

Risk characterization results for CAPs via ambient air inhalation pathway is presented in Table 4.4.1.1-1. Concentrations of CAP were below their respective guidelines at the MPOI and at the receptor location with maximum concentrations.

Risk characterization results for PAHs via ambient air inhalation pathway is presented in Table 4.4.1.1-2. The HQ for all points of reception, including the MPOI, had a HQ of less than 1.

Risk characterization results for DPM via ambient air inhalation pathway is presented in Table 4.4.1.1-3. The HQ for all points of reception, including the MPOI, had a HQ of less than 1.

4.4.1.2 Environmental Media Exposure Risks

Non-cancer Effects

The non-cancer total hazard quotient (THQ) risk characterization results via the multimedia exposure assessment (soil, sediment, surface water and ingestion of country foods) for the PORs and MPOI are summarized in Table 4.4.1.2-1 to Table 4.4.1.2-4, below. A detailed model output of all the risk characterization results is provided in Attachment B-2. Sample calculations are included in Attachment B-3.

It is noted that the level of conservatism associated with the country foods assessment is relatively high due to the modelling of chemical concentrations into country foods based on modelled environmental predictions and the use of published uptake factors to estimate concentrations in some country food items including mammals and birds. In addition, the THQs are based on highly conservative exposure assumptions, including that receptors obtain 100% of their country foods from within the LSA and obtain all of their drinking water from a cabin area (for receptors assumed to spend 40% of their time at a cabin) or TLRU location (for receptors assumed to spend 20% of their time at a TLRU locations) within the LSA. Overall, the risk estimates represent an overestimate of potential risk.

Arsenic

The predicted non-cancer THQ associated with non-carcinogenic effects from exposure to arsenic are presented in Table 4.4.1.2-1.

Table 4.4.1.1-1: Hazard Quotients for Air - Criteria Air Parameters

Parameter	Averaging Period	Criteria (µg/m³)	Maximum at MPOI				Maximum at Points of Reception			
			Modelled Prediction (µg/m³)	Background[(1)] (µg/m³)	Cumulative Prediction (µg/m³)	HQ	Modelled Prediction (µg/m³)	Background[(1)] (µg/m³)	Cumulative Prediction (µg/m³)	HQ
Total suspended particulate	24-hour	120	29.7	14.1	43.8	0.37	21.0	14.1	35.1	0.29
	Annual	60	2.4	5.3	7.7	0.13	2.1	5.3	7.4	0.12
PM_{10}	24-hour	50	29.7	9.1	38.8	0.78	21.0	9.1	30.1	0.60
$PM_{2.5}$	24-hour	27	17.2	9.1	27.0	1	9.9	9.1	19.0	0.70
	Annual	8.8	1.07	4.2	5.27	0.60	0.6	4.2	4.8	0.55
CO	1-hour	36,200	2,150	114	2,264	0.063	8,458.5	114	8,572	0.24
	8-hour	15,700	419	114	533	0.034	1,093.0	114	1,207	0.077
NO_2	1-hour	400	148	30	178	0.45	273.2	30.0	303.2	0.76
	24-hour	200	57	28	85	0.43	56.5	28.0	84.5	0.43
	Annual	23	3.40	0.6	4.00	0.17	NV	NV	NV	NV
SO_2	1-hour	106.4	26.9	1.0	27.9	0.26	5.1	1.00	6.1	0.057
	Annual	10.6	0.04	0.30	0.34	0.032	0.04	0.30	0.34	0.032

Notes:
Bold text indicates HQ exceeds Target of 1. There are no sensitive receptors present at the MPOI.
The maximum at Points of Reception occur at POR02, POR03 or POR05.
NV – No value

Table 4.4.1.1-2: Hazard Quotients for Air – Benzo(a)Pyrene(1)

Point of Reception	Baseline	Project	Post - Closure
POR01	2.2E-02	2.3E-02	2.2E-02
POR24	2.2E-02	2.2E-02	2.2E-02
POR22	2.2E-02	2.2E-02	2.2E-02
POR07	2.2E-02	2.2E-02	2.2E-02
POR38	2.2E-02	2.2E-02	2.2E-02
POR05	2.2E-02	2.4E-02	2.2E-02
POR04	2.2E-02	2.3E-02	2.2E-02
POR02	2.2E-02	2.3E-02	2.2E-02
POR61	2.2E-02	2.3E-02	2.2E-02
MPOI	2.2E-02	2.4E-02	2.2E-02

Notes:
Bold text indicates HQ exceeds Target of 1. There are no sensitive receptors present at the MPOI.
(1) B(a)P concentrations used in the HQ calculations were conservatively set to B(a)P Total Potency Equivalents (TPE)

Table 4.4.1.1-3: Hazard Quotient for Inhalation of Diesel Particulate Matter

Point of Reception	Baseline	Project	Post - Closure
POR01	3.6E-01	3.7E-01	3.6E-01
POR24	3.6E-01	3.6E-01	3.6E-01
POR22	3.6E-01	3.6E-01	3.6E-01
POR07	3.6E-01	3.6E-01	3.6E-01
POR38	3.6E-01	3.6E-01	3.6E-01
POR05	3.6E-01	4.1E-01	3.6E-01
POR04	3.6E-01	3.7E-01	3.6E-01
POR02	3.6E-01	3.9E-01	3.6E-01
POR61	3.6E-01	3.7E-01	3.6E-01
MPOI	3.6E-01	4.1E-01	3.6E-01

Notes:
Bold text indicates HQ exceeds Target of 1. There are no sensitive receptors present at the MPOI.

Table 4.4.1.2-1: Total Hazard Quotients for Arsenic (Indigenous Resident/ Cabin User (Toddler)

Scenarios	Area	Surface Water Node	Point of Receptor Location	Scenario	Total HQ	Total HQ
					Heavy Consumer	Average Consumer
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	1.0	0.7
				Project	**1.1**	0.7
				Post-Closure	**1.1**	0.7
	West of Birch Lake	8	POR24 Cabin	Baseline	1.0	0.7
				Project	1.0	0.7
				Post-Closure	1.0	0.7
	South of Springpole Lake	DL	POR22 Cabin	Baseline	1.0	0.7
				Project	1.0	0.6
				Post-Closure	0.9	0.6
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	1.0	0.7
				Project	**1.1**	0.8
				Post-Closure	1.0	0.7
	Gull Lake	10	POR38 Cabin	Baseline	1.0	0.7
				Project	**1.1**	0.7
				Post-Closure	1.0	0.7
TLRU	North of Birch Lake	6	POR05	Baseline	1.0	0.7
				Project	**1.3**	0.9
				Post-Closure	**1.3**	0.9
	West of Mine	7	POR04	Baseline	1.0	0.7
				Project	**1.1**	0.8
				Post-Closure	**1.1**	0.8
	South of Mine	11	POR02	Baseline	1.0	0.7
				Project	1.0	0.7
				Post-Closure	**1.1**	0.7
	Further South of Mine	8	POR61	Baseline	1.0	0.7
				Project	1.0	0.7
				Post-Closure	1.0	0.7
MPOI	North of Mine	6	NA	Baseline	1.0	0.7
				Project	**1.3**	0.9
				Post-Closure	**1.3**	0.9

Notes:
Bold text indicates THQ exceeds Target of 1.

A THQ at the target of 1 occurs at baseline conditions for the heavy country foods consumer. The change in THQs at the selected PORs from Baseline to Project and Post-closure Assessment Scenarios are negligible, representing a negligible increase in predicted human health risk from arsenic exposure. THQs shown are based on highly conservative exposure assumptions, including that receptors spend extended time at the PORs and obtain 100% of their country foods and drinking water from within the LSA while they are there. A number of additional conservative assumptions are included to characterize baseline conditions and to predict the Project and Post-closure air, soil, surface water and country foods quality used to predict the THQs in the models. These include using 95% upper confidence level on the mean (UCLM) for baseline soil and country foods, maximum 75th percentile over the year for surface water and using ½ detection limits

to represent non-detect values in the datasets. There are no receptors present at the MPOI. Individual HQ results for the heavy consumer are included in Attachment B-3a.

There were no THQ exceedances for the average country foods consumer. Individual HQ results for the average consumer are included in Attachment B-3b.

Cobalt

The non-cancer THQ associated with non-carcinogenic effects from exposure to cobalt (all media and exposure pathways) are presented in Table 4.4.1.2-2.

Table 4.4.1.2-2: Total Hazard Quotients for Cobalt (Toddler Resident)

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Total HQ	Total HQ
					Heavy Consumer	Average Consumer
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	0.2	0.1
				Project	1.0	0.3
				Post-Closure	0.5	0.2
	West of Birch Lake	8	POR24 Cabin	Baseline	0.2	0.1
				Project	0.4	0.1
				Post-Closure	0.4	0.1
	South of Springpole Lake	DL	POR22 Cabin	Baseline	0.2	0.1
				Project	0.4	0.1
				Post-Closure	0.2	0.1
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	0.2	0.1
				Project	0.4	0.1
				Post-Closure	0.2	0.1
	Gull Lake	10	POR38 Cabin	Baseline	0.2	0.1
				Project	0.4	0.1
				Post-Closure	0.2	0.1
TLRU	North of Birch Lake	6	POR05	Baseline	0.2	0.1
				Project	1.0	0.3
				Post-Closure	0.5	0.2
	West of Mine	7	POR04	Baseline	0.2	0.1
				Project	**1.1**	0.3
				Post-Closure	0.4	0.2
	South of Mine	11	POR02	Baseline	0.2	0.1
				Project	0.4	0.2
				Post-Closure	0.6	0.2
	Further South of Mine	8	POR61	Baseline	0.2	0.1
				Project	0.4	0.1
				Post-Closure	0.4	0.2
MPOI	North of Mine	6	NA	Baseline	0.2	0.1
				Project	1.0	0.3
				Post-Closure	0.5	0.2

Notes:
Bold text indicates THQ exceeds the Target of 1.

The calculated THQ associated with predicted non-carcinogenic effects from exposure to cobalt (all media and exposure pathways) are below the threshold of 1 for all receptor locations and Assessment Scenarios for both heavy and average consumers, with the exception of a THQ of 1.1 at POR04, representing a negligible exceedance. The THQs are based on highly conservative exposure assumptions, including that receptors are present 100% of their time and obtain 100% of their country foods and drinking water from within the LSA. A number of additional conservative assumptions are included to characterize baseline conditions and to predict the Project and Post-closure air, soil, surface water and country foods quality used to predict the THQs in the models. These include using 95% upper confidence level on the mean (UCLM) for baseline soil and country foods, maximum 75th percentile over the year for surface water and using ½ detection limits to represent non-detect values in the datasets. HQ results for each contributing pathway for the heavy consumer and average consumer Resident receptors are included in Attachment B-3a and B-3b, respectively.

The HQ of 1.1 at POR04 is driven by the fish ingestion pathway. In this calculation, the fish are assumed to be exposed to surface water at Node 7 their entire lives. In reality, fish will move about this area and be exposed to lower concentrations (spatially and temporally). As such, a HQ greater than 1 is not anticipated and cobalt is not considered to represent a human health risk.

Mercury

The non-cancer THQs associated with non-carcinogenic effects from exposure to mercury (all media and exposure pathways) are presented in Table 4.4.1.2-3.

Table 4.4.1.2-3: Total Hazard Quotients for Mercury (Toddler Resident)

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Total HQ	Total HQ
					Heavy Consumer	Average Consumer
Indigenous Resident/ Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.2	0.3
	West of Birch Lake	8	POR24 Cabin	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.1	0.1
	South of Springpole Lake	DL	POR22 Cabin	Baseline	0.1	0.1
				Project	0.1	0.2
				Post Closure	0.1	0.1
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.1	0.1
	Gull Lake	10	POR38 Cabin	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.1	0.1

Table 4.4.1.2-3: Total Hazard Quotients for Mercury (Toddler Resident)

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Total HQ	Total HQ
					Heavy Consumer	Average Consumer
Indigenous Resident/ TLRU	North of Birch Lake	6	POR05	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.2	0.3
	West of Mine	7	POR04	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.1	0.2
	South of Mine	11	POR02	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.1	0.1
	Further South of Mine	8	POR61	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.1	0.1
MPOI	North of Mine	6	NA	Baseline	0.1	0.1
				Project	0.1	0.1
				Post Closure	0.2	0.1

Notes:
Bold text indicates THQ exceeds the Target of 1.

There were no THQ exceedances for the heavy consumer or average consumer in any of the Assessment Scenarios. HQ results for each contributing pathway for the average consumer are included in, Attachment B-3a and B-3b.

The change in THQs at the Resident receptor locations and the MPOI from Baseline to Project and Post-closure Assessment Scenarios are negligible, representing no increase in predicted human health risk from mercury exposure due to the Project.

Methylmercury

The calculated THQs associated with predicted non-carcinogenic effects from exposure to methylmercury (all applicable media and exposure pathways) are presented in Table 4.4.1.2-4. Note that the only applicable media and exposure pathways for methylmercury are surface water and fish and the THQs are based on highly conservative exposure assumptions, including that receptors are present full time at the TLRU or cabin POR and obtain 100% of their country foods from this area.

The THQ are calculated using two different TRVs, one protective of sensitive individuals and one protective of the general population. Sensitive individuals include women of child-bearing age (i.e., the TRV employed is protective of the developing fetus), infants and children under 12 years of age. The general population (non-sensitive) includes anyone over the age of 12 years that is not a woman of child-bearing age.

The heavy consumer, sensitive receptors scenario is calculated for the toddler and is based on a fish ingestion rate of 89.91 g/day. The heavy consumer, general population scenario, is calculated for an adult and is based on a fish ingestion rate of 178.91 g/day. The average consumer has an ingestion rate of 17.43 and 24.86 g/day for the toddler and adult, respectively. The MECP assumes a fish meal size of 227 g. As such, the heavy consumer adult is assumed to eat a fish meal 288 days per year.

Table 4.4.1.2-4: Total Hazard Quotients for Methylmercury

Scenarios	Area	Surface Water Node	Point of Receptor Location	Scenario	Total HQ – Heavy Consumer		Total HQ – Average Consumer	
					Sensitive Receptor (Toddler)	General Population (Adult)	Sensitive Receptor (Toddler)	General Population (Adult)
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	11.1	2.2	2.1	0.4
				Project	**11.2**	2.2	**2.2**	0.4
				Post Closure	**11.7**	**2.3**	**2.3**	0.5
	West of Birch Lake	8	POR24 Cabin	Baseline	11.1	2.2	2.1	0.4
				Project	11.1	2.2	2.1	0.4
				Post Closure	11.1	2.2	2.1	0.4
	South of Springpole Lake	DL	POR22 Cabin	Baseline	11.1	2.2	2.1	0.4
				Project	**11.4**	**2.3**	**2.2**	0.4
				Post Closure	11.1	2.2	2.1	0.4
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	11.1	2.2	2.1	0.4
				Project	10.4	2.1	2.0	0.4
				Post Closure	10.1	2.0	2.0	0.4
	Gull Lake	10	POR38 Cabin	Baseline	11.1	2.2	2.1	0.4
				Project	11.1	2.2	**2.2**	0.4
				Post Closure	10.8	2.1	2.1	0.4
TLRU	North of Birch Lake	6	POR05	Baseline	11.1	2.2	2.1	0.4
				Project	**11.2**	2.2	**2.2**	0.4
				Post Closure	**11.7**	**2.3**	**2.3**	0.5
	West of Mine	7	POR04	Baseline	11.1	2.2	2.1	0.4
				Project	**11.2**	2.2	**2.2**	0.4
				Post Closure	**11.3**	2.2	**2.2**	0.4
	South of Mine	11	POR02	Baseline	11.1	2.2	2.1	0.4
				Project	11.1	2.2	**2.2**	0.4
				Post Closure	11.1	2.2	2.1	0.4
TLRU	Further South of Mine	8	POR61	Baseline	11.1	2.2	2.1	0.4
				Project	11.1	2.2	2.1	0.4
				Post Closure	11.1	2.2	2.1	0.4
MPOI	North of Mine	6	NA	Baseline	11.1	2.2	2.1	0.4
				Project	**11.2**	2.2	**2.2**	0.4
				Post Closure	**11.7**	**2.3**	**2.3**	0.5

Notes:
A THQ>1 occurs at Baseline. **Bold** text indicates THQ increase over Baseline.

The THQ associated with non-carcinogenic effects from exposure to methylmercury (all media and exposure pathways) exceed the threshold of 1 for the heavy consumer (sensitive individuals and general population) and average country foods consumer at all receptor locations and Assessment Scenarios, including Baseline. The THQ was not exceeded for the general population for the average consumer. A number of additional conservative assumptions are included to characterize baseline conditions and to predict the Project and Post-closure surface water and fish quality used to predict the THQs in the models. These include using the 95% UCLM for baseline fish quality, maximum 75th percentile over the year for surface water quality and using ½ detection limits to represent non-detect values in the datasets.

The only exposure pathway contributing to the THQs is fish ingestion which accounts for 100% in all exposure Assessment Scenarios (Baseline, Project and Post-closure), as illustrated in Attachment B-3a and B-3b. This result is not unexpected and is reflected in the fish consumption advisory that has been put in place by the Government of Ontario for Birch Lake and other lakes in Ontario, due to existing mercury concentrations in fish. The increase in the THQ over baseline was up to 0.6 for heavy consumer, sensitive receptors scenario. For the increase in the THQ ranged from 0.1 to 0.2.

Concentrations of methylmercury in fish fillets is quite variable amongst fish species and the length of the fish.

- Lake Whitefish concentrations ranged from 0.0365 to 0.204 mg/kg wet weight in the 2022 data set. The fish tissue concentrations estimated as occurring during the project are up to 0.143 mg/kg wet weight.
- Walleye concentrations ranged from 0.112 to 1.94 mg/kg wet weight in the 2022 data set. The fish tissue concentrations estimated as occurring during the project are up to 0.716 mg/kg wet weight.

As such, changes in fish tissue concentrations from the Baseline Assessment Scenario to the Project and Post-closure Assessment Scenarios are expected to be negligible. Therefore, potential increases in risk associated with the Project from consumption of fish is not expected.

The HQ results for each contributing pathway for the heavy and average consumer are included in Attachment B-3a and B-3b.

4.4.2 Additive Chemical Interactions

Chemical exposures do not usually occur independently, but in combination with other chemicals. Therefore, the potential health effects associated with mixtures of COPCs were assessed according to guidance from Health Canada (2010a). Additive interactions may apply to chemicals that behave toxicologically through similar mechanisms or that affect the same target endpoint in biological systems (i.e., common effect) (Health Canada 2010a).

The critical endpoints of the exposure limits used in the assessment provide the basis for a particular chemical's inclusion in a chemical mixture. A summary of the toxicity endpoints (i.e., effects on the target organ) relied upon for the determination of potential adverse effects is provided in Table 4.4.2-1.

The nature of toxicity for each of the COPC was provided in Section 4.2- Toxicity Assessment.

Table 4.4.2-1: Nature of Chemical Toxicity for Determination of Additive Chemical Interactions

Chemical of Concern	Toxicity Endpoint
Methylmercury	Oral - Neurological
Cobalt	Inhalation – Heart Disease Oral - Hematological
Arsenic	Inhalation and Oral – Skin lesions and possible vascular complications
Mercury	Inhalation – Neurological Oral - Immunotoxicity

Given that none of the COPC share a common toxicological endpoint, no cumulative effects were calculated.

4.4.3 Results of Risk Characterization - Carcinogens

For the following chemicals, which are considered to exhibit non-carcinogenic effects based on the nature of their toxicity, risk is characterized by a HQ for each relevant exposure pathway-receptor combination:

- Inhalation pathway – PAHs and DPM
- Multimedia exposure assessment – Arsenic

4.4.3.1 Carcinogenic Inhalation Risks

Risk characterization results for carcinogenic PAHs via ambient air inhalation pathway is presented in Table 4.4.3.1-1.

Risk characterization results for DPM via ambient air inhalation pathway is presented in Table 4.4.3.1-2 and Table 4.4.3.1-3. Exposure was evaluating using two scenarios. Scenario #1 assumes exposure starts during Operations. As such, the air concentration is set equal to the Operations DPM concentration and exposure is assumed to occur for 15 years. Scenario #2 assumes exposure starts during Construction. As such, the air concentration is set equal to the Construction DPM concentration (i.e., maximum of Construction, Construction Road and Construction T-Line) for the first 3 years and to the Operations DPM concentration for 15 years.

Table 4.4.3.1-1: Incremental Lifetime Cancer Risk for Air – Polycyclic Aromatic Hydrocarbons

Scenario	Area	Receptor Location	ILCR
Indigenous Resident (POR16), 40% of time spent at a Cabin	North of PDA on northern edge of Birch Lake	POR01 / POR16	1.1E-10
	West of PDA on SW side of Birch Lake	POR24 / POR16	9.1E-11
	South of PDA near Seagrave Lake	POR22 / POR16	7.5E-11
	Springpole Lake Southeast Arm	POR07 / POR16	7.2E-11
	Gull Lake	POR38 / POR16	3.2E-11
Indigenous Resident (POR16), 20% of time spent at a TLRU	North of PDA in Birch Lake	POR05 / POR16	2.2E-10
	West of PDA in Birch Lake	POR04 / POR16	9.2E-11
	South of PDA near Springpole Lake north basin	POR02 / POR16	1.7E-10
	Further South of PDA in Cromarty Lake	POR61 / POR16	6.9E-11

Table 4.4.3.1-2: Incremental Lifetime Cancer Risk for Air – Diesel Particulate Matter Scenario #1

Scenario	Area	Receptor Location	ILCR
Indigenous Resident (POR16), 40% of time spent at a Cabin	North of PDA on northern edge of Birch Lake	POR01 / POR16	4.9E-06
	West of PDA on SW side of Birch Lake	POR24 / POR16	1.1E-06
	South of PDA near Seagrave Lake	POR22 / POR16	1.6E-06
	Springpole Lake Southeast Arm	POR07 / POR16	2.0E-06
	Gull Lake	POR38 / POR16	9.6E-07
Indigenous Resident (POR16), 20% of time spent at a TLRU	North of PDA in Birch Lake	POR05 / POR16	1.0E-05
	West of PDA in Birch Lake	POR04 / POR16	1.6E-06
	South of PDA near Springpole Lake north basin	POR02 / POR16	5.9E-06
	Further South of PDA in Cromarty Lake	POR61 / POR16	1.7E-06

Table 4.4.3.1-3: Incremental Lifetime Cancer Risk for Air – Diesel Particulate Matter Scenario #2

Scenario	Area	Receptor Location	ILCR
Indigenous Resident (POR16), 40% of time spent at a Cabin	North of PDA on northern edge of Birch Lake	POR01 / POR16	4.8E-06
	West of PDA on SW side of Birch Lake	POR24 / POR16	1.5E-06
	South of PDA near Seagrave Lake	POR22 / POR16	1.9E-06
	Springpole Lake Southeast Arm	POR07 / POR16	2.4E-06
	Gull Lake	POR38 / POR16	1.4E-06
Indigenous Resident (POR16), 20% of time spent at a TLRU	North of PDA in Birch Lake	POR05 / POR16	9.4E-06
	West of PDA in Birch Lake	POR04 / POR16	2.2E-06
	South of PDA near Springpole Lake north basin	POR02 / POR16	5.8E-06
	Further South of PDA in Cromarty Lake	POR61 / POR16	2.3E-06

The results of the assessment of potential cancer risk, via the exposure to predicted incremental B(a)P TPE and DPM concentrations due to the Project, indicated that the inhalation ILCR is within the target ILCR of 1×10^{-5} for all receptor locations.

4.4.3.2 Multimedia Carcinogenic Risks

The carcinogenic risk characterization results for arsenic exposure for the Project Alone scenario for the heavy and average country foods consumers for all applicable media and relevant exposure pathways are presented in Table B-2-6 in Attachment B-2. The ILCR estimates, considering all exposure pathways, are summarized in Table 4.4.3.2-1.

Table 4.4.3.2-1: Incremental Lifetime Cancer Risks for Arsenic (Resident) – Project Alone

POR Locations Closest to the Mine	POR	Heavy Consumer ILCR 100% Country Food From Area of Mine	Heavy Consumer ILCR 50% Country Food From Area of Mine	Average Consumer ILCR 100% Food From Area of Mine
Birch Lake North (LSA)	POR01 Cabin	**1.6E-05**	8.5E-06	3.7E-06
Birch Lake West (RSA)	POR24 Cabin	8.8E-07	5.7E-07	3.9E-07
South of Springpole Lake	POR22 Cabin	7.8E-06	4.0E-06	1.6E-06
Springpole Lake Southeast Arm	POR07 Cabin	1.0E-05	6.8E-06	4.7E-06
Gull Lake (RSA)	POR38 Cabin	4.9E-06	3.2E-06	2.2E-06
Birch Lake North (LSA)	POR05 TLRU	**2.3E-05**	**1.4E-05**	8.4E-06
Birch Lake West (LSA)	POR04 TLRU	**1.1E-05**	6.2E-06	3.2E-06
Springpole Lake north basin South of Mine	POR02 TLRU	**1.9E-05**	**1.2E-05**	7.1E-06
Further South of Mine	POR61 TLRU	8.3E-07	5.3E-07	3.3E-07

Notes:
Bold text indicates ILCR exceeds Target of 1.0E-05.

There are no ILCR exceedances of the target ILCR of 1×10^{5} for a receptor that is an average country foods consumer.

The ILCR for a receptor that is a heavy country foods consumer and is assumed to obtain 100% of their country foods from the LSA are marginally greater than the target ILCR at some POR locations:

- Within the LSA of Birch Lake, but not the area of Birch Lake within the RSA that is outside of the LSA.
- Within the north basin of Springpole Lake and the southeast arm of Springpole Lake

If it is assumed that heavy country foods consumer obtain 50% of their country foods from the LSA, calculated ILCRs are reduced with negligible exceedances at POR locations closest to the PDA.

In all cases, the potential risk greater than 1×10^{-5} is driven by the fish consumption exposure pathway. These are conservative estimates:

1) receptors are assumed to obtain 50 to 100% of their country foods from Birch Lake or Springpole Lake throughout an entire lifetime. These are likely conservative estimates as the area is remote and although some Indigenous communities in the area report harvesting country foods including fish from within the LSA, they also report harvesting country foods from areas outside the LSA and RSA.
2) Surface water concentrations are predicted based on conservative models which do not account for mixing throughout the water column, resulting in surface water concentrations greater than is likely to occur.

3) Fish concentrations are predicted based on uptake from conservatively predicted surface water concentrations.

Consideration of Existing Fish Consumption Advisories

Fish represent an important nutritional source and this becomes especially true in northern Ontario. Although fish represent a source of high-quality protein, beneficial omega-3 fats and other nutrients, they also represent a meaningful potential exposure pathway for COPC such as mercury. Based on their size, type and location, certain fish may be more suitable to eat than others. The MECP provides an interactive tool entitled *A Guide to Eating Ontario Fish (https://www.ontario.ca/page/eating-ontario-fish)*. The guide provides easy-to-understand information in aid of choosing fish caught from Ontario lakes and rivers to minimize exposure to toxins. Consumption advice in the guide is based on guidelines provided by Health Canada. As outlined in *A Guide to Eating Ontario Fish*, a fish consumption advisory is in place for Birch Lake. The guide provides recommendations for both the general population and those considered to be members of a sensitive population. The sensitive population includes women of child-bearing age (women who intend to become pregnant or are pregnant) and children younger than 15 years of age. Women of child-bearing age, including pregnant women and nursing mothers, can affect the health of their baby through a diet elevated in COPCs such as mercury. Young children and developing fetuses are affected by COPCs at lower concentrations than the general population. The guide is based on an average meal of 227 grams of a skinless, boneless dorsal fillet (e.g., a fillet of dinner plate length) for an average-size adult weighing 154 pounds.

To assist those ingesting fish in Ontario, fish consumption advisory tables are generated where the ingestion of fish may pose risk to human health.

In the area directly surrounding the Project, a fish consumption advisory exists for the following lakes and species of fish:

- **Birch Lake:** Burbot, Lake Trout, Lake Whitefish, Northern Pike, Walleye and White Sucker.

In the area in the vicinity of the Project, the following two related chemicals are considered as part of the consumption advisory:

- **Mercury and Methylmercury:** Mercury is converted to methylmercury in sediment by bacteria and absorbed by a fish either from water passing over its gills or it is ingested with its diet. Since fish eliminate mercury at a very slow rate, concentrations of this substance gradually increase. Fish at the top of the food web, such as Walleye and Northern Pike, usually have the highest mercury and methylmercury levels.

Following the consumption advisory may act to limit exposure to arsenic, mercury and methylmercury within the LSA/ RSA for all Assessment Scenarios, including Baseline.

4.5 Uncertainty Analysis

As a result of the scientific investigations, literature reviews and risk assessment guidance followed in the preparation of this Human Health Risk Assessment, it is believed that the risk assessment results present a reasonable yet conservative evaluation of the risk to human receptors present at the site and predicted from the Project. Where uncertainty was encountered in the development of the risk estimates, reasonable yet conservative assumptions were made, or data were selected, to help ensure that risks were not underestimated. A risk assessment containing a high degree of confidence is based on:

- Conditions where the problem is defined with a high level of certainty based on data and physical observations;

- An acceptable and reasonable level of conservatism in assumptions, which will help ensure that risks are overstated; and
- An appreciation of the bounds and limitations of the final solution.

The exposure assessment performed as part of this study was based on:

- Available data to describe existing site conditions;
- Sound conservative assumptions for certain parameters, as required; and
- Well-understood and generally accepted methods for risk prediction.

Table 4.5-1 contains a summary of the assumptions used in the human health risk assessment, providing an evaluation for each assumption and an opinion as to whether the assumption is acceptable.

Table 4.5-1: Evaluation of Assumptions in the Human Health Risk Assessment

Risk Assessment Assumption/ Uncertainty	Discussion of Conservatism	Analyses of Risk Estimate (Overestimate / Neutral / Under-Estimate)
Problem Formulation		
Measured concentrations in media (air, soil, plants, surface water and fish) are representative of baseline conditions.	There were sufficient samples in each media to provide a reasonable estimate of representative baseline concentrations.	Neutral
Predicted concentrations in country foods (plants, meat) were based on published uptake factors from predicted concentrations in soil or surface water.	Conservative assumption based on published uptake factors in the absence of site-specific data on soil to plant, plant to animal and surface water to fish uptake.	Overestimate
It was assumed that there is a uniform distribution of chemicals in vegetation and meat (especially the edible portions, such as the fruit and muscles) and that an equilibrium is rapidly established in the tissues of the plant or meat.	Reasonable and conservative assumptions in accordance with Health Canada guidance.	Overestimate to neutral
Maximum concentrations in each media were used in the initial identification of COPC.	Conservative and in accordance with Health Canada Guidance	Overestimate to neutral
Modelled exposure to COC EPC.	Conservative estimate of the reasonable maximum exposure over the LSA in accordance with Health Canada guidance.	Overestimate to neutral
Groundwater was eliminated from consideration as a media source of exposure during the problem formulations stage.	Although there is no known potable groundwater wells in the LSA or RSA, Lac Seul First Nation identified a potential groundwater spring location within the LSA near the proposed effluent discharge location. There were also numerous reports of community members consuming surface water for drinking water. Since the potential groundwater spring location is outside the influence of groundwater impacts from the Project, surface water concentrations are considered to conservatively represent drinking water in the area. The assessment conservatively assumes humans would consume the local surface water on a daily basis.	Overestimate to neutral
Sediment was considered as a media source of exposure for humans accessing Birch Lake or Springpole Lake during TLRU or recreational activities.	It was assumed sediment is available for contact by humans in the LSA / RSA.	Overestimate to neutral
The most sensitive human receptors on the site were assumed to be Indigenous community members (infant to elder) who were assumed to reside in their community and spend 40% of their time at cabin locations close to the PDA, practising TLU activities, including harvesting and consuming 100% of their country foods from the LSA. Both a heavy and average consumer of country foods were evaluated. The most sensitive age group evaluated for non-cancer effects was a toddler.	The most sensitive receptor, life stage and exposure were considered for the Human Health Risk Assessment.	Overestimate to neutral
Toxicity Assessment TRVs developed by regulatory agencies often incorporate assumptions that lead to varying degrees of uncertainty, such as those listed below:		
• Animal studies are often used to predict effects on humans. For the extrapolation of animals to human exposures, the exposure limits for chemicals are typically based on animal experiments where exposures to chemicals are administered. Statistical manipulations are performed to derive an appropriate TRV. Therefore, these procedures to derive the TRV imply that humans and animals will respond in similar fashion. In addition, the derivation also requires an assumption that the effects observed at the high doses that were used in the animal experiments would be equally or proportionally similar to effects at the low doses that human exposures would typically occur. • TRVs assume that the chemical exposures yield effects that follow similar physiological mechanisms of action in both animals and humans. These include the detoxification processes as well as the toxicological implications. All of these toxicological uncertainties may contribute to either an over- or under-estimation of the potential risks for the humans exposed to the chemicals.	Exposure limits (TRVs) developed by leading regulatory agencies typically incorporate large safety / uncertainty factors to compensate for uncertainties. The process used to establish TRVs is more likely to overestimate than underestimate the risks.	Overestimate to neutral
• Short-term toxicity studies (e.g., maximum two years for rodent studies) are used to predict effects from long-term exposures in humans. • Predicting potential health effects from the exposure to media at the site requires the use of models to extrapolate the observed health effects from the high doses used in laboratory studies to the anticipated human health effects from low doses experienced in the environment. The models contain conservative assumptions to account for the large degree of uncertainty associated with this extrapolation. • Toxicity testing on homogenous inbred animal populations are used to predict the effects on the heterogeneous human population. • Derivation of the cancer slope or unit risk factors are often an upper bound 95th percentile of the probability of response.		

Table 4.5-1: Evaluation of Assumptions in the Human Health Risk Assessment

Risk Assessment Assumption/ Uncertainty	Discussion of Conservatism	Analyses of Risk Estimate (Overestimate / Neutral / Under-Estimate)
Exposure Assessment: The exposure assessment makes assumptions regarding the exposure regimes that the human receptors undergo. Uncertainties in the exposure assessment include:		
The EPCs used for environmental media are estimated based on measured and modelled data.	Measures are taken (e.g., use of 90th percentile) to reduce the likelihood of underestimating exposure.	Overestimate to neutral
Uptake factors from literature are employed to estimate concentrations in some country foods.	Uptake factors are likely conservative estimates of uptake.	Overestimate to neutral
For non-cancer calculations, receptors were assumed to be present 7 days a week, 24 hours a day in the LSA. For cancer calculations, resident/cabin receptors were assumed spend 7 days a week, 24 hours a day in the LSA for 40% of their lifetime, while resident/TLRU receptors were assumed to spend 7 days a week, 24 hours a day in the LSA for 20% of their lifetime.	The exposure times likely represent conservative estimates.	Overestimate to neutral
Receptor characteristics (e.g., body weight, soil ingestion rate) were obtained from published sources (e.g., Health Canada) and country foods species and ingestion rates were estimated from literature (e.g., Chan et al. 2014) applicable to Indigenous communities in the region.	The receptor characteristics employed are considered to be reasonably conservative and unlikely to underestimate exposure.	Overestimate to neutral
Receptors are assumed to obtain 100% of their country foods consumed and 100% of their drinking water from within the LSA.	This results in a conservative assumption of exposure as Indigenous communities have reported conducting TLRU activities including collection of Traditional foods from outside the RSA in addition to within the LSA and RSA.	Overestimate
Point estimates of the chemical physical-chemical parameters in the assessment that are assumed to be consistent in a real world situation. The physical-chemical characteristics are typically laboratory derived data under controlled situations and their values may change in the actual environment where external variables, such as temperature fluxes and atmospheric air pressure changes, may change the parameter values.	Reasonable and conservative assumption in accordance with applicable guidance.	Overestimate to neutral
The assumption that the metabolism of chemicals in an individual is zero. This is especially important since some metabolism and depuration would occur during the lifespan of an individual. Bioavailability is assumed to be 100% for oral exposure for most chemicals, which may not be the case for all COPCS.	These assumptions will consequently over-estimate the risks.	Overestimate
The assessment assumed that individuals will be eating wild game as part of their normal diet. Although there is no analysis of game meat quality, uptake models were used to predict concentrations in game meat.	Due to the conservatism incorporated into the uptake values and bioavailability assumptions, the estimated game meat concentrations may overestimate risk.	Overestimate to neutral
Risk Characterization		
The level of conservatism associated with the characterization of risk, in particular from the Project, is relatively high due to the conservative assumptions incorporated into the modelling of predicted chemical concentrations in various media including air, soil, surface water and country foods, as well as the use of published uptake factors to model chemical concentrations into some country food items including mammals and birds. In addition, it was conservatively assumed that 100% of country foods and water consumed by receptors are from the LSA.	Overall, the human health risk estimates represent an overestimate of potential risk.	Overestimate

Note:
Overestimation of risk indicates that the assumption was conservative and could possibly overestimate the risks at the site (i.e., higher than actual). Underestimating the risk indicates that the assumptions made could slightly underestimate the level of risk at the site. Based on the assessment conducted at the site, the assumptions with underestimates are very slight and are not likely to pose a concern (i.e., assumption is acceptable).

4.6 Human Health Risk Assessment Summary

The results of the HHRA for exposure to criteria air parameters (CAPs) via the inhalation of air pathway indicated that CAPs were below their respective guidelines at the point of reception locations (PORs) with maximum concentrations, including at the maximum point of impingement (MPOI).

Based on screening of baseline conditions in soil against applicable human health-based guidelines, arsenic and cobalt were carried forward for additional consideration in the HHRA. Screening of predicted concentrations in soil due to the Project did not result in any additional COPC being carried forward to the HHRA. PAHs and diesel particulate matter associated with air emissions from the Project were also carried forward for further consideration. Due to the potential for bioaccumulation in aquatic country foods, mercury and methyl mercury were also carried forward for further assessment in the HHRA.

The predicted increases in COPC concentrations between the Baseline Assessment Scenario and the Project and Post Closure Assessment Scenarios were negligible for air, soil, sediment and terrestrial country foods and marginal for surface water and aquatic country foods. Predicted increases in COPC concentrations in surface water did not result in exceedance of applicable human health or aquatic life guidelines.

The human receptors considered for the assessment of potential adverse effects to human health in the HHRA were assumed to be Residents of nearby Indigenous or non-Indigenous communities who spend part of their time at cabins and/or who conduct TLRU activities within the LSA/RSA near the PDA. Points of reception (PORs) used to predict air concentrations and deposition rates in the Air Quality Assessment (Appendix G-2) were used to represent cabins and TLRU areas where receptors may spend time in the LSA/RSA. To ensure the worst-case potential human exposure was evaluated, the most sensitive human receptors were assumed to be Indigenous community Residents who spend a portion of their time at PORs near the PDA and are either average or heavy consumers of a variety of country foods (which they are assumed to hunt or harvest year-round, predominantly from the LSA). Therefore, the following receptor exposure scenarios were assessed in the HHRA:

1) Indigenous Resident/ Cabin receptor – This receptor is assumed to spend 60% of their time in their community (represented by POR 16 in the LSA) and 40% of their time at one of the cabins located closest to the PDA (POR01 and POR07 within the LSA and POR22, POR24 and POR38 within the RSA but outside the LSA), conducting TLRU activities and consuming country foods harvested from the same areas. For this receptor exposure scenario, HHRA calculations were completed to assess exposure considering both average and heavy country foods consumption rates reported by Indigenous communities in the area.
2) Indigenous Resident/ TLRU receptor - This receptor is assumed to spend 80% of their time in their community and 20% of their time conducting TLRU activities near the PDA (POR02, POR04, POR05 and POR61 within the LSA), consuming country foods harvested from the area. For this receptor scenario, HHRA calculations were completed to assess exposure considering both average and heavy country foods consumption rates reported by Indigenous communities in the area.

These receptor exposure scenarios also conservatively assess exposure to non-indigenous residents who spend time in cabins and/or conduct recreational activities within the LSA/ RSA, including harvesting and consuming country foods at average and heavy country foods consumption rates.

In general, a high degree of conservatism is incorporated into the models used to predict Project related air emissions, deposition to soil and surface water, sediment and fish concentrations. In addition, the assumptions used in the HHRA model (such as exposure assumptions and TRVs) result in overestimation of the predicted risks to human health.

Risk characterization results for PAHs and DPM via ambient air inhalation pathway indicated that results for all points of reception considered in the HHRA were within non-carcinogenic and carcinogenic targets, indicating no unacceptable risk to receptors.

The HHRA results for predicted non-carcinogenic effects for metals COPC are as follows:

- Arsenic (all media and exposure pathways) – the THQ are at the target of 1 at baseline conditions for the heavy country foods consumer. The change at the selected PORs from Baseline to Project and Post-closure Assessment Scenarios are conservative, as discussed below, representing a negligible increase in predicted human health risk from arsenic exposure. There were no exceedances for the average country foods consumer.
- Cobalt (all media and exposure pathways) – the THQs are below the threshold of 1 for all receptor locations and Assessment Scenarios for both heavy and average consumers, with the exception of a negligible exceedance at POR04 (i.e., a THQ of 1.1 versus a target of 1.0 at the TLRU immediately west of the PDA). The calculations are highly conservative, as discussed below, and potential increases in risk associated with non-carcinogenic effects from cobalt from the Project is not expected.
- Mercury (all media and exposure pathways) - There were no exceedances of the non-carcinogenic targets for exposure to mercury via all exposure pathways combined.
- Methylmercury (all media and exposure pathways) – the THQs exceed the threshold of 1 for the heavy consumer (sensitive individuals and general population) and average country foods consumer at all receptor locations and Assessment Scenarios, including Baseline. The threshold was not exceeded for the general population for the average consumer. The only exposure pathway contributing to the HHRA results for methylmercury is fish ingestion which accounts for 100% in all exposure Assessment Scenarios (Baseline, Project and Post-closure). This result is not unexpected and is reflected in the fish consumption advisory that has been put in place by the Government of Ontario for Birch Lake and other lakes in Ontario, due to existing mercury concentrations in fish. Concentrations of methylmercury in fish fillets is quite variable amongst fish species and the length of the fish. The Lake Whitefish fish tissue concentrations estimated as occurring during the project are up to 0.143 mg/kg wet weight, within the range of Baseline concentrations measured in 2022 (0.0365 to 0.204 mg/kg wet weight). The Walleye fish tissue concentrations estimated as occurring during the project are up to 0.716 mg/kg wet weight, within the range of Baseline concentrations measured in 2022 (0.112 to 1.94 mg/kg wet weight). As such, changes in fish tissue methyl mercury concentrations from the Baseline Assessment Scenario to the Project and Post-closure Assessment Scenarios are expected to be negligible. The calculations are highly conservative, as discussed below, and potential increases in risk associated with non-carcinogenic effects from methylmercury from the Project is not expected.

A number of assumptions are included in this assessment which are expected to overestimate potential risk. The receptor is assumed to obtain 100% of their country foods in close proximity to the PDA. Additionally, concentrations used in the exposure assessment assume 95% UCLM for baseline soil and country foods quality and maximum 75th percentile over the year for surface water quality. The conservative surface water concentration has a notable effect on the overall risk estimates. In addition, the toxicity reference values used to calculate the THQs are designed to be conservative. Therefore, potential increases in risk associated with non-carcinogenic effects from COPCs from the Project is not expected.

Incremental lifetime cancer risk estimates for arsenic identified negligible exceedances of the target of 0.00001 (ranging from 0.000011 to 0.000023) at some POR locations for the heavy consumers of country

foods who are assumed to be harvesting all of their country foods from areas closest to the PDA. If it is assumed that heavy country foods consumer obtain 50% of their country foods from the LSA, calculated risks are reduced with negligible exceedances (0.000011 to 0.000014) at only two TLRU POR locations closest to the PDA. There are no exceedances of the target for average country foods consumers.

The evaluation of potential risk from carcinogenic effects assumes the receptors are exposed to COPCs near the PDA for a portion of every year for their entire lifetime. In addition, the toxicity reference value used to calculate the ILCRs are designed to be conservative. The change in calculated risk levels from the Baseline Assessment Scenario to Project and Post-Closure Assessment Scenarios are negligible considering the conservatism built into the models.

In all cases, the potential risk is driven primarily by the fish consumption exposure pathway. These are conservative estimates as:

1) receptors are assumed to obtain 50 to 100% of their country foods from Birch Lake or Springpole Lake throughout an entire lifetime. These likely over-estimates as the area is remote and although some Indigenous communities in the area report harvesting country foods including fish from within the LSA, they also report harvesting country foods from areas outside the LSA and RSA.
2) Surface water concentrations are based on models which do not account for mixing throughout the water column, resulting in surface water concentrations greater than is likely to occur.
3) Fish concentrations are predicted based on uptake from predicted surface water concentrations that are likely to be over-estimated.

There is a provincial fish consumption advisory currently in effect for Birch Lake and other lakes in Ontario (based on existing mercury concentrations in upper trophic level fish). Following the consumption advisory may act to limit exposure to arsenic, cobalt and methylmercury within the LSA/ RSA for all Assessment Scenarios, including Baseline. It is noted that fish consumption serves as an essential source of nutrition and fish consumption has been linked to many health benefits such as cardiovascular health (Health Canada, 2007).

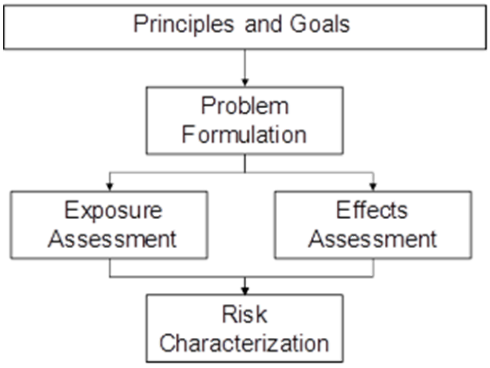
The change in calculated risk levels from the Baseline Assessment Scenario to Project and Post-Closure Assessment Scenarios are negligible considering the conservatism built into the models. Potential risks resulting from the Project to human receptors who spend time in cabins and/or practice traditional land use in areas surrounding the Project are not anticipated. As a result, there are no anticipated residual effects on human health from the Project.

Monitoring programs, including for surface water and fish, will be implemented to verify the accuracy of the predicted effects, validate the models and 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. 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.

5.0 ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment (ERA) follows standard framework consistent with the FCSAP ERA Guidance (FCSAP 2012; CCME 2020), as illustrated in the diagram below.

The fundamental steps in the ERA are:



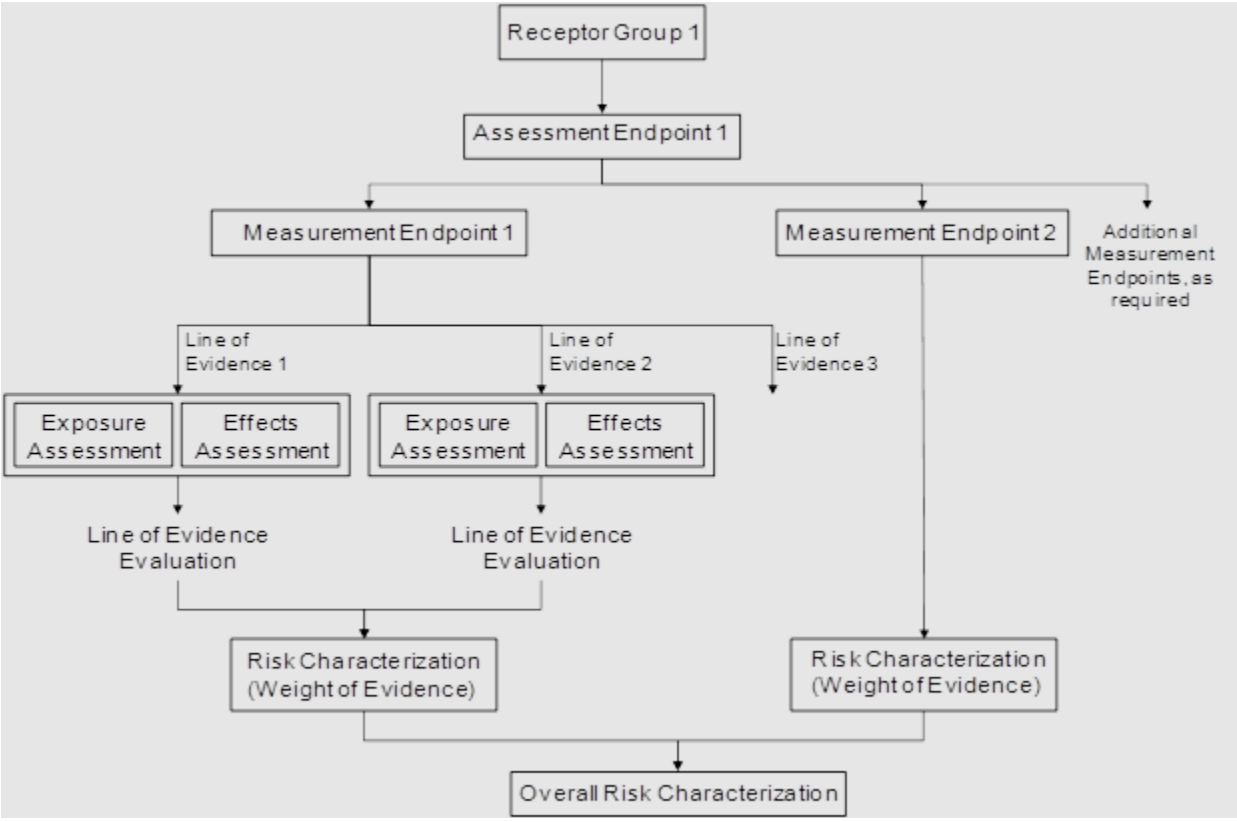
- **Principles and goals:** describe the purpose of the risk assessment and answer the question "Why is the risk assessment being conducted?"
- **Problem formulation:** identifies the issues at the site and sets out the framework within which the risk assessment will be conducted.
- **Exposure assessment:** quantifies the degree to which organisms encounter COPC stressors.
- **Effects assessment:** characterizes the potential ecological effects by each COPC for exposure conditions.
- **Risk characterization:** discusses the magnitude and probability of adverse ecological impacts based on the outcomes of the exposure and effects assessments.

5.1 Weight of Evidence Approach

The weight of evidence (WOE) approach to ERA has been developed as an effective means to evaluate multiple receptor groups via multiple exposure pathways using various lines of evidence (LOE). WOE is defined as any process used to aggregate information from different lines of scientific evidence to render a conclusion regarding the probability and magnitude of harm (FCSAP 2012). WOE assessments typically combine both qualitative (e.g., best professional judgment) and quantitative methods. The WOE assessment presented here follows the guidance published by Environment Canada (FCSAP 2012; CCME 2020) as illustrated in Figure 5-1.

For each receptor group, an assessment endpoint is identified that defines the property of the receptor group that is to be protected. The information needed to deal directly with the assessment endpoints is difficult to generate and rarely available. Therefore, measurement endpoints are used to bridge the gap. A measurement endpoint is a parameter that measures or describes exposure of, or an effect on, a receptor of concern. As part of a WOE approach, one or more measurement endpoint may be used for each assessment endpoint.

Figure 5-1: Weight of Evidence Framework



LOE are developed that pair exposure and effects measures to provide evidence for the evaluation of a specific measurement endpoint. If the focus of the LOE is an effects measure (e.g., a toxicity test), the paired exposure measure may be quantitative (e.g., COPC concentrations) or categorical (e.g., on-site versus a reference condition). Each LOE is evaluated in a WOE risk characterization for each measurement endpoint. This information is combined to provide an overall risk characterization for each receptor group. Finally, the WOE for each receptor group is evaluated to complete the overall risk characterization for the site.

5.2 Principles and Goals

Risk assessment principles identify that assessment goals are required to specify the objectives of the assessment with sufficient clarity to enable the identification and assessment of risks relating to ecological health.

5.2.1 Site Management Goal

An important first step is to understand the purpose and application of the ERA. The ERA management goal is the overall planning objective and is a high-level narrative statement that reflects the scope of work and objectives of the current study. The management goal for the ERA is:

- To determine the potential risk to birds, mammals, amphibians and reptiles, invertebrate and plant communities from COPCs in environmental and Project-specific media.
- To determine the potential risk to SAR from COPCs in environmental and Project-specific media.
- To summarize the potential risk to aquatic receptors evaluated in other sections of the EA.

5.2.2 Protection Goals

In accordance with FCSAP (2012) and CCME (2020) guidance, the protection goals considered in the ERA are:

- Terrestrial invertebrate and plant communities exposed to COPCs associated with the Project in environmental media will have sustainable populations and continue to support ecosystem services.
- Aquatic receptors exposed to COPCs associated with the Project in surface water will have sustainable populations.
- Exposure to COPCs associated with the Project in environmental media will not have an effect on the sustainability (survival, growth or reproduction) of wildlife populations.
- SAR will not be adversely impacted by COPCs associated with the Project.

5.3 Problem Formulation

The Problem Formulation step defines the conditions at the Site as they relate to ecological receptors. In this step, COPCs were identified, and an ecological conceptual site model was developed that describes basic assumptions regarding fate and transport of COPCs, ecological receptors and exposure pathways within the LSA.

As part of the baseline studies completed for the Project, extensive characterization of plant and invertebrate communities, terrestrial and aquatic organisms including mammals and birds, as well as species at risk was completed. When selecting the ecological receptors assessed as part of the ERA, emphasis was placed on species that are present in or near the LSA.

The ERA relied on an ecologically meaningful LSA and RSA, as previously defined for the HHRA and used for biological baseline data collection (Figure 3-1). The LSA and RSA were considered in the identification of ecological receptors and exposure pathways pertinent to the ERA.

5.3.1 Sources of Contamination

During the construction, operations and active closure phases of the Project, air emissions and/or surface water releases will occur. This is described in more detail in Section 3.3.3.

5.3.2 Identification of Potential Ecological Hazards

A COPC screening was completed, as described in in Section 3.4. The screening has identified the following COPCs for further evaluation:

- **Soil**: arsenic, cobalt and molybdenum;
- **Fish:** mercury and methylmercury; and,
- **Sediment:** arsenic, cadmium, total chromium; copper, iron, lead, nickel, manganese, mercury, nickel, phosphorous and zinc.

5.3.3 Selection of Ecological Receptors

Receptors of Concern (ROC) are considered any non-human individual, species, population, community, habitat or ecosystem that may potentially be exposed to COPCs at the LSA. In the case of selecting lower trophic level ROCs such as plants and invertebrates, the community as a whole will be identified as the ROC. Conversely, for higher trophic levels such as some birds and mammals, the ROCs will be identified at the species level. For higher trophic levels, appropriate surrogate receptors will be selected as ROCs in the ERA to represent a group of receptors with similar characteristic features.

Based on review of the species inventories for the LSA (WSP 2024b) a representative subset of ecological receptors was selected as the basis for this ERA. Ecological receptors were chosen for the ERA by considering ROCs following risk assessment guidance (CCME 2020):

- Characteristic of land use based on local and regional habitat surveys and species inventory including identification of SAR;
- Most likely to be exposed to COPC due to habitat and potential Project emissions;
- Able to serve as a baseline from which effects of changes can be evaluated;
- Representative of various levels in the aquatic and terrestrial trophic web; and
- Economic or socially valued.

Based on the results of the baseline biological data collection, ROCs that are in reasonably close proximity to the Project include: terrestrial plants, soil invertebrates, mammals, birds, amphibians and reptiles (Appendix P-1 of the EIS/EA). Additionally, aquatic receptors are present on site and off site (Appendix 0-1 of the EIS/EA).

5.3.3.1 Plants

The Project occurs in Ecoregion 3S, the Lake St. Joseph Ecoregion, and is classified as part of the Subhumid Mid-Boreal ECOP Climatic Region by the Ecoregions Working Group (Appendix P-1 of the EIS/EA). Significant growing season moisture deficits can occur. Coniferous forest dominates Ecoregion 3S, approximately 30% of the area occupied by it. Upland vegetation is composed primarily of Jack Pine and Black Spruce, with White Spruce and Balsam Fir associates, depending on the time since last disturbance by fire. Trembling Aspen and White Birch can form open and closed stands, as well as forming part of Jack Pine- or Black Spruce-dominated mixed woods. Dry sites often support open Jack Pine lichen woodlands that are important habitat for Caribou (Boreal population). Large open peatlands (fens or bogs) dominate the lowlands; treed lowlands are dominated by Black Spruce with tamarack (Appendix P-1 of the EIS/EA). Glacial till is generally less than 1 m in thickness; on richer, moist mineral sites, Balsam Poplar and Black Ash occur as components of lowland and riparian mixed wood forests. Outcrops are limited and small and are generally covered by a thick layer of moss or muskeg. With the landscape dominated by shallow substrates and a periodically dry climate, Ecoregion 3S experiences intense and frequent fire disturbance. Upland coniferous forest fire cycles range between 50 to 187 years and the fires tend to be stand replacing.

Wetland Communities

The wetland communities in the LSA and RSA include marsh, swamp, fen and bog. Wetland communities comprise approximately 18% of both the LSA and RSA (Appendix P-1 of the EIS/EA). Wetlands exist in different site types, including palustrine (inland with no flow or intermittent inflow and either permanent or intermittent outflow), lacustrine (associated with a lake) and isolated (e.g., fens and bogs). Wetlands are important ROCs, as they support bird and mammal populations, invertebrate communities and fish populations.

Terrestrial Plants

The terrestrial communities from the Far North Land Cover data in the LSA and RSA include sparse treed, deciduous treed, mixed treed, coniferous treed and bedrock. Terrestrial communities compose approximately 47% of the LSA and 46% of the RSA. The predominant vegetation community in the RSA is coniferous forest, which may be of widely varying height depending on age and may have an open canopy or a closed canopy with very little vegetation underneath. Most areas are heavily dominated by Black Spruce and Jack Pine, with the Black Spruce being more common in moister and more mature forests, while Jack

Pine is more common in drier, rockier settings and in areas regenerating from fires and logging ow shrubs, including Labrador Tea and blueberries are often abundant, but taller shrubs such as Green Alder are less common. Coniferous forests are important to ecosystem services because they cover a large part of the earth's surface, representing the largest land habitat for plant and animal species; provide food and shelter for animals and humans; offer recreation; and filter water—and they convert carbon dioxide into oxygen for us to breathe.

Consistent with CCME (2020) guidance, plants were assessed as groups rather than as separate species. Plants are potentially exposed to COPCs via direct contact, root uptake and, in some cases, foliar uptake. The foliar uptake pathway is considered essentially negligible relative to the direct uptake pathway of exposure and therefore foliar uptake was not considered a pertinent exposure pathway. Direct contact and root uptake from soil was considered the routes of exposure for terrestrial plants examined in this ERA.

5.3.3.2 Terrestrial Insects

Incidental observations gathered during the 2021 field efforts included over 30 species of butterflies and 32 species of dragonflies and damselflies (Appendix P-1 of the EIS/EA). One species of butterfly, the Old World Swallowtail, is considered a rare species in Ontario and was observed in low numbers throughout the RSA. One species of dragonfly, the Subarctic Darner, is considered a rare species in Ontario. One Subarctic Darner was observed in a lakeshore fen during field investigations, but the species is likely more widespread throughout the RSA.

Consistent with CCME (1996a, 2020) guidance, soil invertebrates were assessed as a group, rather than as separate species. Soil invertebrates are in near-constant direct dermal contact with soil. Soil invertebrates can play a role in nutrient cycling and serve as food sources to many animals higher in the food chain.

5.3.3.3 Mammals

Eighteen species of mammals were observed during field investigations, including bats recorded on detectors, as well as incidental sightings (including tracks and other sign). North American River Otter, North American Beaver, American Marten were frequently recorded in riparian and open water areas through the RSA. Wolverine tracks were documented along the edges of lakes and streams in multiple locations. WSP Canada Inc. completed ungulate surveys and frequently documented Moose, especially in the southern portion of the baseline investigation area, Wolves (group of 5 in 2021, single in 2022) and frequent signs, and numerous Caribou groups. Caribou were also documented frequently during summer and fall field surveys.

Large mammals (caribou, wolves, wolverines, moose, bears) were identified during surveys.

The FSCAP and CCME guidance for completing an ERA (FCSAP 2012, CCME 2020) provides recommendations for surrogate mammal receptors by feeding guild, to be used in an ERA for terrestrial and aquatic environments. For the Springpole ERA, emphasis is given to the FSCAP surrogate receptors that were identified in the LSA or RSA as part of the baseline biological data collection as identified in Table 5.3-1.

Within the Terrestrial Resources Baseline Report (Appendix P-1 of the EIS/EA), the following were discussed as mammalian species at risk (SAR) that were confirmed to be present and have a SARA of ESA designation:

- Caribou (Boreal population) (*Rangifer tarandus*) – SARA and ESA: Threatened;
- Little Brown Myotis (*Myotis lucifugus*) – SARA and ESA: Endangered;
- Northern Myotis (*Myotis septentrionalis*) – SARA and ESA: Endangered; and
- Wolverine (*Gulo gulo*) – SARA: Special Concern; ESA: Threatened.

Table 5.3-1: Potential Mammals Receptor of Concern for the Ecological Risk Assessment

Feeding Guild	Surrogate	Discussion	Present within LSA
Herbivore	Meadow vole	Small mammals provide valuable indicators for potential effects of changes in environmental media. Red-backed voles have been identified in the PDA and therefore further consideration is required.	Yes
	Moose / Caribou (SAR)	Moose have been observed near the Project footprint and are valued for socio economic and cultural value and therefore further consideration is required. Caribou have been observed in the Region and are SAR and further consideration is required. The Moose will be used as surrogate for exposure.	Yes
	Muskrat	Muskrat have been observed near the PDA and therefore further consideration is required.	Yes
	Beaver	Beaver have been observed near the Project footprint and are valued for socioeconomic and cultural value and therefore further consideration is required.	Yes
	Hare	The hare is an important part of the diet of carnivores and is also used as a country food.	Yes
Insectivore	Common shrew / Northern myotis (SAR)	Small mammals provide valuable indicators for potential effects of changes in environmental media. The Common shrew have been identified in the PDA and therefore further consideration is required. Northern myotis have been observed in the Region and are SAR and further consideration is required. The common shrew will be used as surrogate for exposure.	Yes
Carnivore	Short-tailed weasel	Various weasel species were identified based on wildlife surveys conducted in the PDA.	Yes
Omnivore	Black bear / Wolverine (SAR)	Black bears have been observed near the Project footprint and are valued for socio economic and cultural value and therefore further consideration is required. Wolverine have been observed in the Region and are SAR and further consideration is required. The black bear will be used as surrogate for exposure.	Yes

The Northern Myotis feeds a variety of insects, including moths, beetles, flies, ants, and true-bugs. They capture prey both in the air and off surfaces, and commonly feed on spiders by gleaning them from their webs (Bat Conservation International 2024). The common shrew, which also eats terrestrial insects, was selected as a surrogate.

The Little Brown Myotis forages over water where their diet consists of aquatic insects, mainly midges, mosquitoes, mayflies and caddisflies. They also feed over forest trails, cliff faces, meadows and farmland where they consume a wide variety of insects, from moths and beetles to crane flies (MECP 2021b). As this species is predominantly exposure to insects associated with the aquatic habitat, they are not aligned with a specific receptor but are addressed further qualitatively.

5.3.3.4 Avians

The most abundant and frequently observed birds in the RSA are representative of the avifauna and habitats found in the RSA (boreal coniferous forest and wetland): Ruby-crowned Kinglet, Nashville Warbler, White-throated Sparrow, Dark-eyed Junco and Yellow-rumped Warbler. More than 20 raptor nests, including those for Bald Eagle and Osprey were confirmed in the RSA.

The FSCAP and CCME guidance for completing an ERA (FCSAP 2012) provides recommendations for surrogate mammal receptors by feeding guild, to be used in an ERA for terrestrial and aquatic environments. For the Springpole ERA, emphasis is given to the FSCAP surrogate receptors that were identified in the LSA or RSA as part of the baseline biological data collection. Avian species at risk (SAR) were confirmed to be present that have a SARA or ESA designation (Appendix P-1 of the EIS/EA). Endangered and Threatened species receive individual and habitat protection. Special Concern species are protected under Significant Wildlife Habitat (SWH). In the context of the ERA, endangered and threatened species require specific consideration. These include:

- Barn Swallow (*Hirundo rustica*) – SARA: Threatened; ESA: Special Concern
- Canada Warbler (*Cardellina canadensis)* - SARA: Threatened; ESA: Special Concern
- Common Nighthawk (*Chordeiles minor)* - SARA: Threatened; ESA: Special Concern
- Eastern Whip-poor-will (Antrostomus vociferus - SARA and ESA: Threatened
- Lesser Yellowlegs (*Tringa flavipes*) – SARA: Not listed; ESA: Threatened
- Olive-sided Flycatcher (*Contopus cooperi)* - SARA: Threatened; ESA: Special Concern

Table 5.3-2: Potential Avian Receptors of Concern for the Ecological Risk Assessment

Feeding Guild	Surrogate	Discussion	Present within LSA
Ominivore (Aquatic)	Mallard	The Mallard is migratory but may breed and overwinter in Canada. These avian have been observed in the study area. They are also of socio economic and cultural value.	Yes
Omnivore (Terrestrial)	American Robin	The American Robin is migratory but may breed and overwinter in Canada. Earthworms are one of the most important food sources in many areas but fruit, berries and seeds are also consumed. The American Robin will be used as a surrogate for SAR omnivores such as the Rusty Blackbird and Yellow Rail.	Yes
Omnivore	Ruffed Grouse	The Ruffed Ground is a resident species, which has been observed in the baseline investigation area. It predominantly eats leaves and berries, with invertebrates making up a smaller portion of the diet.	Yes
Insectivore	Barn Swallow (SAR)	The Barn Swallow is migratory and does not overwinter in Canada. These avian have been observed in the investigation area and is a species of special concern. Barn Swallows are almost exclusively insectivorous, hawking insects which have aquatic life stages. The Barn Swallow is an insectivore that is included in the multimedia exposure model within the ERA. The Barn Swallow is also a surrogated for other insectivorous SAR, including the Canada Warbler, Common Nighthawk, Eastern Whip-poor-will and Olive-sided Flycatcher.	Yes
Insectivore	Spotted Sandpiper / Lesser Yellowlegs (SAR)	The Spotted Sandpiper is migratory and does not overwinter in Canada. The Spotted Sandpiper forages principally for terrestrial and aquatic invertebrates. The Spotted Sandpiper will be used as a surrogate for the Lesser Yellowlegs.	Yes

Table 5.3-2: Potential Avian Receptors of Concern for the Ecological Risk Assessment

Feeding Guild	Surrogate	Discussion	Present within LSA
Carnivore	Bald Eagle	The Bald Eagle is migratory but may breed and overwinter in Canada. The Bald Eagle is an opportunistic forager and scavenger that preferentially eats fish but also consumes a variety of prey items. Bald Eagle have been observed in the study area and they are also of socio economic and cultural value.	Yes

5.3.3.5 Reptiles and Amphibians

Spring Peeper, American Toad and Wood Frog were abundant throughout the RSA in a wide variety of habitats, while Northern Leopard Frog was present locally in low numbers. Several other frog species have the potential to be present in the RSA; Boreal Chorus Frog and Mink Frog has historical ranges that overlap the Study Area while Green Frog occurs to the south. Common Gartersnake was observed frequently throughout the RSA. No turtles were observed during field investigations, and it is further than the northern range for most turtles in Canada; Western Painted Turtle and Snapping Turtle occur around Sioux Lookout and Ear Falls and may be found around the RSA. For the Springpole ERA, emphasis is given to the FSCAP surrogate receptors that were identified in the LSA or RSA as part of the baseline biological data collection as identified in Table 5.3-3.

Table 5.3-3: Potential Reptiles and Amphibians Receptors of Concern for the Ecological Risk Assessment

Feeding Guild	Surrogate	Discussion	Present within LSA
Carnivore amphibian	Wood frog	Has a broad distribution in North America, Wood frogs are forest-dwelling organisms that breed primarily in ephemeral, freshwater wetlands: woodland vernal pools. Their diet dominated by arthropods such as insects and spiders	Yes
Carnivore reptile	common garter snake	The common garter snake is indigenous to North America and found widely across the continent. Prey includes amphibians, earthworms, small mammals and birds	Yes

5.3.3.6 Aquatic Receptors

It is assumed that because the site has closed circuit drainage the ponds and water areas of the site do not represent aquatic habitat. As such, this exposure pathway is incomplete within the mine site area of the PDA. Aquatic receptors near the Project include Birch Lake, Springpole Lake, L-2 and several small streams and tributaries. It has a predominantly rocky heterogeneous shoreline and contains numerous islands and rocky shoals. The ecological risk assessment will examine the potential risk to aquatic life by comparing the various different media (i.e., surface water, sediment) to CCME and MECP guidelines and considers the following generic receptors:

- Aquatic plants;
- Benthic invertebrates; and
- Fish.

5.3.4 Identification of Exposure Scenarios and Pathways

For COPCs to have adverse effects on ecological receptors, they must gain access to the organism or receptor. The route by which this occurs is referred to as an exposure pathway and is dependent on the nature of the chemical and the nature of the receptor. A complete exposure pathway is one that meets the following criteria (CCME 2020):

- A source of COPC of interest must be present.
- Release and transport mechanisms and media must be available to move the COPC from the source to the ecological receptors.
- An opportunity must exist for the ecological receptors to contact the affected media.
- A means must exist by which the COPC is taken up by ecological receptors, such as ingestion, inhalation, or direct contact.

5.3.4.1 Direct Contact with Soil

Plants are potentially exposed to COPCs via direct contact with soil, root uptake from soil and, in some cases, foliar uptake. Foliar uptake from particulate deposition was considered for plants. Root uptake is the primary route of exposure for terrestrial plants. For root uptake to occur, roots must make contact with COPC in soil pore water.

The primary route of exposure for soil invertebrates is direct contact with, or ingestion of, COPCs in soil.

5.3.4.2 Incidental Soil Ingestion and Potential Dermal Exposure

Mammals and birds are exposed to contaminants in soil and/or mine rock via several pathways, including ingestion and dermal contact. While both pathways can potentially result in uptake depending on the properties of the chemical, the dominant pathway for both birds and mammals is usually ingestion. Feathers and fur limit the amount of contact that chemicals have with skin, and soil adhered to feathers or fur is ultimately ingested during grooming (Sample and Suter 1994).

The inhalation exposure pathway is not commonly addressed for ecological receptors due to the absence of toxicological effects data. At the Site, there were no volatile COPCs identified in the environmental or Project-specific media.

5.3.4.3 Water Consumption and Direct Exposure

Mammals and birds are exposed to contaminants in surface water through ingestions. Amphibians and reptiles can also be exposed through ingestion in addition to direct contact.

5.3.4.4 Food Consumption

Mammals and birds as well as amphibians and reptiles can be exposed to COPCs through the ingestion of food items that live or have been exposed to impacted media including soil, surface water and/or sediment.

Pathways of exposure identified in the ecological conceptual site model are presented in Table 5.3-4.

Table 5.3-4: Selected Receptors of Concern for the Ecological Risk Assessment

Receptor Group	Exposure Pathway Description	Pathway Complete?	Assessment Required?	Justification
Plants	Root Uptake (Soil)	Yes	Yes	Soil COPCs identified
Invertebrate	Direct Contact (Soil)	Yes	Yes	Soil COPCs identified
Mammals	Air	Yes	No	Inhalation not addressed for mammals; however, particulate deposition incorporated into multimedia model
	Water Consumption	Yes	Yes	Considered as part of the multimedia model
	Food Consumption	Yes	Yes	COPCs identified in baseline soil and sediment
	Incidental Soil Ingestion	Yes	Yes	Soil COPCs identified
	Dermal Exposure	Yes	No	Exposure considered minimal
	Inhalation	Yes	No	No volatile COPCs identified
Birds	Air	Yes	No	Inhalation not addressed for mammals; however, particulate deposition incorporated into multimedia model
	Water Consumption	Yes	Yes	Considered as part of the multimedia model
	Food Consumption	Yes	Yes	COPCs identified in baseline soil and sediment
	Incidental Soil Ingestion	Yes	Yes	Soil COPCs identified
	Incidental Sediment Ingestion	Yes	Yes	Sediment COPCs identified
	Dermal Exposure	Yes	No	Exposure considered minimal
	Inhalation	Yes	No	No volatile COPCs identified
Amphibians and Reptiles	Air	Yes	No	A qualitative discussion is provided
	Water Consumption	Yes	No	
	Food Consumption	Yes	No	
	Incidental Soil Ingestion	Yes	No	
	Incidental Mine Rock Ingestion	Yes	No	
	Dermal Exposure to Soil	Yes	No	
	Inhalation	Yes	No	No volatile COPCs
	Direct / Dermal Contact to Surface Water	Yes	No	A qualitative discussion is provided
	Ingestion of Surface Water	Yes	No	
	Food Consumption in Surface Water	Yes	No	

5.3.4.5 Water Consumption by Birds and Mammals

Mammals and birds have the potential to be exposed to COPCs in surface water. Ingestion of surface water is considered a pathway of exposure. Exposure via dermal contact to animals with fur and feathers is considered to be negligible relative to the ingestion pathway.

5.3.4.6 Exposure to Surface Water and Sediment

Aquatic receptors, including plants, fish, invertebrates and amphibians, may be exposed to COPCs in surface water and sediment or restored terrestrial habitat. Aquatic and terrestrial receptors can be exposed to COPCs through ingestion, direct / dermal contact, and the ingestion of plants and prey.

5.3.4.7 Ingestion of Prey

Mammals and birds can be exposed to COPCs in environmental media via consumption of plant materials, invertebrates and/or prey that have accumulated COPCs from these media.

5.3.5 Development of Conceptual Site Model

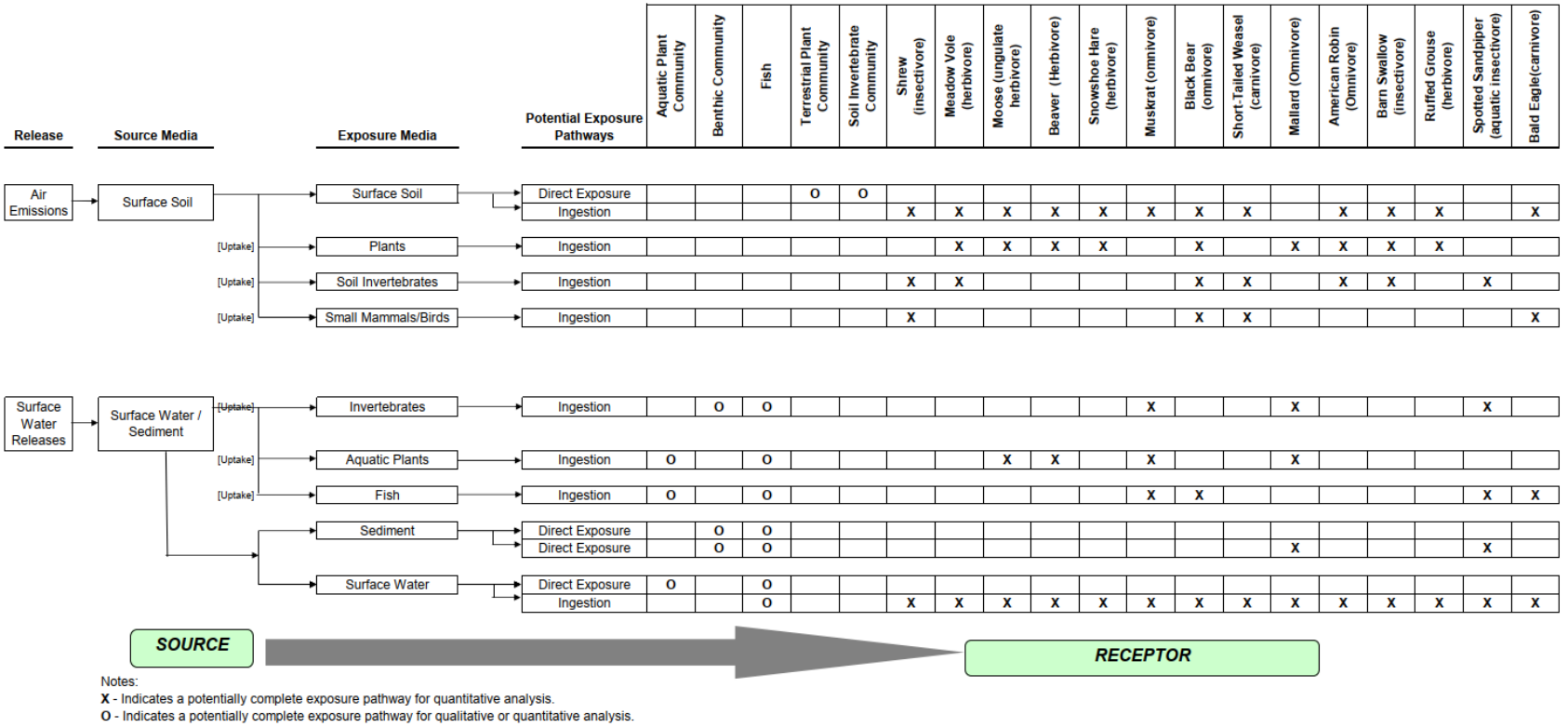
The conceptual site model developed for this site, presented in Figure 5-2, schematically represents the interactions between the receptors and the COPC, via the identified exposure pathways. In Figure 5-2, the relevant exposure pathways are designated by arrows leading from the COPC source media to each receptor. The pathways marked with an "O" represent communities that are addressed by considering screening guidelines for surface water, soil or sediment (as per Section 3.4.2). All other receptors (i.e., bird and mammal species) are assessed using a multimedia exposure model.

5.3.6 Assessment and Measurement Endpoints

Assessment and measurement endpoints link protection goals to a specific scope of work within the risk assessment. Assessment endpoints are explicit expressions of the environmental value that is to be protected (FCSAP 2012; CCME 2020). Measurement endpoints are conceptually related to assessment endpoints and can be used to characterize exposure or effects on an ecological receptor. For example, using aquatic receptors, the measurement endpoint will be a sediment quality guideline which is protective of the benthic community.

LOE are a pairing of exposure and effects which provide evidence for a specific assessment endpoint. Assessment and measurement endpoints and LOE for the surrogate receptor groups are displayed in Table 5.3-5, based on data collected to date.

Figure 5-2: Ecological Conceptual Site Model



Notes:
X - Indicates a potentially complete exposure pathway for quantitative analysis.
O - Indicates a potentially complete exposure pathway for qualitative or quantitative analysis.

Table 5.3-5: Assessment and Measurement Endpoints for Ecological Receptors

Receptor Group	Assessment Endpoint	Measurement Endpoints	Line of Evidence
Plants	Plant community function as food for and cover for wildlife.	Soil Chemistry of COPCs	Compare site soil concentrations to benchmarks for plants.
Terrestrial Invertebrates	Soil invertebrate function as food for wildlife.	Soil Chemistry of COPCs	Compare site soil concentrations of COPCs to benchmarks for invertebrates.
Terrestrial Birds and Mammals	Mammalian and bird populations will not have adverse effects from soil at the site.	Estimated daily exposure from COPCs in soil and food	Compare the estimated dose from the food web model to TRVs for COPCs identified from soil.
			Compare the concentrations of soil COPCs to guidelines protective of wildlife.
Aquatic Birds and Mammals	Mammalian and bird populations will not have adverse effects from sediment at the site.	Estimated daily exposure from COPCs in sediment and fish	Compare the estimated dose from the food web model to TRVs for COPCs identified from sediment.
Aquatic plants and zooplankton	Maintenance of aquatic communities similar to those found in reference areas.	Surface water chemistry of COPCs	Compare baseline concentrations of COPCs to modelled increases in surface water chemistry.
Benthic (aquatic) Invertebrates	Benthic community health as reflected in quantity and diversity of taxa.	Sediment chemistry of COPCs	Compare bulk sediment concentrations to federal and provincial guidelines.
			Compare baseline sediment concentrations of COPCs to modelled increases in sediment chemistry.
Fish	Maintenance of fish communities in aquatic exposure areas similar to those found in reference areas.	Sediment chemistry of COPCs	Compare bulk sediment concentrations (baseline, Project and post-closure) to federal and provincial guidelines.
			Compare baseline sediment concentrations of COPCs to modelled increases in sediment chemistry.
		Surface water chemistry of COPCs	Compare surface water concentrations (baseline, Project and post-closure) to federal and provincial guidelines.

5.4 Exposure Assessment

Exposure assessment characterizes the mechanisms by which receptor groups are exposed to COPC and quantifies the magnitude of these exposures. As noted earlier, exposure and effects are then matched for each LOE. In some instances, the same exposure information (e.g., sediment chemistry) is used for multiple LOE (e.g., benthic invertebrates and fish). In general, exposure measures are grouped into three categories (FCSAP 2012):

- External media (e.g., soil concentrations);
- Dose (e.g., total dose of COPCs through dietary ingestion); and
- Categorical measures (e.g., site compared to reference conditions).

Exposure estimates are provided for ecological receptors with complete exposure pathways, as described below. EPCs are concentrations in each relevant media to which receptors were assumed to be exposed. The EPCs used as inputs in the ERA Model are provided in Attachment A. A summary of the relevant information regarding the exposure model is discussed in the sections below.

5.4.1 Terrestrial Plants and Soil Invertebrates

Because plants and invertebrates have low mobility, exposure to COPCs cannot be averaged or integrated among areas of the property with higher and lower concentrations. Some fractions of individuals in a population at a site are potentially exposed to the highest concentrations of COPCs. The soil concentration for baseline is based on the 95th UCLM. For the Project, the EPC is based on the baseline plus incremental soil concentration from the MPOI. The MPOI represents the maximum potential increase in soil concentrations.

5.4.2 Birds and Mammals

To evaluate the dose for each ecological receptor to each potential COPC, it is necessary to first estimate the concentration of each COPC in various media or biological tissues.

This includes soil, soil invertebrate, plant, water, aquatic invertebrates and aquatic plants, fish, as well as small mammal/bird tissues. Baseline EPC for soil, small mammals, vegetation and fish COPCs are based on the 95th UCLM from available data. The 75th percentile of the water chemistry results were used in the assessment.

Concentrations of COPCs in soil invertebrates, plants and mammals associated with Project were characterized using regression equations or other uptake factors.

Incremental COPC in prey items in the aquatic food web model (fish, aquatic invertebrates, benthic invertebrates and plants) were estimated using bioconcentration factors or bioaccumulation factors.

A complete list of the regression equations, BAFs and BCFs are presented in Attachment A – Baseline Data, Section 1.6.

Within a multimedia exposure model each of the COPC are evaluated further, with the exception of iron. Appropriate inputs are not available to assess iron quantitatively for birds and mammals and thus iron is addressed qualitatively.

5.4.3 Aquatic Life

To evaluate the potential effects on aquatic life, the 75th percentile of the water chemistry results and the 95th UCLM percentile of sediment chemistry were utilized as conservative estimates of the EPC for the assessment.

5.4.4 Summary of Model Output for Prey Food Items

Based on the soil, surface water and sediment concentrations identified in Section 3.4.2 and the regression equations, BAFs and BCFs are presented in Attachment A – Baseline Data, Section 1.6, concentrations in prey food items are estimated.

The concentration in each food items is displayed in Table 5.4-1 and Table 5.4-4 below.

Methylmercury is considered an aquatic only COPC and therefore no terrestrial food item concentrations were calculated.

Table 5.4-1: Tissue Concentrations Estimated at the Maximum Point of Impingement for Prey (mg/kg wet weight)

COPC	Concentration of COPC in Small Mammal (Prey Item)			Concentration of COPC in Bird (Prey Item)		
	Baseline	Project	Post-closure	Baseline	Project	Post-closure
Arsenic	7.92E-02	2.55E-03	2.55E-03	1.71E-02	1.72E-02	1.72E-02
Cadmium	3.15E-02	4.76E-04	4.76E-04	1.62E-04	1.62E-04	1.62E-04
Chromium	1.38E-01	1.70E-02	1.70E-02	1.97E-03	1.97E-03	1.97E-03
Cobalt	7.18E-02	2.11E-04	2.11E-04	5.74E-04	5.74E-04	5.74E-04
Copper	3.38E+00	1.88E-01	1.88E-01	3.05E-01	3.05E-01	3.05E-01
Lead	2.92E-01	9.73E-05	9.72E-05	4.83E-03	4.87E-03	4.87E-03
Manganese	1.15E+01	9.50E-03	9.50E-03	1.21E-01	1.21E-01	1.21E-01
Mercury	4.99E-02	5.01E-03	5.01E-03	1.29E-04	1.29E-04	1.29E-04
Nickel	2.60E-01	1.82E-03	1.82E-03	2.39E-03	2.40E-03	2.40E-03
Zinc	3.49E+01	9.90E-01	9.90E-01	2.10E+01	2.10E+01	2.10E+01
Mercury (methyl)	0.00E+00	9.33E-13	3.94E-13	9.09E-14	3.64E-13	1.54E-13
Molybdenum	2.46E-01	1.23E-03	1.22E-03	5.11E-03	5.13E-03	5.11E-03

Table 5.4-2: Tissue Concentrations Estimated at the Maximum Point of Impingement for Plants (mg/kg wet weight)

COPC	Total Concentration in Plants (Leaves)			Total Concentration in Plants (Berries)			Total Concentration in Plants (Aquatic)		
	Baseline	Project	Post-closure	Baseline	Project	Post-closure	Baseline	Project	Post-closure
Arsenic	3.92E-02	5.71E-02	3.96E-02	2.22E-02	2.49E-02	2.25E-02	1.04E+00	1.06E+00	1.40E+00
Cadmium	2.28E-03	7.03E-03	6.86E-03	2.26E-02	2.64E-02	2.64E-02	3.68E-02	3.67E-02	3.85E-02
Chromium	3.99E-02	5.18E-02	4.01E-02	5.31E-02	5.48E-02	5.33E-02	4.10E-01	1.62E+00	3.98E+00
Cobalt	2.55E-02	2.98E-02	2.55E-02	3.24E-02	3.30E-02	3.24E-02	2.19E-01	4.38E-01	9.46E-01
Copper	1.49E+00	1.70E+00	1.69E+00	1.66E+00	1.83E+00	1.82E+00	1.26E+00	1.33E+00	1.36E+00
Lead	2.15E-02	6.66E-02	5.41E-02	3.15E-02	5.99E-02	5.82E-02	5.30E-01	9.97E-01	7.31E-01
Manganese	3.12E+02	3.12E+02	3.12E+02	7.66E+02	7.66E+02	7.66E+02	9.52E+01	9.59E+01	1.00E+02
Mercury	3.71E-03	5.59E-03	5.56E-03	4.01E-03	5.53E-03	5.53E-03	4.79E-03	1.47E-02	9.01E-02
Nickel	3.45E-01	3.57E-01	3.48E-01	4.33E-01	4.37E-01	4.36E-01	5.73E-01	5.61E-01	3.62E-01
Zinc	1.03E+01	1.08E+01	1.08E+01	8.40E+00	8.83E+00	8.82E+00	2.99E+00	4.33E+00	4.31E+00
Mercury (methyl)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.79E-03	1.24E-02	1.75E-02
Molybdenum	1.74E-02	1.77E-02	1.77E-02	4.09E-01	4.10E-01	4.09E-01	2.66E-01	5.72E-01	3.49E-01

Table 5.4-3: Tissue Concentrations Estimated at the Maximum Point of Impingement for Fish (mg/kg wet weight)

COPC	Concentration of COPC in Fish Tissue – Large Bodied			Concentration of COPC in Fish Tissue – Small Bodied		
	Baseline	Project	Post-closure	Baseline	Project	Post-closure
Arsenic	1.42E-01	6.96E-01	9.76E-01	1.42E-01	6.96E-01	9.76E-01
Cadmium	1.66E-02	5.07E-03	5.68E-03	1.66E-02	5.07E-03	5.68E-03
Chromium	2.32E-02	4.48E-01	2.12E-01	2.32E-02	4.48E-01	2.12E-01
Cobalt	1.36E-02	1.76E-01	9.39E-02	1.36E-02	1.76E-01	9.39E-02
Copper	9.83E-01	3.76E-01	2.38E-01	9.83E-01	3.76E-01	2.38E-01
Lead	1.51E-02	6.05E-01	4.43E-02	1.51E-02	6.05E-01	4.43E-02
Manganese	5.04E+00	4.91E+00	4.91E+00	5.04E+00	4.91E+00	4.91E+00
Mercury	5.19E-01	7.91E-01	8.44E-01	5.20E-02	7.91E-02	8.44E-02
Nickel	4.31E-02	6.19E-01	4.18E-01	4.90E-02	6.19E-01	4.18E-01
Zinc	6.19E+01	1.33E+01	5.36E+00	6.19E+01	1.33E+01	5.36E+00
Mercury (methyl)	5.09E-01	7.12E-01	7.60E-01	4.60E-02	7.27E-02	7.77E-02
Molybdenum	2.69E-02	1.73E-01	8.89E-03	2.69E-02	1.73E-01	8.89E-03

Table 5.4-4: Tissue Concentrations Estimated at the Maximum Point of Impingement for Invertebrates (mg/kg wet weight)

	Concentration of COPC in Soil Invertebrates Tissue			Concentration of COPC in Aquatic Invertebrates Tissue			Concentration of COPC in Benthic Invertebrates Tissue		
	Baseline	**Project**	**Post-Closure**	**Baseline**	**Project**	**Post-Closure**	**Baseline**	**Project**	**Post-Closure**
Arsenic	2.24E-01	2.24E-01	2.24E-01	8.80E-02	1.27E-01	1.78E-01	1.01E+01	1.01E+01	1.01E+01
Cadmium	3.57E-01	3.58E-01	3.58E-01	9.09E-02	8.77E-02	9.82E-02	2.05E+00	2.05E+00	2.05E+00
Chromium	1.41E+00	1.42E+00	1.42E+00	7.50E-01	6.73E+00	3.18E+00	1.31E+01	1.31E+01	1.31E+01
Cobalt	1.83E-01	1.84E-01	1.84E-01	3.25E-01	2.39E+00	1.27E+00	8.70E+00	8.71E+00	8.71E+00
Copper	1.49E+00	1.49E+00	1.49E+00	3.72E+00	6.99E+00	4.43E+00	1.02E+01	1.02E+01	1.02E+01
Lead	1.14E+00	1.15E+00	1.15E+00	1.52E-01	1.02E+01	7.47E-01	1.25E+01	1.25E+01	1.25E+01
Manganese	6.46E+00	6.46E+00	6.46E+00	3.83E+01	3.99E+01	3.99E+01	7.23E+02	7.23E+02	7.23E+02
Mercury	5.92E-02	5.92E-02	5.92E-02	1.01E-01	1.60E-01	1.70E-01	6.94E-03	6.94E-03	6.94E-03
Nickel	2.28E+00	2.28E+00	2.28E+00	2.13E-01	1.73E-01	1.17E-01	2.21E+01	2.21E+01	2.21E+01
Zinc	5.23E+01	5.23E+01	5.23E+01	9.16E+00	2.96E+01	1.19E+01	4.25E+01	4.25E+01	4.25E+01
Mercury (methyl)	0.00E+00	0.00E+00	0.00E+00	1.26E-02	5.06E-02	2.14E-02	4.90E-03	4.90E-03	4.90E-03
Molybdenum	1.13E-01	1.13E-01	1.13E-01	4.11E-02	2.84E+00	1.46E-01	1.11E+00	1.15E+00	1.15E+00

5.4.5 Receptor Characteristics

To calculate the exposure dose, the body weights, food and soil consumption rates and dietary compositions of the receptors are required. A summary of the values is provided in Table 5.4.5-1.

As stated above in the total dose calculation, all receptors are conservatively assumed to spend 100% of their time exposed to the COPC concentrations within the LSA, which has the potential to overestimate potential risk.

Table 5.4.5-1: Ecological Receptor Characteristics

Ecological Receptors	Description	Body Weight	Foraging Range	Water Ingestion Rate	Food Ingestion Rate	Soil Ingestion Rate	Fraction of Diet: Forage	Fraction of Diet: Berries	Fraction of Diet: Aquatic Vegetation	Fraction of Diet: Invertebrate	Fraction of Diet: Bird	Fraction of Diet: Mammal	Fraction of Diet: Modelled Fish
		kg	ha	L/kg wet BW/day	kg dry food/kg wet BW/day	% of dry food ingestion rate	—	—	—	—	—	—	—
Eco_Rec_1	Meadow Vole	0.0349	0.0069	0.21	**0.05**	0.024	40%	60%	—	—	—	—	—
Eco_Rec_2	Moose	400	460	0.05	0.02	0.02	80%	—	20%	—	—	—	—
Eco_Rec_3	Beaver (1)	19.31	16.4	1.4	0.040	0.033	90%	—	10%				
Eco_Rec_4	Common Shrew	0.0041	0.6	0.17	0.34	0.02		—	—	95%	—	5%	—
Eco_Rec_5	Short tailed weasel	0.089	1	0.13	0.11	0.02	—	—	—	5%	25%	70%	—
Eco_Rec_6	Muskrat	1.0	0.03	0.1	0.07	0.02			80%	15%			5%
Eco_Rec_7	Black Bear	68	300	0.06	0.03	0.02	30%	50%		5%		10%	5%
Eco_Rec_8	Snowshoe Hare	1.3	1.6	0.1	0.06	0.063	90%	10%	—	—	—	—	—
Eco_Rec_9	Ruffed Grouse	0.552	1	0.07	0.06	0.02	55%	30%	—	15%	—	—	—
Eco_Rec_10	Mallard Duck	1.2	9.2	0.06	0.05	0.02	—	5%	50%	45%	—	—	—
Eco_Rec_11	Barn Swallow	0.0187	80	0.22	0.26	0.02	—	1%	—	99%	—	—	—
Eco_Rec_12	Bald Eagle	4.7	210	0.04	**0.03**	0.02	—	—	—	—	15%	20%	65%
Eco_Rec_13	Spotted Sandpiper	0.0375	0.08	0.17	0.18	0.02			5%	Ter: 60% Aqu: 30			5%
Eco_Rec_14	American Robin	0.079	0.7	0.14	**0.18**	0.04	—	60%	—	40%	—	—	—

Notes:
(1) Receptor characteristics for Beaver unavailable via FCSAP guidance, Characteristics obtained from US EPA, 1993.
BOLD values indicate: Food ingestion rate provided as kg wet food/kg wet Body Weight/day converted to kg dry food/kg wet Body Weight/day.
Source: Receptor characteristics obtained from FCSAP ERA Guidance: Module 3- Standardization of Wildlife Receptor Characteristics (FCSAP 2012).
NV = No Value

5.4.6 Estimated Dose from Dietary Ingestion

For wildlife, exposure to COPCs via relevant exposure pathways is determined by calculating an exposure dose (in units of mg/kg/d). Exposure doses calculated in such a manner can be compared to reference doses reported in the literature. This approach assumes mechanisms of toxicity for chemicals are the same regardless of the method of intake.

For representative avian and mammalian receptors, exposure to a COPC was calculated as the average daily dose (ADD) ingested. The ADD was defined as the amount of a COPC a modelled species might be exposed to on a mg/kg - body weight (bw)/day basis. For each modelled species and COPC combination, the ADD was calculated by summing the intake from each applicable exposure pathway.

For exposure pathway j, the generalized equation for ADD is:

$ADDj = iFj \times aFj \times EPCj$

Where: ADDj = average daily dose for exposure pathway j (mg/kg – bw/day);
iFj = intake factor (kg medium/kg – bw/day);
aFj = absorption factor (default value of 1; most conservative); and
EPCj = exposure point concentration (mg/kg).

The intake factor (IF) is not specific to each COPC, but is a characteristic of the modelled species and is calculated for each receptor and exposure pathway combination as follows:

$iFj = iRj / BW$

Where: iRj = medium-specific ingestion rate (kg medium/day); and
BW = receptor body weight (kg).

The absorption factor (AF) relates to the potential for COPCs to be absorbed across the gut wall following ingestion. Trace elements are part of the natural environment and exist in many different forms, having potentially differing relative bioavailability. In this ERA the AF is assumed to have a value of 1 for all ingested food items. Average daily can be found in Section 5.6.2.

Based on the exposure equations, media concentrations and receptor characteristics described above, exposure estimates for the Base Case, Project and Post-closure Assessment Scenarios, are provided in Section 5.6.2 for each of the 14 mammals or birds evaluated.

5.5 Ecological Toxicity Assessment

The risk of a toxic effect is evaluated based on a TRV. The toxicological database supporting a TRV preferably includes a number of chronic or multi-generational exposure studies involving exposure of relevant test species (i.e., the ecological receptor of interest or a phylogenetically similar species) to appropriate chemical forms of the substance of interest. Ideally, one or more relevant biological endpoints such as growth, reproductive effects, or survival were measured in the study.

5.5.1 Terrestrial Plants and Soil Invertebrates

TRVs for plants and invertebrates are representative of soil concentrations. In the identification of a soil TRV for terrestrial plants and soil invertebrates, values available from the CCME (or supporting Environment and Climate Change Canada documents used by CCME) for Agricultural Soil Use. TRVs for plants and invertebrates are displayed in Table 5.5.1-1.

Only the COCs in soil (i.e., arsenic, cobalt and molybdenum) require consideration as plants and invertebrates.

Table 5.5.1-1: Plant and Soil Invertebrate Soil Toxicity Reference Values Used in Assessment for Plants and Soil Invertebrates

Parameter	Plants (mg/kg)	Invertebrates (mg/kg)	Endpoint and Reference
Arsenic	17	17	CCME SQG (CCME 1997) for soil contact pathway, agricultural land use
Cobalt	40	40	CCME SQG (CCME 1991 as noted in CCME 2024).
Molybdenum	5	5	CCME SQG (CCME 1991 as noted in CCME 2024).

5.5.2 Birds and Mammals

As discussed in Section 5.3.6, two LOE were utilized in the assessment of potential effects on potential wildlife receptors. Soil benchmarks for agricultural land use which are identified by CCME and the MECP for the protection of wildlife receptors were utilized as LOE for the assessment and the TRVs are displayed in Table 5.5.2-1.

Table 5.5.2-1: Soil and Food Ingestion Benchmark Used in Assessment for Wildlife

Parameter	Wildlife Soil Screening Benchmark (mg/kg)	Endpoint and Reference
Arsenic	380	CCME SQG for soil and food ingestion, agricultural land use
Cobalt	180	MECP bird and mammal soil and food ingestion, agricultural land use
Molybdenum	6.9	MECP bird and mammal soil and food ingestion, agricultural land use

The Ecological Soil Screening Level (Eco-SSL) database is used as the preferred benchmark for the FCSAP (2021) default TRVs and is mostly based on the highest NOAEL value lower than the lowest bound and Lowest Observed Adverse Effect Levels (LOAEL) value for effects on reproduction, growth or survival. The default FCSAP (2021) TRVs were LOAEL and NOAEL TRVs obtained from:

- Oak Ridge National Laboratory Toxicity Benchmarks for Wildlife (Sample et al. 1996); and
- US EPA Eco-SSL documents.

TRVs used in the evaluation of risks to birds and mammals are based on an acceptable exposure dose (expressed as mg/kg/day) as opposed to a soil concentration. TRVs for birds and mammals are developed through the use of toxicity studies that commonly assess growth, reproduction and mortality.

The TRVs for mammals and birds are presented in Table 5.5.2-2 and Table 5.5.2-3, respectively.

Table 5.5.2-2: Toxicity Reference Values for Mammals - No Observable Adverse Effect Levels

COPC	NOAEL (mg/kg/day)	Endpoint and Reference
Arsenic	1.04	Reproduction, growth and survival (FCSAP 2021)
Cadmium	0.77	Reproduction, growth and mortality (FCSAP 2021)
Chromium	2.4	Growth (FCSAP 2021)
Cobalt	7.33	Reproduction and Growth (US EPA Eco-SSLs 2005a)
Copper	5.6	Reproduction, growth, survival (FCSAP 2021)
Lead	4.7	Reproduction, growth and mortality (FCSAP 2021)

Table 5.5.2-2: Toxicity Reference Values for Mammals - No Observable Adverse Effect Levels

COPC	NOAEL (mg/kg/day)	Endpoint and Reference
Manganese	51.5	Reproduction and growth (US EPA 2007)
Mercury	5.8	Reproduction (FCSAP 2021)
Molybdenum	0.26	Reproduction (Sample et al. 1996)
Nickel	1.7	Reproduction, growth and survival (FCSAP 2021)
Zinc	75.4	Reproduction and growth (FCSAP 2021)
Methylmercury	0.015	Mortality and growth (Sample et al. 1996)

Table 5.5.2-3: Toxicity Reference Values for Birds - No Observable Adverse Effect Levels

COPC	NOAEL (mg/kg/day)	Endpoint and Reference
Arsenic	4.4	Reproduction, growth and mortality (FCSAP 2021)
Cadmium	2.1	Reproduction, juvenile growth and survival (FCSAP 2021)
Chromium	2.66	Reproduction and growth (FCSAP 2021, US EPA Eco-SSLs, 2008)
Cobalt	7.61	Growth (US EPA Eco-SSLs, 2005)
Copper	4.5	Reproduction (FCSAP 2021)
Lead	1.63	Reproduction, growth and mortality (FCSAP 2021)
Manganese	179	Reproduction and growth (US EPA 2007)
Molybdenum	3.5	Reproduction (Sample et al. 1996)
Mercury	0.8	Survival (FCSAP 2021))
Nickel	6.71	Reproduction and growth (FCSAP 2021)
Zinc	66.1	Reproduction and growth (FCSAP 2021)
Methylmercury	0.03	Reproduction (Fuchsman et al., 2017)

5.5.3 Aquatic Life

Surface water guidelines were discussed in Section 3.4.2. As there were no exceedances of the surface water guidelines, no further discussion of guidelines or toxicity values are warranted for surface water.

The CCME guidelines for sediment were used as TRVs in the assessment of potential effects on aquatic receptors.

A summary of the sediment TRVs used in the assessment is displayed in Table 5.5.3-1.

Table 5.5.3-1: Benthic Invertebrate Benchmarks Used in the Assessment

Parameter	Benthic Invertebrate Benchmark (mg/kg)	Endpoint and Reference
Arsenic	17	CCME Probable effect level (PEL)
Cadmium	3.5	CCME PEL
Chromium	90	CCME PEL
Cobalt	50	MECP Table 1 SCS
Copper	197	CCME PEL
Iron	40,000	MECP SEL since iron is high in the region
Lead	91.3	CCME PEL

Table 5.5.3-1: Benthic Invertebrate Benchmarks Used in the Assessment

Parameter	Benthic Invertebrate Benchmark (mg/kg)	Endpoint and Reference
Manganese	11,000	MECP SEL since manganese is high in the region
Mercury	0.486	CCME PEL
Molybdenum	23,000	Verbruggen et al., 2001 (50th Percentile of NOEC), adjusted to 2% organic carbon
Nickel	75	MECP SEL since nickel is high in the region
Zinc	315	CCME PEL
Methylmercury	NA	Mercury benchmark represents total mercury, which includes methylmercury.

Note:
NA – Not available

5.6 Ecological Risk Characterization

Characterization of risk to ecological receptors in an ERA can employ qualitative or quantitative methods. The ecological hazard quotient (EHQ or HQ) is a simple approach that provides a quantitative estimate of overall risk. The HQ is a unitless value defined as the ratio of the magnitude of exposure to magnitude of a standard effect:

$$Hazard\ Quotient = \frac{Exposure\ Estimate}{Benchmark}$$

Exposure ratios are interpreted as follows: if the HQ is less than one, no unacceptable risks to ecological receptors would be expected, because concentrations are below levels known to cause adverse effects. Conversely, if the HQ exceeds one, it may be inferred that adverse effects on individuals are possible. Given a certain magnitude and type of effect associated with a particular benchmark, TRV or assessment endpoint, inferences about potential effects can be made. For example, if the level of exposure exceeds a benchmark or TRV based on a 25% reduction in a growth-based endpoint (HQ >1), it can be inferred that one possible outcome may be diminished growth of individuals, potentially (but not necessarily) leading to a reduction in population abundance of that receptor. It is important to note that exceeding an HQ of one does not necessarily mean adverse effects will occur; rather, it suggests that there is less confidence that an adverse effect will not occur. For a variety of reasons, adverse effects demonstrated in laboratory studies often fail to manifest in the field as a measurable or meaningful impact. It is also important to recognize that the magnitude of HQs is not directly associated with the magnitude of potential effects. That is, a large HQ (>10) should not be interpreted as a 10-fold greater risk than an HQ of 1.

5.6.1 Plants and Soil Invertebrates

During problem formulation, one LOE was identified for the assessment of the potential risk to plants and soil invertebrates. The modelled soil concentrations for the various Project cases were compared to the TRVs for plants and soil invertebrates. A summary of the model output and TRVs is displayed below in Table 5.6.1-1.

Table 5.6.1-1: Comparison of Modelled Concentrations of Soil to Toxicity Reference Value for Plants and Soil Invertebrates

Parameter	Exposure Dose (mg/kg/day)			Benchmark (mg/kg)	Hazard Quotient		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	1.20E+01	1.20E+01	1.20E+01	17	0.71	0.71	0.71
Cobalt	9.40E+00	9.41E+00	9.41E+00	40	0.24	0.24	0.24
Molybdenum	3.22E+00	3.22E+00	3.22E+00	5	0.64	0.64	0.64

A HQ greater than 1 was not identified. An incremental effect on plants and soil invertebrates from the Project is not anticipated.

5.6.2 Birds and Mammals

For wildlife receptors which may reside in the vicinity of the Project, two lines of evidence were developed to assess the potential risk of the Project. The modelled soil concentrations for the various Project cases were compared to the soil TRVs for the protection of birds and mammals from soil and food ingestion are displayed in Table 5.6.2-1. This line of evidence is applicable to soil COPCs.

Table 5.6.2-1: Comparison of Modelled Concentrations of Soil to Toxic Reference Value for Birds and Mammals

Parameter	Exposure Dose (mg/kg/day)			Benchmark (mg/kg)	Hazard Quotient		
	Baseline	Project	Post-Closure		Baseline	Project	Post-Closure
Arsenic	1.20E+01	1.20E+01	1.20E+01	380	0.03	0.03	0.03
Cobalt	9.40E+00	9.41E+00	9.41E+00	180	0.05	0.05	0.05
Molybdenum	3.22E+00	3.22E+00	3.22E+00	6.9	0.47	0.47	0.47

Notes:
Bold text indicates HQ exceeds the Target of 1.

A HQ greater than 1 was not identified. An incremental effect on birds and mammals from the Project is not anticipated.

As a second line of evidence a food web model was developed to estimate the dose to birds and mammals based on the baseline condition, the Project and post-closure. This line of evidence is applicable to all COPCs being addressed for ecological receptors. A summary of the estimated dose, TRV and hazard quotient from dietary exposure for wildlife receptors is displayed in Table 5.6.2-2 to Table 5.6.2-14.

Table 5.6.2-2: Exposure Ratio for Ecological Receptor 1 (Meadow Vole)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	2.4E-02	2.7E-02	2.4E-02	1.04	2.3E-02	2.6E-02	2.4E-02
Cadmium	5.0E-03	6.4E-03	6.4E-03	0.77	6.5E-03	8.3E-03	8.3E-03
Chromium	5.0E-02	5.3E-02	5.0E-02	2.4	2.1E-02	2.2E-02	2.1E-02
Cobalt	2.1E-02	2.2E-02	2.1E-02	7.33	2.9E-03	3.0E-03	2.9E-03
Copper	5.5E-01	6.1E-01	6.1E-01	5.6	9.8E-02	1.1E-01	1.1E-01
Lead	1.9E-02	3.2E-02	2.9E-02	4.7	4.1E-03	6.7E-03	6.2E-03
Manganese	1.9E+02	1.9E+02	1.9E+02	51.5	**3.8E+00**	**3.8E+00**	**3.8E+00**
Mercury	1.4E-03	1.9E-03	1.9E-03	5.8	2.4E-04	3.3E-04	3.3E-04
Methylmercury	4.8E-08	7.6E-08	8.2E-08	0.015	3.2E-06	5.1E-06	5.4E-06
Molybdenum	8.7E-02	9.1E-02	8.7E-02	0.26	**3.4E-01**	**3.5E-01**	**3.4E-01**
Nickel	1.5E-01	1.6E-01	1.5E-01	1.7	9.1E-02	9.2E-02	9.1E-02
Zinc	3.1E+00	3.2E+00	3.2E+00	75.4	4.1E-02	4.3E-02	4.3E-02

Notes:
Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.
Bold with yellow highlighted indicated ER exceeds the Target of 1 and HQ is greater than baseline.

Table 5.6.2-3: Exposure Ratio for Ecological Receptor 2 (Moose)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	3.9E-02	4.2E-02	5.0E-02	1.04	3.8E-02	4.0E-02	4.8E-02
Cadmium	1.4E-03	1.9E-03	1.9E-03	0.77	1.8E-03	2.5E-03	2.5E-03
Chromium	2.8E-02	6.4E-02	1.3E-01	2.4	1.2E-02	2.7E-02	5.5E-02
Cobalt	1.3E-02	2.0E-02	3.4E-02	7.33	1.8E-03	2.7E-03	4.6E-03
Copper	2.0E-01	2.3E-01	2.3E-01	5.6	3.6E-02	4.1E-02	4.1E-02
Lead	2.1E-02	4.0E-02	3.0E-02	4.7	4.5E-03	8.4E-03	6.5E-03
Manganese	3.6E+01	3.6E+01	3.6E+01	51.5	7.1E-01	7.1E-01	7.1E-01
Mercury	5.6E-04	1.1E-03	3.2E-03	5.8	9.7E-05	1.8E-04	5.6E-04
Methylmercury	1.4E-04	1.8E-04	5.1E-04	0.015	9.3E-03	1.2E-02	3.4E-02
Molybdenum	1.1E-02	2.1E-02	1.3E-02	0.26	4.2E-02	7.9E-02	5.1E-02
Nickel	6.1E-02	6.2E-02	5.5E-02	1.7	3.6E-02	3.6E-02	3.2E-02
Zinc	1.2E+00	1.3E+00	1.3E+00	75.4	1.6E-02	1.7E-02	1.7E-02

Table 5.6.2-4: Exposure Ratio for Ecological Receptor 3 (Beaver)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	5.2E-02	5.7E-02	6.2E-02	1.04	5.0E-02	5.5E-02	6.0E-02
Cadmium	1.8E-03	2.9E-03	2.9E-03	0.77	2.3E-03	3.8E-03	3.8E-03
Chromium	5.8E-02	9.3E-02	1.5E-01	2.4	2.4E-02	3.9E-02	6.4E-02
Cobalt	2.4E-02	3.1E-02	4.3E-02	7.33	3.3E-03	4.2E-03	5.9E-03
Copper	4.1E-01	4.6E-01	4.6E-01	5.6	7.3E-02	8.3E-02	8.2E-02
Lead	3.1E-02	5.4E-02	4.4E-02	4.7	6.5E-03	1.1E-02	9.3E-03
Manganese	7.8E+01	7.8E+01	7.8E+01	51.5	**1.5E+00**	**1.5E+00**	**1.5E+00**
Mercury	1.1E-03	1.8E-03	3.8E-03	5.8	1.9E-04	3.1E-04	6.5E-04
Methylmercury	1.3E-04	1.7E-04	4.6E-04	0.015	8.4E-03	1.1E-02	3.1E-02
Molybdenum	1.5E-02	2.5E-02	1.8E-02	0.26	**5.9E-02**	**9.5E-02**	**6.8E-02**
Nickel	1.2E-01	1.2E-01	1.2E-01	1.7	7.2E-02	7.3E-02	6.9E-02
Zinc	2.6E+00	2.8E+00	2.8E+00	75.4	3.4E-02	3.7E-02	3.7E-02

Notes:
Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.

Table 5.6.2-5: Exposure Ratio for Ecological Receptor 4 (Common Shrew)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	5.3E-01	5.3E-01	5.3E-01	1.04	5.1E-01	5.1E-01	5.1E-01
Cadmium	7.2E-01	7.2E-01	7.2E-01	0.77	9.4E-01	9.4E-01	9.4E-01
Chromium	3.1E+00	3.1E+00	3.1E+00	2.4	**1.3E+00**	**1.3E+00**	**1.3E+00**
Cobalt	4.3E-01	4.3E-01	4.3E-01	7.33	5.9E-02	5.9E-02	5.9E-02
Copper	3.1E+00	3.1E+00	3.1E+00	5.6	5.6E-01	5.6E-01	5.6E-01
Lead	2.4E+00	2.4E+00	2.4E+00	4.7	5.0E-01	5.1E-01	5.1E-01
Manganese	1.8E+01	1.8E+01	1.8E+01	51.5	3.5E-01	3.5E-01	3.5E-01
Mercury	1.2E-01	1.2E-01	1.2E-01	5.8	2.1E-02	2.1E-02	2.1E-02
Methylmercury	3.9E-08	6.2E-08	6.6E-08	0.015	2.6E-06	4.1E-06	4.4E-06
Molybdenum	2.5E-01	2.5E-01	2.5E-01	0.26	9.6E-01	9.8E-01	9.6E-01
Nickel	4.7E+00	4.7E+00	4.7E+00	1.7	**2.8E+00**	**2.8E+00**	**2.8E+00**
Zinc	1.1E+02	1.1E+02	1.1E+02	75.4	**1.4E+00**	**1.4E+00**	**1.4E+00**

Notes:
Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.

Table 5.6.2-6: Exposure Ratio for Ecological Receptor 5 (Short-tailed Weasel)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	7.6E-02	3.6E-02	3.6E-02	1.04	7.3E-02	3.5E-02	3.5E-02
Cadmium	7.9E-02	1.5E-02	1.5E-02	0.77	1.0E-01	1.9E-02	1.9E-02
Chromium	3.7E-01	1.1E-01	1.1E-01	2.4	1.5E-01	4.8E-02	4.8E-02
Cobalt	6.0E-02	2.7E-02	2.7E-02	7.33	8.2E-03	3.7E-03	3.7E-03
Copper	4.3E-01	1.7E-01	1.7E-01	5.6	7.7E-02	3.0E-02	3.0E-02
Lead	2.6E-01	6.0E-02	5.9E-02	4.7	5.6E-02	1.3E-02	1.3E-02
Manganese	3.5E+00	2.3E+00	2.3E+00	51.5	6.8E-02	4.5E-02	4.5E-02
Mercury	1.3E-02	2.4E-03	2.4E-03	5.8	2.2E-03	4.1E-04	4.1E-04
Methylmercury	3.0E-08	4.7E-08	5.0E-08	0.015	2.0E-06	3.2E-06	3.4E-06
Molybdenum	3.2E-02	1.3E-02	1.1E-02	0.26	1.2E-01	5.2E-02	4.4E-02
Nickel	5.3E-01	1.2E-01	1.2E-01	1.7	3.1E-01	7.1E-02	7.1E-02
Zinc	1.4E+01	4.2E+00	4.2E+00	75.4	1.8E-01	5.5E-02	5.5E-02

Table 5.6.2-7: Exposure Ratio for Ecological Receptor 6 (Muskrat)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	6.1E-01	6.3E-01	7.7E-01	1.04	5.9E-01	6.0E-01	7.4E-01
Cadmium	5.2E-02	5.2E-02	5.2E-02	0.77	6.7E-02	6.7E-02	6.8E-02
Chromium	4.4E-01	1.0E+00	1.9E+00	2.4	1.8E-01	4.3E-01	8.1E-01
Cobalt	2.6E-01	3.8E-01	5.7E-01	7.33	3.5E-02	5.2E-02	7.7E-02
Copper	7.9E-01	8.6E-01	8.3E-01	5.6	1.4E-01	1.5E-01	1.5E-01
Lead	4.4E-01	8.1E-01	5.3E-01	4.7	9.4E-02	1.7E-01	1.1E-01
Manganese	5.3E+01	5.3E+01	5.5E+01	51.5	**1.0E+00**	**1.0E+00**	**1.1E+00**
Mercury	3.9E-03	1.0E-02	4.1E-02	5.8	6.7E-04	1.7E-03	7.0E-03
Methylmercury	2.9E-03	4.0E-03	8.6E-03	0.015	1.9E-01	2.6E-01	5.7E-01
Molybdenum	1.3E-01	3.1E-01	1.7E-01	0.26	5.1E-01	1.2E+00	6.5E-01
Nickel	6.4E-01	6.4E-01	5.6E-01	1.7	3.8E-01	3.8E-01	3.3E-01
Zinc	3.0E+00	3.2E+00	2.8E+00	75.4	4.0E-02	4.3E-02	3.7E-02

Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.
Bold with yellow highlighted indicated ER exceeds the Target of 1 and HQ is greater than baseline.

Table 5.6.2-8: Exposure Ratio for Ecological Receptor 7 (Black Bear)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	1.5E-02	1.9E-02	2.0E-02	1.04	1.4E-02	1.9E-02	1.9E-02
Cadmium	6.0E-03	6.6E-03	6.5E-03	0.77	7.7E-03	8.5E-03	8.5E-03
Chromium	3.9E-02	4.2E-02	4.0E-02	2.4	1.6E-02	1.7E-02	1.7E-02
Cobalt	1.2E-02	1.4E-02	1.3E-02	7.33	1.7E-03	1.8E-03	1.7E-03
Copper	2.9E-01	3.1E-01	3.1E-01	5.6	5.1E-02	5.6E-02	5.6E-02
Lead	2.0E-02	3.0E-02	2.5E-02	4.7	4.4E-03	6.3E-03	5.4E-03
Manganese	9.6E+01	9.6E+01	9.6E+01	51.5	**1.9E+00**	**1.9E+00**	**1.9E+00**
Mercury	1.4E-03	6.2E-03	6.6E-03	5.8	2.4E-04	1.1E-03	1.1E-03
Methylmercury	3.1E-03	4.7E-03	4.7E-03	0.015	2.0E-01	3.2E-01	3.1E-01
Molybdenum	4.5E-02	4.6E-02	4.5E-02	0.26	1.7E-01	1.8E-01	1.7E-01
Nickel	9.7E-02	1.0E-01	9.9E-02	1.7	5.7E-02	6.0E-02	5.8E-02
Zinc	2.4E+00	2.1E+00	2.1E+00	75.4	3.1E-02	2.8E-02	2.8E-02

Notes:
Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.

Table 5.6.2-9: Exposure Ratio for Ecological Receptor 8 (Snowshoe Hare)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	6.0E-02	6.6E-02	6.0E-02	1.04	5.7E-02	6.4E-02	5.8E-02
Cadmium	1.5E-03	3.3E-03	3.2E-03	0.77	2.0E-03	4.2E-03	4.2E-03
Chromium	1.2E-01	1.3E-01	1.2E-01	2.4	5.2E-02	5.3E-02	5.2E-02
Cobalt	4.5E-02	4.6E-02	4.5E-02	7.33	6.1E-03	6.3E-03	6.1E-03
Copper	6.0E-01	6.8E-01	6.8E-01	5.6	1.1E-01	1.2E-01	1.2E-01
Lead	4.1E-02	5.7E-02	5.3E-02	4.7	8.7E-03	1.2E-02	1.1E-02
Manganese	1.2E+02	1.2E+02	1.2E+02	51.5	**2.2E+00**	**2.2E+00**	**2.2E+00**
Mercury	1.6E-03	2.3E-03	2.3E-03	5.8	2.8E-04	3.9E-04	3.9E-04
Methylmercury	2.3E-08	3.6E-08	3.9E-08	0.015	1.5E-06	2.4E-06	2.6E-06
Molybdenum	1.8E-02	2.0E-02	1.9E-02	0.26	7.1E-02	7.8E-02	7.2E-02
Nickel	1.9E-01	2.0E-01	2.0E-01	1.7	1.1E-01	1.2E-01	1.1E-01
Zinc	3.9E+00	4.1E+00	4.1E+00	75.4	5.2E-02	5.4E-02	5.4E-02

Notes:
Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.

Table 5.6.2-10: Exposure Ratio for Ecological Receptor 9 (Ruffed Grouse)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	3.8E-02	4.3E-02	3.9E-02	4.4	8.7E-03	9.7E-03	8.8E-03
Cadmium	2.4E-02	2.5E-02	2.5E-02	2.1	1.1E-02	1.2E-02	1.2E-02
Chromium	1.3E-01	1.3E-01	1.3E-01	2.66	4.9E-02	5.0E-02	4.9E-02
Cobalt	3.1E-02	3.2E-02	3.1E-02	7.61	4.1E-03	4.2E-03	4.1E-03
Copper	6.3E-01	7.0E-01	7.0E-01	4.5	1.4E-01	1.6E-01	1.5E-01
Lead	8.3E-02	9.7E-02	9.4E-02	1.63	5.1E-02	6.0E-02	5.8E-02
Manganese	1.6E+02	1.6E+02	1.6E+02	179	9.0E-01	9.0E-01	9.0E-01
Mercury	4.7E-03	5.3E-03	5.3E-03	0.8	5.9E-03	6.6E-03	6.6E-03
Methylmercury	1.6E-08	2.5E-08	2.7E-08	0.0064	5.4E-07	8.5E-07	9.1E-07
Molybdenum	6.3E-02	6.5E-02	6.3E-02	3.5	1.8E-02	1.8E-02	1.8E-02
Nickel	2.8E-01	2.8E-01	2.8E-01	6.71	4.1E-02	4.2E-02	4.2E-02
Zinc	6.3E+00	6.5E+00	6.4E+00	66.1	9.5E-02	9.8E-02	9.7E-02

Table 5.6.2-11: Exposure Ratio for Ecological Receptor 10 (Mallard Duck)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	2.1E-01	2.1E-01	2.8E-01	4.4	4.7E-02	4.8E-02	6.3E-02
Cadmium	1.4E-02	1.4E-02	1.5E-02	2.1	6.8E-03	6.7E-03	7.2E-03
Chromium	1.6E-01	8.2E-01	9.9E-01	2.66	6.1E-02	3.1E-01	3.7E-01
Cobalt	7.4E-02	2.6E-01	2.7E-01	7.61	9.7E-03	3.5E-02	3.6E-02
Copper	5.6E-01	8.1E-01	6.3E-01	4.5	1.2E-01	1.8E-01	1.4E-01
Lead	1.3E-01	9.4E-01	2.1E-01	1.63	7.8E-02	5.8E-01	1.3E-01
Manganese	3.4E+01	3.4E+01	3.5E+01	179	1.9E-01	1.9E-01	1.9E-01
Mercury	8.4E-03	1.4E-02	2.9E-02	0.8	1.0E-02	1.8E-02	3.6E-02
Methylmercury	1.8E-03	2.6E-03	4.7E-03	0.0064	6.0E-02	8.7E-02	1.6E-01
Molybdenum	5.9E-02	3.2E-01	8.2E-02	3.5	1.7E-02	9.1E-02	2.3E-02
Nickel	1.5E-01	1.5E-01	1.1E-01	6.71	2.3E-02	2.2E-02	1.6E-02
Zinc	1.4E+00	3.2E+00	1.9E+00	66.1	2.2E-02	4.8E-02	2.8E-02

Table 5.6.2-12: Exposure Ratio for Ecological Receptor 11 (Barn Swallow)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	4.2E-01	4.2E-01	4.2E-01	4.4	9.6E-02	9.6E-02	9.6E-02
Cadmium	5.8E-01	5.8E-01	5.8E-01	2.1	2.7E-01	2.7E-01	2.7E-01
Chromium	2.4E+00	2.4E+00	2.4E+00	2.66	9.1E-01	9.1E-01	9.1E-01
Cobalt	3.4E-01	3.4E-01	3.4E-01	7.61	4.5E-02	4.5E-02	4.5E-02
Copper	2.5E+00	2.5E+00	2.5E+00	4.5	5.6E-01	5.6E-01	5.6E-01
Lead	1.9E+00	1.9E+00	1.9E+00	1.63	**1.2E+00**	**1.2E+00**	**1.2E+00**
Manganese	2.2E+01	2.2E+01	2.2E+01	179	1.2E-01	1.2E-01	1.2E-01
Mercury	9.6E-02	9.6E-02	9.6E-02	0.8	1.2E-01	1.2E-01	1.2E-01
Methylmercury	5.1E-08	8.0E-08	8.5E-08	0.0064	1.7E-06	2.7E-06	2.8E-06
Molybdenum	2.0E-01	2.1E-01	2.0E-01	3.5	5.8E-02	5.9E-02	5.8E-02
Nickel	3.8E+00	3.8E+00	3.8E+00	6.71	5.6E-01	5.6E-01	5.6E-01
Zinc	8.4E+01	8.4E+01	8.4E+01	66.1	**1.3E+00**	**1.3E+00**	**1.3E+00**

Notes:
Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.

Table 5.6.2-13: Exposure Ratio for Ecological Receptor 12 (Bald Eagle)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	1.9E-02	6.3E-02	8.4E-02	4.4	4.4E-03	1.4E-02	1.9E-02
Cadmium	1.4E-03	5.3E-04	5.7E-04	2.1	6.8E-04	2.5E-04	2.7E-04
Chromium	2.1E-02	5.4E-02	3.6E-02	2.66	7.9E-03	2.0E-02	1.3E-02
Cobalt	7.3E-03	2.0E-02	1.4E-02	7.61	9.6E-04	2.6E-03	1.8E-03
Copper	9.5E-02	4.9E-02	3.8E-02	4.5	2.1E-02	1.1E-02	8.4E-03
Lead	7.0E-03	5.3E-02	9.3E-03	1.63	4.3E-03	3.3E-02	5.7E-03
Manganese	9.3E-01	9.2E-01	9.2E-01	179	5.2E-03	5.2E-03	5.2E-03
Mercury	1.2E-03	3.4E-02	3.6E-02	0.8	1.5E-03	4.3E-02	4.5E-02
Methylmercury	2.2E-02	3.4E-02	3.3E-02	0.0064	7.2E-01	**1.1E+00**	**1.1E+00**
Molybdenum	4.3E-03	1.6E-02	2.9E-03	3.5	1.2E-03	4.7E-03	8.3E-04
Nickel	1.6E-02	6.1E-02	4.5E-02	6.71	2.4E-03	9.0E-03	6.7E-03
Zinc	5.2E+00	1.4E+00	7.9E-01	66.1	7.9E-02	2.1E-02	1.2E-02

Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.
Bold with yellow highlighted indicated ER exceeds the Target of 1 and HQ is greater than baseline.

Table 5.6.2-14: Exposure Ratio for Ecological Receptor 13 (Spotted Sandpiper)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	2.8E-01	3.1E-01	3.5E-01	4.4	6.4E-02	7.0E-02	7.9E-02
Cadmium	2.6E-01	2.6E-01	2.6E-01	2.1	1.2E-01	1.2E-01	1.3E-01
Chromium	1.2E+00	2.4E+00	1.9E+00	2.66	4.6E-01	8.9E-01	7.1E-01
Cobalt	2.3E-01	6.1E-01	4.5E-01	7.61	3.0E-02	8.0E-02	5.9E-02
Copper	1.9E+00	2.4E+00	2.0E+00	4.5	4.2E-01	5.4E-01	4.4E-01
Lead	9.0E-01	2.7E+00	1.0E+00	1.63	5.5E-01	**1.7E+00**	6.3E-01
Manganese	2.0E+01	2.1E+01	2.1E+01	179	1.1E-01	1.2E-01	1.2E-01
Mercury	5.8E-02	7.2E-02	7.9E-02	0.8	7.3E-02	9.0E-02	9.9E-02
Methylmercury	4.2E-03	6.5E-03	7.6E-03	0.0064	1.4E-01	2.2E-01	2.5E-01
Molybdenum	1.1E-01	6.2E-01	1.3E-01	3.5	3.0E-02	1.8E-01	3.7E-02
Nickel	1.7E+00	1.7E+00	1.7E+00	6.71	2.5E-01	2.6E-01	2.5E-01
Zinc	4.0E+01	4.1E+01	3.8E+01	66.1	6.0E-01	6.3E-01	5.8E-01

Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.
Bold with yellow highlighted indicated ER exceeds the Target of 1 and HQ is greater than baseline.

Table 5.6.2-15: Exposure Ratio for Ecological Receptor 14 (American Robin)

Parameter	Exposure Dose (mg/kg/day)			TRV (mg/kg/day)	Exposure Ratio		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	2.2E-01	2.2E-01	2.2E-01	4.4	4.9E-02	5.0E-02	5.0E-02
Cadmium	1.9E-01	1.9E-01	1.9E-01	2.1	9.1E-02	9.2E-02	9.2E-02
Chromium	9.5E-01	9.5E-01	9.5E-01	2.66	3.6E-01	3.6E-01	3.6E-01
Cobalt	1.9E-01	1.9E-01	1.9E-01	7.61	2.4E-02	2.4E-02	2.4E-02
Copper	2.1E+00	2.2E+00	2.2E+00	4.5	4.6E-01	4.9E-01	4.9E-01
Lead	6.4E-01	6.7E-01	6.7E-01	1.63	3.9E-01	4.1E-01	4.1E-01
Manganese	5.6E+02	5.7E+02	5.6E+02	179	**3.2E+00**	**3.2E+00**	**3.2E+00**
Mercury	3.2E-02	3.3E-02	3.3E-02	0.8	4.0E-02	4.2E-02	4.2E-02
Methylmercury	3.2E-08	5.1E-08	5.4E-08	0.0064	1.1E-06	1.7E-06	1.8E-06
Molybdenum	3.8E-01	3.8E-01	3.8E-01	3.5	1.1E-01	1.1E-01	1.1E-01
Nickel	1.6E+00	1.6E+00	1.6E+00	6.71	2.3E-01	2.3E-01	2.3E-01
Zinc	3.2E+01	3.2E+01	3.2E+01	66.1	4.8E-01	4.9E-01	4.9E-01

Notes:
Bold text indicates ER exceeds the Target of 1 but HQ is not greater than baseline.

Mammals

A HQ greater than 1.0 was identified for some mammals. However, with the exception of the meadow vole exposed to molybdenum and the muskrat exposed to manganese, the HQ are consistent with the HQ at baseline conditions. This can occur in modelling exercises due to the presence of conservative values. In these cases, the Project has not resulted in an increase in risk to mammals.

Molybdenum resulted in a HQ of 3.6 for the meadow vole. This HQ is marginally greater than the HQ at baseline of 3.5. Molybdenum is considered to represent a low potential risk given the marginal increase over baseline, the conservative nature of the surface water concentration and the conservative nature of the TRV (i.e., based on a NOAEL).

Manganese resulted in a HQ of 1.1 for the muskrat. This HQ is marginally greater than the HQ at baseline of 1.0. Manganese is considered to represent a low potential risk given the marginal increase over baseline, the conservative nature of the surface water concentration and the conservative nature of the TRV (i.e., based on a NOAEL).

Birds

The Barn Swallow and American Robin was identified with a HQ greater than 1.0; however, the HQ was consistent with the HQ at baseline conditions. The Project has not resulted in an increase in risk to the Barn Swallow or American Robin.

A HQ greater than 1, which is also greater than the HQ for baseline, was identified for the Sandpiper and the Bald Eagle.

For the Sandpiper, a potential risk is identified for lead (HQ of 1.7) which is being drive by the ingestion of aquatic invertebrates. There are notable conservative assumptions associate with this HQ. The surface water concentration is based on a maximum estimated value (i.e., 2.02E-03 mg/L) which occurs during a given month during active closure in the southeast arm of Springpole Lake. The averaged exposure concentration over the year at this location is 9E-04 mg/L, which results in a HQ<1. Additionally, the TRV employed (i.e., 1.63 mg/kg/day) is based a NOAEL and is anticipated to overestimate the potential. Lead is considered to represent a low potential risk given the conservative assumptions within the assessment.

For the Bald Eagle a potential risk is identified for methylmercury which is being driven from fish ingestion. A potential risk is identified during the Project (HQ of 1.1) and during post-closure (HQ of 1.1). Methylmercury concentrations are estimated from mercury concentrations, based on the methylmercury/mercury ratio identified from samples in Birch Lake and Springpole Lake. For the Project phase, the surface water concentration is based on a maximum estimated value occurring during a given month. During the Project, the estimated methylmercury concentration resulting in a HQ>1 is present during active closure in Springpole Lake and during post-closure in Birch Lake. The exposure concentrations averaged over a year for active closure in Springpole Lake and over a year for post-closure in Birch Lake result in a HQ of 1 or less. Methylmercury is considered to represent a low potential risk given the conservative assumptions within the assessment.

Little Brown Myotis

The assessment did not include a bat species due to limited information on their exposure characteristics. Bats are mammals whose diet includes flying insects. They have the potential to be exposed to COCs through ingesting flying insects and water. A potential risk was not identified for any mammals that eat insects. The surface water concentrations and soil concentrations do not exceed screening values. Based on the results of the quantitative assessment, a potential risk to bats is not anticipated.

5.6.3 Aquatic Life

The baseline, Project and post-closure concentrations in surface water do not exceed the surface water guidelines, as presented in Section 3.4.2. The sediment concentrations are compared to benchmarks in Table 5.6.3-1.

Table 5.6.3-1: Comparison of Modelled Concentrations of Sediment to Toxicity Reference Values for Aquatic Life

Parameter	Sediment (mg/kg)			Sediment Benchmark (mg/kg)	Hazard Quotient		
	Baseline	Project	Closure		Baseline	Project	Closure
Arsenic	64.6	64.6	64.6	17	**3.8**	**3.8**	**3.8**
Cadmium	1.29	1.29	1.29	3.5	0.37	0.37	0.37
Chromium	62.4	62.4	62.4	90	0.69	0.69	0.69
Cobalt	27.9	27.9	27.9	50	0.56	0.56	0.56
Copper	53.8	53.8	53.8	197	0.27	0.27	0.27
Iron	85,600	85,600	85,600	40,000	**2.1**	**2.1**	**2.1**
Lead	41.2	41.2	41.2	91.3	0.45	0.45	0.45
Manganese	5,380	5,380	5,380	1,100	**4.9**	**4.9**	**4.9**
Mercury	0.238	0.238	0.238	0.486	0.49	0.49	0.49
Molybdenum	6.28	6.32	6.32	23000	0.00027	0.00027	0.00027
Nickel	39.4	39.4	39.4	75	0.53	0.53	0.53
Zinc	146	146	146	315	0.46	0.46	0.46

Notes:
Bold text indicates HQ exceeds the Target of 1.

A HQ greater than 1 was identified for arsenic, iron and manganese. However, there is no measurable increases in the hazard quotient, as the incremental increase in the sediment concentration is marginal. An effect on fish and aquatic life from the Project is considered low.

5.6.4 Amphibians and Reptiles

Due to a lack of exposure and toxicity information to support the evaluation of risks for amphibians and turtles, a quantitative assessment cannot be completed. Terrestrial turtles were identified to not likely be present and were not identified in the LSA.

Amphibians and reptiles have the potential to be exposed to COPCs in surface water, soil and food through the same exposure pathways as birds and mammals. Concentrations in surface water were not identified as greater than the screening criteria (Section 3.4).

Based on the multimedia exposure assessment, and consideration of the conservative evaluation, no potential risk via exposure to chemicals in Project-influenced media within the LSA / RSA is anticipated.

5.6.5 Uncertainty Assessment

The ERA incorporates assumptions that lead to uncertainty. This section of the report qualitatively discusses some significant aspects of uncertainty inherent in this risk assessment.

Habitat Survey and Receptor Selection: This risk assessment relied on a desktop review of habitat which included literature reviews, review of site assessment photographs and observations by field staff who conducted the sampling. As such, the habitat and receptor selection have low uncertainty for this ecological risk assessment.

Utilization of Receptors as Sentinels to Represent Other Organisms: The use of receptors as sentinels is intended to limit the number of ecological receptors evaluated. The receptors selected are considered to be sensitive, and consistently present on the site, and to be highly exposed to the COPCs present at the site via relevant exposure pathways. Therefore, it is reasonable to assume that conclusions that are reached in respect of the modelled receptor organisms can be generalized to other biota that might use the site. The uncertainty associated with using sentinels in risk assessment is low.

Species at Risk: Based on a review of the federal and provincial species at risk lists, all threatened and endangered species were considered within the risk assessment. Based on the conservatism built into the assessment, there is low uncertainty associated with the interpretation of risks for SAR.

Receptor-Specific Toxicity Data: For most COPCs and receptors, toxicity data are available in some form. However, it is important to note that toxicity data are not necessarily available for the particular receptor species under consideration. Toxicity values are not necessarily specific to the receptor species, or to a reproductive or population-level endpoint. As a result, there is uncertainty associated with the extrapolations that may be used to translate toxicity data from one species into a TRV for a second species despite the fact that the toxicity data represent organisms that are expected to be sensitive to the COPC and that the conversion factors are scientifically based and are applied in a reasonable manner. All TRVs selected for inclusion of the risk assessment are derived by federal or provincial guidelines and therefore have been peer reviewed and are conservative for risk assessment and the uncertainty associated with using the TRVs is considered low.

Selection of COPCs: The COPCs were selected independently in each of the media and/or areas evaluated in the ecological risk assessment, and the analysis was completed to include all relevant media and/or areas if the substance exceeded screening criteria for any one of these. Based on the conservative nature of the screening, the uncertainty associated with the COPC identification is considered low.

Concentrations of COPCs: The ecological model estimated exposures associated with concentrations at the MPOI and highest estimated water concentrations. This is anticipated to overestimate potential exposure.

Chemical Speciation: The fate, food chain interactions and toxicity of a number of inorganic COPCs (such as arsenic) depend to a large extent upon their chemical form. Oral reference doses, however, are typically based on chemical forms that have high bioavailability (e.g., salts). When administered in food or water to laboratory animals, it is expected that the bioavailability of the toxicant is maximal. When trace elements are ingested by wildlife, some portion will be of natural origin, distributed through soil fractions ranging from inorganic soil particles to biological materials, having widely varying bioaccessibility. Therefore, conservative assumptions about chemical form, bioavailability and absorption over the gut were generally carried forward in the risk assessment, and the potential for toxicity is likely to be overstated. For example, soil bioaccessibility was conservatively assumed to be 1.0. The uncertainty associated with chemical speciation is moderate and has likely led to conservative estimation of potential ecological risks.

Uptake into Food Chain: Incorporation of uptake factors to estimate tissue concentrations in the food chain model represents a source of uncertainty which is anticipated to overestimate exposure.

5.6.6 Ecological Risk Assessment Summary

The COPC screening identified the following COPCs for further evaluation in the ERA:

- **Soil:** arsenic, cobalt and molybdenum;
- **Fish:** mercury and methylmercury; and

- **Sediment:** arsenic, cadmium, total chromium; copper, iron, lead, nickel, manganese, mercury, nickel, phosphorous and zinc.

The ERA identified the following:

- Surface water concentrations did not exceed guidelines (Section 3.4.2.3).
- Soil concentrations did not exceed benchmark values for terrestrial receptors (Section 5.6.2).
- Sediment concentrations for some metals exceed benchmark values; however, the Project did not result in an increase the potential risk (Section 5.6.2).
- Multimedia exposure model identified a low potential risk to birds and mammals.

The results of the ERA identified risk estimates exceeding baseline and the benchmark in three instances: manganese for the muskrat, methylmercury for the Bald Eagle and lead for the spotted sandpiper. Due to the conservative assumptions associated with these scenarios, no potential risk to mammals and birds via exposure to chemicals in Project-influenced media within the LSA is anticipated.

6.0 HUMAN AND ECOLOGICAL HEALTH RISK ASSESSMENT CONCLUSIONS

The change in calculated risk levels from the Baseline Assessment Scenario to Project and Post-Closure Assessment Scenarios are negligible considering the conservatism built into the models. Potential risks resulting from the Project to ecological receptors, in addition to human receptors who spend time in cabins and/or practice traditional land use, in areas surrounding the Project are not anticipated. As a result, there are no anticipated residual effects on human or ecological health from the Project.

Monitoring programs, including for surface water and fish, will be implemented to verify the accuracy of the predicted effects, validate the models and 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. 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.

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Attachment A
Baseline Data and Modelled Concentrations Used in the HEHRA

1.0 SUMMARY OF BASELINE DATA AND MODELLED CONCENTRATIONS USED IN THE HEHRA

Baseline data collected from a number of studies in the area of the Project were used to describe the current environmental conditions for the Project. Baseline data presented in various reports prepared by WSP and other authors on behalf of First Mining Gold Corp. (FMG) is included in the appendices of the Environmental Assessment / Environmental Impact Statement (EA/EIS) and summarized in the applicable EA/EIS sections.

This document summarizes the baseline chemistry data compiled in support of the Human and Ecological Health Risk Assessment (HEHRA), along with the modelling methods and concentrations used in the HEHRA.

1.1 Soil

Sampling activities in support of the HEHRA included the collection of baseline soil samples at co-located vegetation (berry) and small mammal sample locations. At each of the 5 berry and 20 small mammal sample locations, soil samples were collected using a trowel into a soil jar for analytical analysis. A total of 25 soil samples were collected. All samples were analyzed for metals, Hg, pH, TOC, conductivity and moisture content. Samples co-located with 5 berry samples were also analyzed for arsenic and lead bioavailability. The locations of the soil samples are illustrated in Figure A-1. The dataset is provided in Table A-1.

Soil composition was characterized through qualitative visual field assessments. Samples were kept cool during storage and submitted in a cooler with ice to ALS thunder Bay with a completed Chain of Custody listing the Sample IDs in the cooler along with the requested analyses. Laboratory chemical analyses was conducted by ALS in Thunder Bay, which is accredited by the CALA in accordance with USO/IEC 17025:2005 – "General Requirements for Competence of Testing and Calibration Laboratories" for the tested parameters. ALS has also met the standards for proficiency testing developed by the Standards Council of Canada for parameters set out in the Soil, Groundwater and Sediment Standards.

Sampling followed protocols as set out in the CCME Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, Volume 3 and well as protocols by Canadian Association for Laboratory Accreditation (CALA) Guide to Current Sampling Practices (2014) to help ensure compliance with O. Reg. 153/04. In particular, the following QA / QC measures were implemented during soil sample collection and processing:

- All samples were placed in clean, pre-labelled laboratory prepared glass jars.
- Sampling gear was appropriate for soil present.
- Laboratory gloves (nitrile) were worn throughout the sampling process and replaced between sampling locations.
- Appropriate cleansers and decontaminated agents were employed to clean the sampling equipment prior to use between sampling locations.
- Sample identification, location, date and other pertinent information were recorded in a field log book / logsheet, on the sample jar and on Chain of Custody forms.
- Electronic data were checked to help ensure correctness.

Table A-1: **Baseline Soil Chemistry Used in the Assessment (mg/kg)**

Parameter	Sample ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	ONS2104-22-Berry-01-Soil-01	ONS2104-22-Berry-02-Soil-01	ONS2104-22-Berry-03-Soil-01	ONS2104-22-Berry-04-Soil-01	ONS2104-22-Berry-05-Soil-01
	Date	25-Sep-2022	25-Sep-2022	25-Sep-2022	25-Sep-2022	25-Sep-2022	25-Sep-2022	25-Sep-2022	25-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	24-Sep-2022	29-Aug-2022	29-Aug-2022	29-Aug-2022	29-Aug-2022	29-Aug-2022
	Units	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	Berry	Berry	Berry	Berry	Berry
conductivity	mS/cm	NR	0.0937	0.126	0.084	0.495	0.692	0.355	0.068	0.0413	0.0582	0.0785	0.0389	0.058	0.0276	0.139	0.193	0.238	0.0812	0.12	0.558	0.0398	0.0504	0.019	0.0433	0.0213
moisture	%	87.2	25	24.7	5.79	31.1	45	27.8	9.54	10.8	11.8	10.6	7.79	11.9	11.5	38.8	20.5	53.8	7.33	15.8	69.3	25.5	25.8	16.4	20.9	15.6
pH	pH units	3.61	4.7	5.04	4.5	5.6	6.34	5.99	4.16	4.89	7.2	4.4	4.56	4.38	3.8	3.6	3.67	5.11	3.5	5.24	6.2	3.25	3.43	4.71	3.02	4.08
aluminum	mg/kg	2770	21400	19100	5960	19400	20000	9930	10300	8570	10200	11800	13500	16500	10500	12800	11600	7270	17300	21500	5580	6300	5370	22200	2500	19000
antimony	mg/kg	0.33	0.17	0.13	<0.10	2.66	1.62	0.8	0.24	<0.10	<0.10	<0.10	0.3	0.17	<0.10	0.16	0.15	0.14	0.29	0.12	0.27	<0.10	<0.10	<0.10	<0.10	0.22
arsenic	mg/kg	3.83	8.84	3.98	4.11	36.8	14.4	39.3	5.75	6.41	2.93	2.57	12.8	6.66	4.78	5	5.78	1.72	7.4	5.36	2.66	1.39	1.29	3.12	0.65	5.5
barium	mg/kg	84.4	101	105	44.8	123	125	77.2	33.7	37.2	47	48	26.6	41	23.4	45	45.4	66.2	48.4	93.5	83.3	18.8	35.6	35.4	26.1	30.7
beryllium	mg/kg	<0.15	0.5	0.51	<0.10	0.39	0.53	0.27	0.12	0.16	0.28	0.24	0.28	0.29	0.13	0.21	0.28	0.19	0.15	0.32	0.29	<0.10	0.12	0.59	<0.10	0.33
bismuth	mg/kg	<0.30	<0.20	<0.20	<0.20	0.26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<0.20
boron	mg/kg	<7.5	7.9	7.6	<5.0	7.3	9.2	5.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	11.1	<5.0	<5.0	<5.0	<5.0	<5.0
cadmium	mg/kg	0.186	0.084	0.146	0.066	0.243	0.348	0.382	0.049	0.035	0.021	0.043	0.049	0.072	<0.020	0.205	0.056	0.456	0.074	0.199	0.255	0.048	0.12	0.032	0.074	0.08
calcium	mg/kg	8060	6610	8060	1860	8070	12900	14400	1550	2380	5700	3050	2130	2090	2000	2110	1250	6420	1740	7510	26200	1220	1620	749	814	1060
chromium	mg/kg	9.4	43.2	37.9	15.1	44.3	42.7	21	26.4	21.9	25.6	23.8	26	29.5	23.9	16.8	18.4	8.4	29.1	42.9	8.29	24.4	6.42	36.4	6.51	31.3
cobalt	mg/kg	2.26	12.3	8.11	4.07	23.6	18.9	9.62	9.68	5.91	4.75	5.41	7.57	8.08	5.98	3.98	4.97	3.1	9.72	17.9	3.32	2.67	2.04	6.56	0.59	5.99
copper	mg/kg	10.4	13.4	22.7	2.78	32.9	40.3	24.5	9.36	12	9.92	5.86	16.5	15.8	13.8	17.7	15.4	9.17	12.4	21.4	19	6.8	6.29	22.6	3.36	11.2
iron	mg/kg	4600	27900	19300	10700	36300	27700	19900	15600	14600	15500	14500	20600	22800	14900	11800	15900	4630	23800	26400	6200	8000	6160	19000	3900	27800
lead	mg/kg	6.21	8.79	7.6	5.86	15.7	18	8.51	9.2	4.15	3.99	5.35	8.68	5.36	3.05	10.8	9.32	7.87	8.85	8.21	3.87	3.96	8.89	5.52	2.97	6.43
lithium	mg/kg	<3.0	22.5	20.5	5.1	20.6	21.7	11	16.2	8.5	11.2	11.5	16.3	18.4	13.8	5.9	8.7	5.3	16.8	20.4	<3.0	7	<2.0	19.5	<2.0	18.5
magnesium	mg/kg	2120	7360	6670	1930	7250	7640	4480	4220	3200	4350	3850	3990	4130	4060	1910	1630	1080	7160	7800	2600	2810	970	2660	261	3180
manganese	mg/kg	238	280	226	344	2710	1160	826	506	278	263	287	233	195	123	84.6	137	25.5	326	838	277	84.5	49.7	71.2	19.3	157
mercury	mg/kg	0.0564	0.023	0.0266	0.0139	0.101	0.121	0.0927	0.0426	0.0134	0.0143	0.0285	0.0197	0.0317	0.0089	0.122	0.094	0.0925	0.0544	0.0258	0.192	0.0311	0.0342	0.0307	0.0186	0.0389
molybdenum	mg/kg	1.96	0.26	0.42	0.53	2.48	2.29	6.69	3.28	0.3	0.44	0.27	1.28	0.71	0.37	0.91	1.23	3.06	21	0.93	0.64	0.33	0.32	0.73	0.18	0.81
nickel	mg/kg	5.49	25.7	22.3	5.97	33.8	29.5	24.9	17	14.2	13.1	12.6	17.8	18.8	16.5	8.78	8.54	7.08	17	25.3	8.7	9.02	2.83	23	2.2	13.4
phosphorus	mg/kg	216	462	679	285	1500	886	608	217	483	809	489	603	340	299	322	270	226	361	260	708	154	148	177	132	305
potassium	mg/kg	740	2600	2420	540	1880	2420	880	550	650	970	790	440	430	270	420	260	290	430	1850	330	560	380	490	220	370
selenium	mg/kg	<0.30	<0.20	<0.20	<0.20	0.39	0.33	0.7	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.33	0.2	0.56	<0.20	0.25	0.97	<0.20	<0.20	0.44	<0.20	0.28
silver	mg/kg	0.19	<0.10	0.1	<0.10	0.19	0.27	0.36	<0.10	<0.10	<0.10	<0.10	<0.10	0.24	<0.10	<0.10	<0.10	0.63	0.35	0.12	0.18	<0.10	<0.10	<0.10	<0.10	0.1
sodium	mg/kg	214	205	244	54	241	300	78	70	88	178	123	71	68	90	62	51	59	69	162	<74	100	129	53	73	80
strontium	mg/kg	36.8	26.9	31.9	11.5	31.7	105	52.2	10.6	11.6	26.4	17.2	10.4	11.6	8.71	12.2	6.88	60.3	12.2	32	63	9.1	11.9	6.01	12	7.88
sulfur	mg/kg	<1500	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	1500	<1000	<1000	<1000	<1000	<1000
thallium	mg/kg	0.1	0.252	0.216	0.117	0.294	0.29	0.28	0.176	0.084	0.113	0.097	0.074	0.081	0.097	0.111	0.066	0.126	0.127	0.255	<0.074	0.06	0.054	0.112	<0.050	0.06
tin	mg/kg	<3.0	<2.0	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<2.0	<2.0	<2.0	<2.0
titanium	mg/kg	89.2	1220	1320	633	884	1020	541	845	714	973	906	786	860	943	502	404	232	1460	1380	162	813	629	993	302	678
tungsten	mg/kg	3.34	<0.50	<0.50	<0.50	0.69	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.74	<0.50	<0.50	<0.50	<0.50	<0.50
uranium	mg/kg	0.322	0.814	0.795	0.273	0.83	0.871	1.04	0.404	0.439	0.571	0.442	0.429	0.332	0.379	0.5	0.275	0.809	0.379	0.628	0.885	0.368	0.273	0.669	0.207	0.426
vanadium	mg/kg	6.8	46.2	44.2	22.7	54.3	50.1	27.3	30.4	27.3	33.5	31.8	34	38.7	29.1	28.8	32.8	9.21	57.6	63.1	12.2	21.1	20.9	37.1	10.2	48.7
zinc	mg/kg	44.6	67.1	63.5	32.6	107	98.7	48	39.9	24.5	23.3	27.6	51.2	79	23	22.1	30.6	7.8	91.4	49.6	14.7	14.7	10	26.5	5.9	61.3
zirconium	mg/kg	2.7	10.9	13	1.1	1.6	4.4	2	2.1	1.1	7.9	2.5	3.4	2.3	3	<1.0	<1.0	<1.0	2.8	3.7	2.4	1.7	1.7	3.9	<1.0	1.7
total organic carbon	%	47.2	1.11	1.72	1.49	10.1	4.68	12.8	1.09	0.73	<0.10	1.5	0.94	1.19	0.42	7.25	9.8	12.5	1.31	2.16	33.5	2.45	8.06	1.13	5.58	2.28
organic matter	%	81.4	1.91	2.96	2.57	17.4	8.07	22.1	1.88	1.26	<0.17	2.59	1.62	2.05	0.72	12.5	16.9	21.6	2.26	3.72	57.8	4.22	13.9	1.95	9.62	3.93
IVBA As	mg/L																					<1.00	<1.00	<1.00	<1.00	<1.00
IVBA Pb	mg/L																					<1.00	<1.00	<1.00	<1.00	<1.00

Notes:

SM Co-located Small Mammal sample location

Berry No-located Berry sample location

550000 560000 570000

5710000 5700000 5690000 5680000 5670000

Shearstone Lake
Birch Lake
L-1
L-2
T20
T16
T19
T1
T2
22-SM-07
22-SM-10
22-SM-15
22-SM-13
22-SM-03
22-Berry-05-Soil-01
T7
22-SM-14
T3
22-SM-09
22-SM-12
T8
22-SM-04
22-SM-02
T14
22-SM-11
22-SM-06
T13
T6
22-SM-08
T10
T4
22-SM-05
T18
T5
T12
22-SM-01
T17
T11
T15
T9
Springpole Lake (North Basin)
250 M
Birch Lake
Keigat Lake
Zionz Lake
Dole Lake
Durkin Lake
Springpole Lake (North Basin)
Birch River
Springpole Lake (Southeast Arm)
Gull Lake
Satterly Lake
Cromarty Lake
Superstition Lake
Graydarl Lake
Seagrave Lake
22-Berry-02-Soil-01
Skingle Lake
Bertha Lake
22-Berry-01-Soil-01
Ruddy Lake
Deaddog Lake
Christina Lake
Cavano Lake
Bumpy Lake
Fawthrop Lake
Cook Lake
Marsh Lake
Hailstone Lake
22-Berry-04-Soil-01
Ferdinand Lake
Margaret Lake
Latreille Lake
Tarpley Lake
Sesikinaga Lake
Allison Lake

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LEGEND

- Proposed Mine Feature
- Proposed 230 kV Transmission Line
- Existing Transmission Line
- Existing Road
- Watercourse
- Waterbody
- Small Mammal Sample Location
- Soil Sample Location*

NOTES:
- Topographic information extracted from LIO, MNRF.
- Aerial imagery 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.

* Labels have ONS2104 prefix removed.

Datum: NAD83
Projection: UTM Zone 15N

0 1 2 4 6 8 10 Kilometres

N W E S

First Mining Gold

wsp

SPRINGPOLE GOLD PROJECT

Soil and Small Mammal Sample Locations

PROJECT N°: ONS2104

FIGURE: A-1

SCALE: 1:150,000

DATE: October 2024

1.2 Surface Water

The surface water baseline and modelling methodology and chemistry data are presented and discussed in the Surface Water Quality Baseline Report (Appendix N-1) and Surface Water Quality Modelling Report (Appendix N-2) of the EIS/EA, respectively. All available baseline data up to 2022 were considered in this assessment. Baseline surface water quality monitoring stations are show in Figure A-2.

Only water quality modelling results for modelling nodes 5, 6, 7, 8, 9, 10, 11, Southeast Arm (POR 07) and the proposed effluent discharge location, which represent modelled water quality in Birch Lake, Springpole Lake and Springpole Lake Southeast Arm are included in the HHERA. Modelling nodes that represent modelled water quality in waterbodies considered for off-setting were not included.

The surface water baseline and modelled Project and post-closure concentrations are screened against applicable screening values in Tables 3.4.2.3-1 (Birch Lake), 3.4.2.3-2 (north basin of Springpole Lake) and 3.4.2.3-3 (southeast arm of Springpole Lake).

The surface water data employed in the non-carcinogenic assessment is provided in Table B-1-5. For the carcinogenic assessment, the data for each node is provided in Table B-1-6 and the data used in the assessment is provided in Table B-1-7.

545000 550000 555000 560000 565000 570000 575000 580000

5700000 5695000 5690000 5685000 5680000

Birch Lake
Keigat Creek
Keigat Lake
Dole Lake
L-1 L-2 L-3 L-4 L-5 L-6 L-10 L-11 L-12 L-13 L-14 L-16 L-18 L-19 L-20
Springpole Lake (North Basin)
Springpole Lake (Southeast Arm)
Durkin Lake
Birch River
Fawcett Lake
Satterly Lake
Cromarty Lake
Seagrave Creek
Superstition Lake
Graydarl Lake
Seagrave Lake
Skingle Lake
Bertha Lake
Gull Lake
Kezik Lake
Wenasaga Forestry Road

MAP OVERVIEW

Enlarged Area
Birch Lake
Zionz Lake
Durkin Lake
Cluderay Lake
Fawcett Lake
Kezik Lake
Gull Lake
Bertha Lake
Deaddog Lake
10 Km
SLATE FALLS NATION RESERVE

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LEGEND

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

Baseline Fisheries Monitoring Stations

- Angling
- Dip Net
- Electrofishing
- Gill Net
- Minnow Trap
- Seine Net
- Broadscale

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

Surface Water Quality and Aquatic Resources Baseline Monitoring Stations

PROJECT N°: ONS2104 | **FIGURE: A-2**

SCALE: 1:97,500 | DATE: October 2024

1.3 Sediment

Sediment chemistry data available from 2020, 2021 and 2022 was used in the baseline dataset for the HEHRA. As part of the sediment sampling program, surface sediment samples were collected at locations co-located with aquatic vegetation sample locations (discussed below). Sediment sampling methodology and data are available in the following reports:

- 2022/2023 Aquatic Baseline (Appendix O-1 of the EIS/EA)
- 2021 Aquatic Baseline (Appendix O-2 of the EIS/EA)
- 2020 Aquatic Baseline (Appendix O-3 of the EIS/EA)

Sampling locations are as identified in Figure A-2 and within the aquatics baseline reports. The sediment samples co-located with aquatic plant sample locations are illustrated in Figure A-3. The full sediment dataset is provided in Table A-2. The maximum concentrations and screening values are provided in Table 3.4.2.4-1.

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			SPL-01	SPL-02	SPL-03	SPL-04	SPL-05	SPL-D-01	SPL-D-02	SPL-D-03	SPL-D-04	SPL-D-05	SPR-EXP-1	SPR-EXP-2	SPR-EXP-3	SPR-EXP-4	SPR-EXP-5
Sample ID			F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-3 2020 SED	F1-5 2019 Aug SED	F1-5 2019 Aug SED	F1-5 2019 Aug SED	F1-5 2019 Aug SED	F1-5 2019 Aug SED
Sample Date (dd-mmm-yy)			10-Sep-20	10-Sep-20	10-Sep-20	11-Sep-20	11-Sep-20	11-Sep-20	11-Sep-20	11-Sep-20	11-Sep-20	12-Sep-20	29-Aug-19	29-Aug-19	29-Aug-19	29-Aug-19	30-Aug-19
Parameter	Unit	MDL															
Physical Tests																	
Moisture	%	1	89	89	89	89	89	90	90	90	90	89	-	-	-	-	-
Physical Tests	pH	N/A	5.4	5.04	5.21	5.24	5.22	5.08	4.94	5.02	5.01	4.86	-	-	-	-	-
Organic Content			22.46	23.9	23.61	23.03	21.79	22.76	23.03	22.83	22.8	24.18	-	-	-	-	-
Leachable Anions & Nutrients																	
Nitrate (N)	ug/g	2	<	<	<	<	<	<	<	<	<	<	-	-	-	-	-
Nitrite (N)	ug/g	0.5	<	<	<	<	<	<	<	<	<	<	-	-	-	-	-
Nitrate + Nitrite (N)	ug/g	3	<	<	<	<	<	<	<	<	<	<	-	-	-	-	-
Total Kjeldahl Nitrogen	ug/g	100	1.25	1.27	1.23	1.22	1.27	1.34	1.37	1.33	1.35	1.2	-	-	-	-	-
Organic / Inorganic Carbon																	
Fraction Organic Carbon	g/g	0.001	-	-	-	-	-	-	-	-	-	-	0.007	0.007	0.005	0.007	0.009
Total Organic Carbon	%	0.05	11.00	12.00	12.00	12.00	12.00	13.00	13.00	13.00	13.00	11.00	0.70	0.74	0.49	0.70	0.92
Metals																	
Aluminum	ug/g	50	17000	17000	18000	18000	17000	18000	18000	18000	17000	17000	2090	1870	1940	1830	3050
Antimony	ug/g	0.20 or 0.10	0.53	0.51	0.55	0.41	0.52	0.41	0.49	0.48	0.4	0.61	<	<	<	<	<
Arsenic	ug/g	1.0 or 0.1	27	12	20	23	21	8	8.2	8.3	8.4	11	1.09	1.07	1.21	1.14	1.28
Barium	ug/g	0.5	210.0	130.0	170.0	200.0	180.0	110.0	120.0	110.0	120.0	140.0	10.6	10.4	9.8	9.4	15.6
Beryllium	ug/g	0.20 or 0.10	0.61	0.52	0.57	0.6	0.55	0.49	0.51	0.5	0.5	0.56	<	<	<	<	<
Bismuth	ug/g	1.0 or 0.2	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Boron	ug/g	5	9.7	9.2	11	10	9.3	9.3	9.4	9.1	9.3	9	<	<	<	<	<
Cadmium	ug/g	0.10 or 0.02	0.91	0.72	0.94	0.91	0.79	1.10	1.00	1.00	1.00	0.82	0.04	0.04	0.04	0.04	0.07
Calcium	ug/g	50	7500	7200	7500	7400	7200	7400	7400	7200	7300	6900	2480	2020	1890	2120	3090
Chromium	ug/g	1.0 or 0.5	42.00	43.00	43.00	44.00	41.00	42.00	40.00	41.00	41.00	42.00	5.81	5.30	5.33	5.18	8.26
Cobalt	ug/g	0.1	16.00	13.00	15.00	17.00	15.00	11.00	11.00	11.00	11.00	16.00	1.62	1.38	1.32	1.42	2.17
Copper	ug/g	0.5	47.00	47.00	46.00	49.00	46.00	53.00	51.00	51.00	51.00	47.00	2.15	2.09	1.68	1.83	3.38
Iron	ug/g	50	52000	37000	46000	51000	48000	29000	29000	28000	30000	36000	3260	3060	3510	3230	4450
Lead	ug/g	1.0 or 0.5	33.00	29.00	32.00	33.00	31.00	35.00	35.00	34.00	35.00	36.00	3.24	2.91	2.80	2.51	3.77
Lithium	ug/g	2	-	-	-	-	-	-	-	-	-	-	2.6	2.5	2.5	2.3	3.8
Magnesium	ug/g	50 or 20	7700	7600	7900	7900	7500	7500	7200	7200	7200	7400	927	807	823	787	1330
Manganese	ug/g	1	3000.0	1000.0	1900.0	2700.0	2300.0	470.0	490.0	470.0	520.0	960.0	71.0	81.6	84.1	81.0	99.2
Mercury	ug/g	0.05	0.14	0.13	0.15	0.14	0.15	0.18	0.16	0.18	0.19	0.14	-	-	-	-	-
Molybdenum	ug/g	0.50 or 0.1	1.80	1.40	1.40	1.80	1.50	1.20	1.20	1.20	1.20	1.60	0.12	<	<	<	0.15
Nickel	ug/g	0.5	36.0	33.0	35.0	37.0	33.0	32.0	31.0	31.0	31.0	34.0	4.0	3.6	3.5	3.3	5.5
Phosphorus	ug/g	50	2600	1700	2300	2600	2500	1400	1500	1400	1800	1500	586	462	411	467	560
Potassium	ug/g	200 or 100	1900	1900	1900	1900	1900	2000	1900	1900	2000	1900	150	150	130	150	260
Selenium	ug/g	0.50 or 0.2	2.2	1.8	2	2.1	2.1	2	2	2	2	2	<	<	<	<	<
Silver	ug/g	0.20 or 0.10	0.22	0.22	0.2	0.21	0.22	0.29	0.29	0.25	0.25	<	<	<	<	<	<
Sodium	ug/g	50	190	160	170	170	160	200	180	180	180	170	72	68	57	57	89
Strontium	ug/g	1.0 or 0.5	26.0	24.0	25.0	26.0	25.0	25.0	25.0	23.0	24.0	24.0	8.6	6.9	7.7	7.7	10.6
Sulfur	ug/g	1000	-	-	-	-	-	-	-	-	-	-	<	<	<	<	<
Thallium	ug/g	0.05	0.41	0.36	0.4	0.42	0.35	0.32	0.35	0.33	0.31	0.38	<	<	<	<	<
Tin	ug/g	1.0 or 2.0	1	1	<	<	<	1	1	1.1	<	<	<	<	<	<	<
Titanium	ug/g	5.0 or 1.0	450	450	520	510	430	510	500	500	490	530	389	291	327	306	463
Tungsten	ug/g	0.5	-	-	-	-	-	-	-	-	-	-	<	<	<	<	<
Uranium	ug/g	0.05	2.40	2.10	2.20	2.20	2.20	2.00	2.00	1.90	1.90	2.10	0.29	0.28	0.28	0.23	0.34
Vanadium	ug/g	5.0 or 0.2	63.00	57.00	63.00	65.00	59.00	53.00	51.00	51.00	51.00	64.00	7.52	6.47	6.83	6.46	9.98
Zinc	ug/g	5.0 or 2.0	120.0	110.0	120.0	120.0	110.0	110.0	100.0	100.0	110.0	120.0	9.1	8.6	8.2	7.9	12.4
Zirconium	ug/g	1	-	-	-	-	-	-	-	-	-	-	<	<	<	<	<
Particle Size (Soil)																	
Gravel (4.75mm - 3in.)	%																
Sand and Gravel (>1.0mm)	%																
Medium Sand (0.425mm - 2.0mm	%																
Medium Sand (0.425mm - 1.0mm	%																
Coarse Sand (2.0mm - 4.75mm)	%																
Fine Sand (0.075mm - 0.425mm)	%																
Silt (0.002mm - 0.075mm)	%																
Silt (0.005mm - 0.075mm)	%																
Clay (<0.002mm)	%																
Clay (<0.005mm)	%																
Notes:																	

MDL; Method Detection Limit provided by Bureau Veritas, Mississauga, ON
'<' indicates that the reported concentration was less than the MDL
'-' indicates that the parameter was not analyzed

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			L-15-B6-SED1	L-15-B6-SED2	L-15-B6-SED3	L-15-B6-SED4	L-15-B6-SED5	L-15-B5-SED1	L-15-B5-SED2	L-15-B5-SED3	L-15-B5-SED4	L-15-B5-SED5	L-15-B4-SED1	L-15-B4-SED2	L-15-B4-SED3	L-15-B4-SED4	L-15-B4-SED5
Sample ID			F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED
Sample Date (dd-mmm-yy)			25-Sep-21	25-Sep-21	25-Sep-21	25-Sep-21	25-Sep-21	28-Sep-21	28-Sep-21	28-Sep-21	28-Sep-21	28-Sep-21	25-Sep-21	25-Sep-21	25-Sep-21	25-Sep-21	25-Sep-21
Parameter	Unit	MDL															
Physical Tests			SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED						SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED
Moisture	%	1															
Physical Tests	pH	N/A	5.79	5.72	5.66	5.68	5.66	4.72	4.34	4.53	4.29	4.75	5.44	5.49	5.5	5.49	5.74
Organic Content																	
Leachable Anions & Nutrients																	
Nitrate (N)	ug/g	2															
Nitrite (N)	ug/g	0.5															
Nitrate + Nitrite (N)	ug/g	3															
Total Kjeldahl Nitrogen	ug/g	100	1.25	1.25	1.32	1.33	1.25	0.95	1.07	1.04	1.02	1.15	1.32	1.37	1.42	1.36	1.34
Organic / Inorganic Carbon																	
Fraction Organic Carbon	g/g	0.001	0.105	0.100	0.103	0.101	0.099	0.098	0.099	0.098	0.093	0.099	0.099	0.105	0.104	0.104	0.105
Total Organic Carbon	%	0.05	10.50	10.00	10.30	10.10	9.87	9.75	9.94	9.80	9.28	9.88	9.89	10.50	10.40	10.40	10.50
Metals																	
Aluminum	ug/g	50	16200	16700	16300	18000	18400	23700	18400	23300	24700	24800	14600	15800	15900	15300	16200
Antimony	ug/g	0.20 or 0.10	0.18	0.2	0.44	0.33	0.18	0.57	0.44	0.51	0.49	0.57	0.39	0.48	0.43	0.46	0.49
Arsenic	ug/g	1.0 or 0.1	4.63	5.06	6.03	6.37	4.67	18.3	17	32.3	23.7	21.4	6.08	8.03	7.23	7.67	8.54
Barium	ug/g	0.5	94.6	95.1	91.7	102.0	101.0	206.0	155.0	221.0	245.0	201.0	86.6	91.0	89.3	86.0	97.3
Beryllium	ug/g	0.20 or 0.10	0.41	0.42	0.47	0.45	0.42	0.83	0.59	0.78	0.95	0.71	0.41	0.41	0.38	0.39	0.42
Bismuth	ug/g	1.0 or 0.2	<0.20	<0.20	0.37	0.28	<0.20	0.58	0.51	0.57	0.57	0.63	0.33	0.37	0.35	0.37	0.4
Boron	ug/g	5	6.9	6.4	8.1	8.3	7.8	9.3	7.3	8.9	8.8	9.3	7.2	7.4	6.8	6.8	7.4
Cadmium	ug/g	0.10 or 0.02	0.31	0.35	0.62	0.52	0.31	1.29	0.92	1.21	1.26	1.28	0.64	0.85	0.79	0.77	0.87
Calcium	ug/g	50	7300	7470	8780	8250	7830	8500	6690	8280	8390	8730	6900	7050	6800	6990	7070
Chromium	ug/g	1.0 or 0.5	42.80	41.40	39.70	45.90	48.40	51.50	38.30	48.70	52.20	52.20	37.80	38.20	39.70	37.20	41.20
Cobalt	ug/g	0.1	10.40	10.40	9.98	10.80	11.10	21.90	16.50	21.70	27.90	19.00	9.12	9.34	9.53	9.19	10.00
Copper	ug/g	0.5	49.50	50.30	46.80	52.60	52.30	53.60	39.90	49.70	53.50	53.80	42.40	44.10	45.30	43.10	46.90
Iron	ug/g	50	22000	22700	21300	22800	23900	46500	39000	59900	64500	46200	18700	19200	19500	19000	20900
Lead	ug/g	1.0 or 0.5	8.24	9.03	23.80	15.00	7.51	32.60	30.50	35.60	32.40	36.20	21.40	31.50	24.70	26.30	27.90
Lithium	ug/g	2	15.3	15.1	17.1	16.5	16.5	18.8	13.9	17.8	18.1	19.3	13.4	13.1	12.7	13	13.5
Magnesium	ug/g	50 or 20	7470	7560	7310	7790	8130	5820	4650	5640	5740	6350	6120	6560	6670	6330	6750
Manganese	ug/g	1	259.0	266.0	242.0	268.0	279.0	1140.0	1040.0	1840.0	1770.0	1020.0	224.0	230.0	234.0	224.0	249.0
Mercury	ug/g	0.05	0.07	0.07	0.11	0.10	0.06	0.13	0.14	0.14	0.12	0.14	0.11	0.13	0.11	0.10	0.12
Molybdenum	ug/g	0.50 or 0.1	1.04	1.03	1.06	1.13	1.14	1.77	1.14	1.25	1.78	1.40	0.96	0.92	0.92	0.97	0.99
Nickel	ug/g	0.5	31.6	31.8	31.1	33.4	33.6	37.8	28.8	35.6	39.4	37.7	27.0	28.1	28.5	27.1	29.3
Phosphorus	ug/g	50	1000	1060	1030	1130	1120	2600	1960	3210	3310	2600	945	991	1010	930	1010
Potassium	ug/g	200 or 100	1750	1760	1720	1900	1940	1760	1470	1690	1720	1880	1560	1690	1700	1590	1740
Selenium	ug/g	0.50 or 0.2	1.42	1.31	1.44	1.57	1.56	2.09	1.85	2.19	2.25	2.35	1.36	1.53	1.49	1.47	1.52
Silver	ug/g	0.20 or 0.10	0.17	0.17	0.22	0.2	0.18	0.19	0.14	0.18	0.18	0.2	0.19	0.2	0.19	0.19	0.2
Sodium	ug/g	50	135	141	140	164	159	215	172	208	221	228	145	153	144	139	159
Strontium	ug/g	1.0 or 0.5	25.1	24.4	29.2	27.4	27.8	31.9	22.4	29.6	31.3	32.2	24.2	23.8	23.8	23.5	23.9
Sulfur	ug/g	1000	2000	1900	2300	2500	2100	3700	2800	3100	3600	4100	2300	2500	2200	2500	2500
Thallium	ug/g	0.05	0.216	0.227	0.253	0.232	0.236	0.368	0.293	0.333	0.414	0.334	0.2	0.2	0.196	0.201	0.215
Tin	ug/g	1.0 or 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	ug/g	5.0 or 1.0	507	486	465	607	660	503	344	433	483	470	502	511	494	460	535
Tungsten	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	ug/g	0.05	1.63	1.61	1.88	1.70	1.75	2.82	2.08	2.60	2.93	2.74	1.47	1.45	1.47	1.45	1.56
Vanadium	ug/g	5.0 or 0.2	44.60	44.50	42.50	48.10	50.00	69.90	50.10	65.40	77.30	61.70	41.40	43.70	42.90	41.50	45.80
Zinc	ug/g	5.0 or 2.0	81.6	84.4	85.9	90.8	87.5	136.0	103.0	131.0	146.0	133.0	75.7	83.0	82.5	79.3	86.7
Zirconium	ug/g	1	3.3	3.4	4.1	3.3	3.1	3	2.3	3.1	3.2	3.4	3	3.2	3.2	3.3	3.1
Particle Size (Soil)																	
Gravel (4.75mm - 3in.)	%		<1.0	<1.0	<1.0	<1.0	<1.0	?					<1.0	<1.0	<1.0	<1.0	<1.0
Sand and Gravel (>1.0mm)	%																
Medium Sand (0.425mm - 2.0mr	%		<1.0	<1.0	<1.0	<1.0	<1.0						<1.0	<1.0	<1.0	<1.0	<1.0
Medium Sand (0.425mm - 1.0mr	%																
Coarse Sand (2.0mm - 4.75mm)	%		<1.0	<1.0	<1.0	<1.0	<1.0						<1.0	<1.0	<1.0	<1.0	<1.0
Fine Sand (0.075mm - 0.425mm)	%		<1.0	<1.0	<1.0	<1.0	<1.0						<1.0	<1.0	<1.0	<1.0	<1.0
Silt (0.002mm - 0.075mm)	%		85	89.3	85.6	85.9	84.3						82.3	85.8	87.3	84.5	85.5
Silt (0.005mm - 0.075mm)	%		80.3	85.5	82	81	80.3						76.9	81.1	83.2	79.1	80.6
Clay (<0.002mm)	%		14.6	10.2	14.1	13.9	15.4						17.6	14.1	12.6	15.5	14.4
Clay (<0.005mm)	%		19.3	14.1	17.7	18.7	19.4	?					23	18.8	16.8	20.9	19.3
Notes:																	

MDL; Method Detection Limit provided by Bureau Veritas, Miss
'<' indicates that the reported concentration was less than the
'-' indicates that the parameter was not analyzed

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			L-15-B2-SED1	L-15-B2-SED2	L-15-B2-SED3	L-15-B2-SED4	L-15-B2-SED5	L15-B1-SED1	L15-B1-SED2	L15-B1-SED3	L15-B1-SED4	L15-B1-SED5	BIRCH-B1-SED1	BIRCH-B1-SED2	BIRCH-B1-SED3	BIRCH-B1-SED4	BIRCH-B1-SED5
Sample ID			F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED
Sample Date (dd-mmm-yy)			26-Sep-21	26-Sep-21	26-Sep-21	26-Sep-21	26-Sep-21	26-Sep-21	26-Sep-21	27-Sep-21	27-Sep-21	27-Sep-21	1-Oct-21	1-Oct-21	1-Oct-21	1-Oct-21	1-Oct-21
Parameter	Unit	MDL															
Physical Tests			SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED										
Moisture	%	1															
Physical Tests	pH	N/A	5.73	5.74	5.75	5.76	5.77	4.79	4.78	4.81	4.76	5.02	4.94	4.76	4.69	4.74	4.64
Organic Content																	
Leachable Anions & Nutrients																	
Nitrate (N)	ug/g	2															
Nitrite (N)	ug/g	0.5															
Nitrate + Nitrite (N)	ug/g	3															
Total Kjeldahl Nitrogen	ug/g	100	0.89	0.91	0.9	0.89	0.92	0.98	0.91	0.84	0.8	0.91	0.76	0.71	0.62	0.72	0.56
Organic / Inorganic Carbon																	
Fraction Organic Carbon	g/g	0.001	0.079	0.083	0.075	0.076	0.076	0.086	0.086	0.085	0.085	0.088	0.081	0.075	0.075	0.075	0.076
Total Organic Carbon	%	0.05	7.88	8.27	7.45	7.58	7.59	8.58	8.64	8.46	8.52	8.78	8.07	7.54	7.52	7.52	7.62
Metals																	
Aluminum	ug/g	50	16100	15800	14800	15300	16300	18700	16500	17200	18000	16200	17900	15400	17600	19500	17200
Antimony	ug/g	0.20 or 0.10	0.38	0.5	0.33	0.48	0.34	0.61	0.56	0.55	0.56	0.55	0.54	0.43	0.5	0.57	0.5
Arsenic	ug/g	1.0 or 0.1	12.8	14.3	15.1	11.8	11.5	16.2	16.7	15.1	16.3	19.4	24.3	19.3	22.9	29.7	24.6
Barium	ug/g	0.5	260.0	237.0	243.0	243.0	242.0	172.0	152.0	149.0	162.0	172.0	140.0	117.0	136.0	160.0	147.0
Beryllium	ug/g	0.20 or 0.10	0.56	0.57	0.58	0.59	0.61	0.55	0.49	0.51	0.52	0.5	0.56	0.55	0.62	0.63	0.6
Bismuth	ug/g	1.0 or 0.2	0.34	0.42	0.3	0.41	0.32	0.52	0.46	0.47	0.48	0.44	0.42	0.39	0.41	0.44	0.41
Boron	ug/g	5	10.1	10.3	9.1	9.7	9	9.8	8.7	8.6	9.1	8.4	9.3	7.8	9.1	10.3	9.2
Cadmium	ug/g	0.10 or 0.02	0.86	0.97	0.76	0.98	0.84	1.08	1.03	0.98	1.00	1.01	0.89	0.63	0.96	0.92	0.82
Calcium	ug/g	50	5680	5770	5790	5590	5740	6630	5830	6090	6390	5920	6240	5290	6090	6540	5820
Chromium	ug/g	1.0 or 0.5	38.10	39.40	38.10	36.40	40.00	43.70	36.50	37.20	39.00	34.80	42.00	35.20	43.30	45.50	40.90
Cobalt	ug/g	0.1	17.00	17.50	17.00	16.90	19.70	12.20	10.40	10.80	11.00	10.20	9.96	8.37	9.81	10.70	9.53
Copper	ug/g	0.5	43.20	44.90	42.70	41.80	46.90	50.10	44.90	44.80	46.80	44.40	39.50	33.60	40.50	42.90	38.50
Iron	ug/g	50	44800	43300	37400	41400	43600	34300	30600	30600	32900	31900	30100	26700	31200	33500	31100
Lead	ug/g	1.0 or 0.5	18.20	24.60	16.50	24.20	16.20	37.10	37.10	33.30	33.90	41.20	35.00	28.80	34.00	36.40	32.20
Lithium	ug/g	2	15.1	15.7	15	14.9	14.8	17.1	14.6	15.6	16.1	14.5	15.2	13	15.1	16.5	14.8
Magnesium	ug/g	50 or 20	6940	6940	6850	6600	7050	7470	6550	6770	7060	6220	6190	5370	6330	6490	6180
Manganese	ug/g	1	3400.0	3010.0	2770.0	3110.0	2850.0	821.0	720.0	688.0	796.0	819.0	740.0	673.0	762.0	771.0	739.0
Mercury	ug/g	0.05	0.09	0.10	0.08	0.10	0.08	0.11	0.12	0.09	0.12	0.13	0.11	0.11	0.11	0.11	0.11
Molybdenum	ug/g	0.50 or 0.1	2.14	2.23	1.97	2.08	2.09	1.54	1.44	1.44	1.47	1.55	0.90	0.76	0.76	1.03	0.86
Nickel	ug/g	0.5	36.4	36.2	36.1	34.6	39.4	34.4	29.1	29.9	31.0	28.4	26.3	22.2	27.0	29.7	25.9
Phosphorus	ug/g	50	2350	2380	2060	2160	2350	2640	2470	2380	3070	3060	1810	1800	2070	2400	2260
Potassium	ug/g	200 or 100	2030	2120	2030	1910	1980	2010	1790	1790	1850	1720	2010	1870	2070	2190	1940
Selenium	ug/g	0.50 or 0.2	1.39	1.53	1.36	1.49	1.4	1.84	1.69	1.54	1.72	1.68	1.76	1.49	1.77	1.83	1.71
Silver	ug/g	0.20 or 0.10	0.16	0.18	0.16	0.17	0.18	0.27	0.26	0.27	0.26	0.27	0.14	0.13	0.15	0.16	0.14
Sodium	ug/g	50	164	166	160	154	162	194	176	170	182	172	256	220	258	285	246
Strontium	ug/g	1.0 or 0.5	23.6	25.1	24.7	24.1	23.9	25.8	23.5	24.4	25.2	23.3	25.5	20.2	24.4	26.8	23.6
Sulfur	ug/g	1000	1200	1400	1200	1200	1200	2800	2500	2500	2700	2700	2100	1800	2000	2300	2000
Thallium	ug/g	0.05	0.411	0.405	0.459	0.425	0.467	0.303	0.273	0.274	0.274	0.26	0.25	0.225	0.252	0.258	0.235
Tin	ug/g	1.0 or 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	ug/g	5.0 or 1.0	547	552	504	471	484	501	420	414	451	385	529	400	521	570	480
Tungsten	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	ug/g	0.05	1.94	1.98	1.88	1.96	2.06	1.89	1.68	1.76	1.75	1.63	2.50	2.13	2.58	2.72	2.47
Vanadium	ug/g	5.0 or 0.2	61.80	62.40	61.30	57.80	64.50	54.50	47.40	46.90	49.30	45.60	48.40	40.40	48.50	52.40	46.40
Zinc	ug/g	5.0 or 2.0	95.8	97.3	93.6	94.2	98.9	99.8	93.1	91.0	97.0	90.5	96.1	81.1	99.0	105.0	93.3
Zirconium	ug/g	1	1.7	1.9	1.8	2.1	2.2	3.4	3	3.4	3.5	3	2.7	2.4	2.9	2.9	2.7
Particle Size (Soil)																	
Gravel (4.75mm - 3in.)	%		<1.0	<1.0	<1.0	<1.0	<1.0										
Sand and Gravel (>1.0mm)	%																
Medium Sand (0.425mm - 2.0mr	%		<1.0	<1.0	<1.0	<1.0	<1.0										
Medium Sand (0.425mm - 1.0mr	%																
Coarse Sand (2.0mm - 4.75mm)	%		<1.0	<1.0	<1.0	<1.0	<1.0										
Fine Sand (0.075mm - 0.425mm)	%		<1.0	<1.0	1.2	<1.0	<1.0										
Silt (0.002mm - 0.075mm)	%		85.7	82.5	84.9	88	87.4										
Silt (0.005mm - 0.075mm)	%		79.9	75.4	80.5	81.9	81.5										
Clay (<0.002mm)	%		13.9	17.2	13.8	11.7	11.9										
Clay (<0.005mm)	%		19.8	24.3	18.3	17.8	17.8										
Notes:																	

MDL; Method Detection Limit provided by Bureau Veritas, Miss
'<' indicates that the reported concentration was less than the
'-' indicates that the parameter was not analyzed

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			BIRCH-B2-SED1	BIRCH-B2-SED2	BIRCH-B2-SED3	BIRCH-B2-SED4	BIRCH-B2-SED5	L-15-B3-SED1	L-15-B3-SED2	L-15-B3-SED3	L-15-B3-SED4	L-15-B3-SED5	L-18-SED1	L-18-SED2	L-18-SED3	L-19-SED1	L-19-SED2
Sample ID			F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED
Sample Date (dd-mmm-yy)			24-Sep-21	24-Sep-21	24-Sep-21	24-Sep-21	24-Sep-21	23-Sep-21	23-Sep-21	23-Sep-21	23-Sep-21	23-Sep-21	30-Sep-21	30-Sep-21	30-Sep-21	30-Sep-21	30-Sep-21
Parameter	Unit	MDL															
Physical Tests			SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED	SEE ATTACHED					
Moisture	%	1															
Physical Tests	pH	N/A	5.5	5.55	5.38	5.43	5.4	5.77	5.16	5.26	5.7	5.27	5.69	5.65	5.71	5.53	6.03
Organic Content																	
Leachable Anions & Nutrients																	
Nitrate (N)	ug/g	2															
Nitrite (N)	ug/g	0.5															
Nitrate + Nitrite (N)	ug/g	3															
Total Kjeldahl Nitrogen	ug/g	100	1.12	1.1	1.05	0.51	0.82	1.36	1.05	1	1.04	1.01	1.26	1.74	1.8	0.67	0.32
Organic / Inorganic Carbon																	
Fraction Organic Carbon	g/g	0.001	0.086	0.087	0.088	0.091	0.090	0.108	0.104	0.099	0.101	0.100	0.146	0.315	0.277	0.032	0.019
Total Organic Carbon	%	0.05	8.58	8.72	8.84	9.06	9.00	10.80	10.40	9.94	10.10	10.00	14.60	31.50	27.70	3.18	1.86
Metals																	
Aluminum	ug/g	50	15200	14100	14400	15100	15600	15400	15500	15800	16700	16200	4520	4340	4860	2280	2970
Antimony	ug/g	0.20 or 0.10	0.51	0.46	0.49	0.42	0.48	0.44	0.46	0.48	0.45	0.46	0.13	0.25	0.22	<0.10	<0.10
Arsenic	ug/g	1.0 or 0.1	14.3	12.3	13.3	13.2	15.5	9.16	10.4	11.8	10.2	12.9	1.91	4.4	2.73	1.55	0.95
Barium	ug/g	0.5	89.1	84.3	86.4	93.2	93.0	109.0	112.0	127.0	118.0	134.0	24.2	35.3	44.0	20.5	17.3
Beryllium	ug/g	0.20 or 0.10	0.49	0.47	0.45	0.43	0.45	0.46	0.48	0.47	0.46	0.45	<0.10	0.11	0.11	<0.10	<0.10
Bismuth	ug/g	1.0 or 0.2	0.36	0.34	0.36	0.33	0.35	0.44	0.45	0.45	0.45	0.45	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	ug/g	5	8.4	8.3	7.9	7.5	7.6	7.9	7.7	7.5	7.8	7.3	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	ug/g	0.10 or 0.02	0.67	0.57	0.61	0.65	0.69	1.00	1.01	0.97	1.06	0.95	0.20	0.36	0.29	0.11	0.05
Calcium	ug/g	50	6370	6370	6200	6270	6280	6530	6500	6050	6330	5930	10300	15300	16000	4890	2370
Chromium	ug/g	1.0 or 0.5	38.20	36.20	36.40	37.80	39.70	37.20	38.10	36.80	38.40	37.50	12.20	8.02	8.94	5.53	7.23
Cobalt	ug/g	0.1	6.91	6.42	6.36	6.84	7.10	9.97	10.80	11.00	10.70	10.80	3.52	3.71	4.03	1.29	1.62
Copper	ug/g	0.5	35.70	33.60	33.70	36.00	38.30	49.50	49.50	49.40	51.10	49.10	16.10	40.60	29.90	3.18	3.00
Iron	ug/g	50	20400	18400	18600	20500	20800	26000	26000	28200	26600	29300	5350	6550	6690	3890	3970
Lead	ug/g	1.0 or 0.5	30.60	26.30	30.00	27.80	31.00	32.60	32.70	31.90	33.60	30.90	4.12	7.79	4.18	3.13	1.88
Lithium	ug/g	2	13.3	13.1	12.6	11.9	12.6	13.1	13.5	12.6	13.5	12.6	2.5	<2.0	<2.0	<2.0	3.9
Magnesium	ug/g	50 or 20	5310	5050	5030	5460	5590	6680	6870	6930	6730	6860	2110	1340	1300	1080	1200
Manganese	ug/g	1	292.0	261.0	261.0	296.0	295.0	472.0	429.0	471.0	467.0	463.0	127.0	336.0	173.0	76.3	49.0
Mercury	ug/g	0.05	0.11	0.11	0.11	0.12	0.12	0.17	0.12	0.14	0.17	0.13	0.05	0.14	0.12	0.02	0.01
Molybdenum	ug/g	0.50 or 0.1	0.89	0.81	0.83	0.79	0.82	1.07	1.12	1.06	1.09	1.09	0.31	0.41	0.44	0.14	0.12
Nickel	ug/g	0.5	23.3	21.5	21.5	23.0	24.3	28.5	30.4	29.9	30.0	29.6	11.4	9.6	10.7	3.3	4.6
Phosphorus	ug/g	50	1080	1010	1000	1220	1190	1160	1080	1670	1350	1690	290	438	335	243	267
Potassium	ug/g	200 or 100	1850	1790	1820	1900	1950	1840	1820	1880	1930	1890	250	220	160	<100	150
Selenium	ug/g	0.50 or 0.2	1.7	1.58	1.54	1.57	1.62	1.84	1.8	1.63	1.82	1.82	0.53	1.16	1.27	0.29	<0.20
Silver	ug/g	0.20 or 0.10	0.15	0.14	0.16	0.14	0.15	0.26	0.25	0.26	0.27	0.25	<0.10	0.14	<0.10	<0.10	<0.10
Sodium	ug/g	50	188	181	178	201	190	151	146	149	159	147	52	<50	64	<50	61
Strontium	ug/g	1.0 or 0.5	24.3	24.5	24.0	24.0	22.3	22.6	22.4	22.3	23.6	22.6	19.2	22.2	33.1	13.0	7.0
Sulfur	ug/g	1000	1800	1800	1800	1600	1800	2000	2300	2200	2000	2400	2000	4500	4700	<1000	<1000
Thallium	ug/g	0.05	0.203	0.196	0.206	0.187	0.198	0.272	0.269	0.264	0.272	0.261	<0.050	<0.050	<0.050	<0.050	<0.050
Tin	ug/g	1.0 or 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	ug/g	5.0 or 1.0	474	462	430	434	453	406	417	429	442	431	144	62	90.5	254	331
Tungsten	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	ug/g	0.05	2.12	2.09	2.10	2.04	2.05	1.67	1.69	1.63	1.65	1.64	0.23	0.26	0.30	0.31	0.30
Vanadium	ug/g	5.0 or 0.2	38.40	36.30	35.80	37.70	39.00	47.60	47.90	47.20	48.70	47.40	8.24	7.81	9.47	6.63	7.45
Zinc	ug/g	5.0 or 2.0	79.4	73.4	76.6	81.2	85.7	92.8	95.0	96.7	97.4	93.7	28.4	34.8	30.8	15.8	9.8
Zirconium	ug/g	1	2.5	2.6	2.7	2.7	2.7	3.2	3.4	3.2	3.3	3.3	1.2	1.9	2.5	1.8	1.9
Particle Size (Soil)																	
Gravel (4.75mm - 3in.)	%		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0					
Sand and Gravel (>1.0mm)	%																
Medium Sand (0.425mm - 2.0mr	%		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0					
Medium Sand (0.425mm - 1.0mr	%																
Coarse Sand (2.0mm - 4.75mm)	%		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0					
Fine Sand (0.075mm - 0.425mm)	%		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0					
Silt (0.002mm - 0.075mm)	%		84.1	83.9	84.5	83.6	83.8	89.7	87.8	85.6	88.1	88.1					
Silt (0.005mm - 0.075mm)	%		76.7	76.1	76.8	76.9	76.5	82.7	80.3	78.5	82.2	82.2					
Clay (<0.002mm)	%		15.8	16	15.4	16.3	16.1	10.2	12	14.4	11.9	11.8					
Clay (<0.005mm)	%		23.2	23.8	23	23	23.4	17.1	19.5	21.4	17.8	17.7					
Notes:																	

MDL; Method Detection Limit provided by Bureau Veritas, Miss
'<' indicates that the reported concentration was less than the
'-' indicates that the parameter was not analyzed

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			L-19-SED3	L2-POTA-02-SED	L2-TYPH-03-SED	L1-TYPH-04-SED	L15-TYPH-05-SED	L15-POTA-06-SED	L15-POTA-07-SED	L15-POTA-08-SED	L15-ACOR-09-SED	L15-ACOR-10-SED	WB02-OUT-S	WB05-OUT-S	WB06-OUT-S	S-9-US02-S	S-9-US01-S
Sample ID			F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-2 2021 SED	F1-4 2019 Sept Sed	F1-4 2019 Sept Sed	F1-4 2019 Sept Sed	F1-4 2019 Sept Sed	F1-4 2019 Sept Sed
Sample Date (dd-mmm-yy)			30-Sep-21	30-Aug-21	30-Aug-21	30-Aug-21	31-Aug-21	31-Aug-21	31-Aug-21	31-Aug-21	31-Aug-21	31-Aug-21	17-Sep-19	13-Sep-19	14-Sep-19	10-Sep-19	11-Sep-19
Parameter	Unit	MDL															
Physical Tests																	
Moisture	%	1		70.1	73.4	84.8	70.9	62.9	74.3	74.8	73.9	70.8	75	83	72	88	79
Physical Tests	pH	N/A	5.78										5.25	5.48	6.23	5.6	5.23
Organic Content																	
Leachable Anions & Nutrients																	
Nitrate (N)	ug/g	2															
Nitrite (N)	ug/g	0.5											<0.5	<0.5	<0.5	<0.5	<0.5
Nitrate + Nitrite (N)	ug/g	3															
Total Kjeldahl Nitrogen	ug/g	100	0.63										6210	8950	3640	12700	13700
Organic / Inorganic Carbon																	
Fraction Organic Carbon	g/g	0.001	0.037														
Total Organic Carbon	%	0.05	3.74										75000	160000	75000	460000.00	230000.00
Metals																	
Aluminum	ug/g	50	3450	7640	9580	7050	5140	4610	5210	6280	6020	10300	8300	9700	7400	4400	8200
Antimony	ug/g	0.20 or 0.10	0.12	0.13	0.12	0.26	<0.10	<0.10	<0.10	0.15	0.15	<0.10	0.25	<0.20	<0.20	<0.20	<0.20
Arsenic	ug/g	1.0 or 0.1	2.03	2.56	2.81	3.6	1.84	1.57	2.67	3.42	3.3	2.38	4.5	3.0	5.0	1.3	1.1
Barium	ug/g	0.5	24.6	43.5	53.3	173.0	36.4	30.1	31.0	51.8	45.8	94.7	59.0	81.0	37.0	120.0	120.0
Beryllium	ug/g	0.20 or 0.10	<0.10	0.23	0.31	0.3	0.13	0.11	<0.10	0.18	0.16	0.2	0.25	0.26	<0.20	<0.20	<0.20
Bismuth	ug/g	1.0 or 0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0
Boron	ug/g	5	<5.0	<5.0	5.2	5.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	10	<5.0
Cadmium	ug/g	0.10 or 0.02	0.16	0.10	0.11	0.41	0.24	0.20	0.21	0.31	0.29	0.20	0.19	0.22	<0.10	0.27	0.22
Calcium	ug/g	50	4700	9440	24200	26000	12000	7980	5570	8900	8380	8780	6300	17000	9300	31000	19000
Chromium	ug/g	1.0 or 0.5	8.54	18.70	24.00	16.90	12.50	11.60	19.90	15.10	14.30	31.20	20.00	28.00	23.00	8.10	22.00
Cobalt	ug/g	0.1	2.38	5.45	6.42	9.86	3.51	3.10	4.49	4.92	4.80	10.50	6.70	7.80	7.90	3.90	6.50
Copper	ug/g	0.5	4.55	13.10	15.80	20.30	10.80	7.97	10.80	19.40	17.70	14.70	17.00	35.00	11.00	16.00	17.00
Iron	ug/g	50	5770	11700	14400	11200	7190	6310	7260	10000	9470	15800	15000	16000	21000	7000	10000
Lead	ug/g	1.0 or 0.5	4.56	4.55	5.30	11.10	5.82	5.21	4.17	6.39	6.31	4.89	7.30	7.70	4.50	5.90	5.30
Lithium	ug/g	2	3.9	7.9	10.5	6.2	7.3	6.8	4.6	6.2	5.7	8.2					
Magnesium	ug/g	50 or 20	1570	4410	7100	3370	2490	2120	2830	2700	2570	4600	3100	3600	4200	1500	2700
Manganese	ug/g	1	82.1	184.0	240.0	581.0	158.0	124.0	229.0	254.0	223.0	752.0	430	660	680	210	450
Mercury	ug/g	0.05	0.02	0.04	0.03	0.10	0.05	0.05	0.05	0.06	0.06	0.05	0.06	0.15	<0.050	0.11	0.09
Molybdenum	ug/g	0.50 or 0.1	0.28	0.36	0.33	1.71	0.67	0.56	0.30	0.43	0.41	0.32	<0.50	<0.50	<0.50	0.76	<0.50
Nickel	ug/g	0.5	5.8	13.5	16.0	15.9	8.8	7.8	14.1	12.6	11.8	18.0	16.0	15.0	14.0	6.8	12.0
Phosphorus	ug/g	50	181	614	623	713	855	906	660	588	549	769	690	820	750	600	770
Potassium	ug/g	200 or 100	140	830	1090	1000	350	260	290	690	650	900	740	560	670	200	430
Selenium	ug/g	0.50 or 0.2	0.28	<0.20	0.21	0.84	0.51	0.41	0.55	0.85	0.84	0.49	<0.50	0.89	<0.50	0.9	0.72
Silver	ug/g	0.20 or 0.10	<0.10	0.44	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	0.2	<0.20	<0.20	<0.20
Sodium	ug/g	50	61	149	196	101	97	82	115	143	145	167	110	70	94	60	66
Strontium	ug/g	1.0 or 0.5	11.0	23.6	32.7	105.0	24.7	18.7	15.3	22.7	22.0	23.0	29	29	15	120	35
Sulfur	ug/g	1000	<1000	<1000	<1000	3200	1700	1200	1200	2400	2400	1200					
Thallium	ug/g	0.05	<0.050	0.086	0.106	0.171	0.05	<0.050	<0.050	0.064	0.066	0.117	0.16	0.14	0.096	0.066	0.086
Tin	ug/g	1.0 or 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0
Titanium	ug/g	5.0 or 1.0	301	514	681	305	418	477	343	356	342	609					
Tungsten	ug/g	0.5	<0.50	<0.50	<0.50	1.17	<0.50	<0.50	<0.50	<0.50	0.65	<0.50					
Uranium	ug/g	0.05	0.26	0.45	0.50	1.73	1.42	1.31	0.49	0.73	0.72	0.69	0.63	1.10	0.52	1.90	0.79
Vanadium	ug/g	5.0 or 0.2	9.67	22.20	28.70	16.60	13.10	12.20	13.70	19.30	18.90	28.50	22.00	26.00	26.00	12.00	20.00
Zinc	ug/g	5.0 or 2.0	23.5	26.0	29.4	41.6	32.1	24.8	24.0	34.6	32.2	43.3	80.0	46.0	35.0	19.0	30.0
Zirconium	ug/g	1	2	4	6.2	5.9	2.3	1.9	1.7	2.7	2.9	2.8					
Particle Size (Soil)																	
Gravel (4.75mm - 3in.)	%			<1.0	10.9	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0					
Sand and Gravel (>1.0mm)	%																
Medium Sand (0.425mm - 2.0mm	%			2.4	3.8	<1.0	27.1	28.5	1.8	<1.0	<1.0	2.7					
Medium Sand (0.425mm - 1.0mm	%																
Coarse Sand (2.0mm - 4.75mm)	%			<1.0	1	<1.0	<1.0	5.8	<1.0	<1.0	<1.0	<1.0					
Fine Sand (0.075mm - 0.425mm)	%			34.2	19.1	<1.0	30.4	29.7	17.8	5.6	6.6	10.6					
Silt (0.002mm - 0.075mm)	%			43.4	45.6	85.8	33.9	29.1	72.9	87.5	86.2	71.9					
Silt (0.005mm - 0.075mm)	%			40.1	37.9	81.2	32.3	27.9	71.7	85.6	83.9	67.8					
Clay (<0.002mm)	%			20	19.6	13.3	8.5	5.6	7.5	6.5	6.7	14.9					
Clay (<0.005mm)	%			23.4	27.3	18	10.1	6.7	8.7	8.5	8.9	19					
Notes:																	

MDL; Method Detection Limit provided by Bureau Veritas, Miss
'<' indicates that the reported concentration was less than the
'-' indicates that the parameter was not analyzed

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			S-9-S	WB16-IN-S	BIRCH-1-B1	BIRCH-1-B2	BIRCH-1-B3	BIRCH-1-B4	BIRCH-1-B5	BIRCH-2-B1	BIRCH-2-B2	BIRCH-2-B3	BIRCH-2-B4	BIRCH-2-B5	BIRCH-3-B1	BIRCH-3-B2	BIRCH-3-B3
Sample ID			F1-4 2019 Sept Sed	F1-4 2019 Sept Sed	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED
Sample Date (dd-mmm-yy)			10-Sep-19	14-Sep-19	08-Oct-2022	08-Oct-2022	08-Oct-2022	08-Oct-2022	08-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022
Parameter	Unit	MDL															
Physical Tests																	
Moisture	%	1	81	80	87.9	88.5	90.2	89.4	91.2	21.9	32.2	52	24.2	38.8	21	31.6	39.9
Physical Tests	pH	N/A	5.45	5.99	5.74	5.59	5.53	5.48	5.4	5.81	5.65	6.29	6	6.88	5.5	5.35	5.9
Organic Content																	
Leachable Anions & Nutrients																	
Nitrate (N)	ug/g	2															
Nitrite (N)	ug/g	0.5	<0.5	<0.5													
Nitrate + Nitrite (N)	ug/g	3															
Total Kjeldahl Nitrogen	ug/g	100	12200	12000													
Organic / Inorganic Carbon																	
Fraction Organic Carbon	g/g	0.001															
Total Organic Carbon	%	0.05	200000.00	130000	10.10	10.50	10.70	10.90	10.80	0.61	1.01	2.20	0.54	1.78	0.86	0.67	0.72
Metals																	
Aluminum	ug/g	50	9600	9500	14000	13700	14000	14800	12900	2610	2730	2470	3300	3060	6170	6230	3990
Antimony	ug/g	0.20 or 0.10	<0.20	<0.20	0.37	0.35	0.44	0.3	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic	ug/g	1.0 or 0.1	1.5	7.5	8.4	7.51	9.26	7.01	7.55	1.13	0.78	1.57	1.44	2.93	5.16	6.8	1.47
Barium	ug/g	0.5	120.0	87.0	74.2	73.8	75.2	75.2	75.6	5.8	5.5	8.2	7.4	9.7	15.5	14.0	13.0
Beryllium	ug/g	0.20 or 0.10	<0.20	0.23	0.39	0.41	0.39	0.39	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Bismuth	ug/g	1.0 or 0.2	<1.0	<1.0	0.24	0.24	0.29	<0.20	0.26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	ug/g	5	<5.0	<5.0	6.8	7	7	6.6	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	ug/g	0.10 or 0.02	0.25	0.19	0.59	0.56	0.78	0.50	0.68	0.02	0.04	0.04	0.03	0.03	0.05	0.06	0.07
Calcium	ug/g	50	17000	15000	7900	8060	7930	7960	7870	1450	1360	1720	1710	1560	1750	1890	1880
Chromium	ug/g	1.0 or 0.5	26.00	27.00	58.60	55.40	48.20	50.30	54.70	7.04	6.56	6.12	8.24	7.66	25.20	23.90	12.50
Cobalt	ug/g	0.1	12.00	12.00	7.44	7.33	7.60	7.46	7.22	1.89	2.26	1.98	2.40	2.27	4.21	4.14	2.60
Copper	ug/g	0.5	22.00	16.00	38.80	38.40	39.80	40.80	37.60	1.42	1.27	1.85	1.48	1.71	3.84	3.18	3.82
Iron	ug/g	50	17000	26000	16600	16500	16100	16700	15700	4910	5080	4850	6350	6600	13300	13900	7160
Lead	ug/g	1.0 or 0.5	5.20	6.60	18.40	18.00	26.00	14.10	24.20	1.35	0.80	1.25	1.18	1.89	3.28	2.84	2.82
Lithium	ug/g	2			14	14.3	13.3	13.8	13.5	2.7	2.6	2.3	3.6	3.3	6.4	6.2	4
Magnesium	ug/g	50 or 20	4100	4500	5580	5410	5400	5700	5360	1650	1710	1510	2010	1760	3560	3390	2120
Manganese	ug/g	1	950	1500	198.0	194.0	190.0	190.0	194.0	62.1	64.4	123.0	87.2	205.0	196.0	175.0	102.0
Mercury	ug/g	0.05	0.11	0.08	0.09	0.09	0.11	0.08	0.11	<0.0050	<0.0050	0.01	0.01	0.01	0.01	0.01	0.01
Molybdenum	ug/g	0.50 or 0.1	<0.50	0.65	3.32	3.03	2.46	2.35	3.06	<0.10	0.11	0.12	0.15	0.19	1.38	1.36	0.27
Nickel	ug/g	0.5	17.0	18.0	38.3	36.4	33.0	33.7	36.0	4.4	4.4	4.0	5.1	4.7	14.6	14.1	6.8
Phosphorus	ug/g	50	870	930	1150	1110	1140	1190	1100	349	272	285	363	257	500	578	550
Potassium	ug/g	200 or 100	510	1000	1710	1690	1770	1710	1650	110	<100	100	140	170	340	340	280
Selenium	ug/g	0.50 or 0.2	0.91	0.55	1.48	1.45	1.5	1.47	1.41	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver	ug/g	0.20 or 0.10	<0.20	<0.20	0.13	0.13	0.14	0.13	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	ug/g	50	91	91	201	204	221	199	185	<50	<50	<50	<50	<50	50	65	<50
Strontium	ug/g	1.0 or 0.5	34	24	25.8	26.6	26.5	27.4	25.9	4.5	4.2	5.4	5.8	5.5	7.4	6.4	6.1
Sulfur	ug/g	1000			2900	3100	3400	3000	2700	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Thallium	ug/g	0.05	0.11	0.14	0.171	0.17	0.172	0.166	0.16	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tin	ug/g	1.0 or 2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	ug/g	5.0 or 1.0			415	416	399	412	341	182	195	179	254	173	216	240	226
Tungsten	ug/g	0.5			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	ug/g	0.05	1.90	0.79	2.06	2.09	1.89	2.09	1.87	0.23	0.18	0.19	0.22	0.20	0.33	0.41	0.38
Vanadium	ug/g	5.0 or 0.2	28.00	32.00	30.20	29.70	29.70	30.20	28.60	8.60	8.97	8.18	10.60	9.08	19.00	17.80	11.20
Zinc	ug/g	5.0 or 2.0	42.0	45.0	82.1	81.4	85.0	81.0	82.8	12.5	12.2	13.0	16.1	16.0	23.5	24.1	18.4
Zirconium	ug/g	1			3.7	3.7	3.8	3.7	3.5	1	1.2	<1.0	1.5	<1.0	<1.0	<1.0	<1.0
Particle Size (Soil)																	
Gravel (4.75mm - 3in.)	%																
Sand and Gravel (>1.0mm)	%				<1.0	<1.0	<1.0	<1.0	<1.0	9.7	4.6	1.7	3.8	26	24.2	11.4	2.2
Medium Sand (0.425mm - 2.0mr	%																
Medium Sand (0.425mm - 1.0mr	%				<1.0	<1.0	<1.0	<1.0	<1.0	15.2	9.6	6.8	8.4	26.3	18	16.1	3.8
Coarse Sand (2.0mm - 4.75mm)	%																
Fine Sand (0.075mm - 0.425mm)	%				1.4	0.9	0.3	0.2	0.8	70.8	83.1	86.2	81.3	43.5	47.6	59.5	79.8
Silt (0.002mm - 0.075mm)	%				90.2	92.9	93	92.7	91.6	4.3	1.3	5.3	6.5	4.2	8.2	13	14.2
Silt (0.005mm - 0.075mm)	%																
Clay (<0.002mm)	%				8.3	6.1	6.6	7.1	7.6	<1.0	1.4	<1.0	<1.0	<1.0	2	<1.0	<1.0
Clay (<0.005mm)	%																
Notes:																	

MDL; Method Detection Limit provided by Bureau Veritas, Miss
'<' indicates that the reported concentration was less than the
'-' indicates that the parameter was not analyzed

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			BIRCH-3-B4	BIRCH-3-B5	BIRCH-4-B1	BIRCH-4-B2	BIRCH-4-B3	BIRCH-4-B4	BIRCH-4-B5	BIRCH-5-B1	BIRCH-5-B2	BIRCH-5-B3	BIRCH-5-B4	BIRCH-5-B5	L-16-B1	L-16-B2	L-16-B3
Sample ID			F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED
Sample Date (dd-mmm-yy)			09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	09-Oct-2022	10-Oct-2022	10-Oct-2022	10-Oct-2022
Parameter	Unit	MDL															
Physical Tests																	
Moisture	%	1	60.7	40.5	48.8	40.5	29.5	37	33.6	85.1	88.6	86	84.6	81.1	94	93.7	92
Physical Tests	pH	N/A	7.41	5.54	6.08	5.29	5.62	5.48	6.13	5.71	5.69	5.61	5.55	5.47	5.7	5.8	5.89
Organic Content																	
Leachable Anions & Nutrients																	
Nitrate (N)	ug/g	2															
Nitrite (N)	ug/g	0.5															
Nitrate + Nitrite (N)	ug/g	3															
Total Kjeldahl Nitrogen	ug/g	100															
Organic / Inorganic Carbon																	
Fraction Organic Carbon	g/g	0.001															
Total Organic Carbon	%	0.05	1.82	1.23	1.10	1.25	1.11	0.69	0.54	9.29	9.90	8.59	8.46	6.04	25.10	28.00	26.30
Metals																	
Aluminum	ug/g	50	10900	5850	6820	6900	5330	2730	4320	16900	17200	15900	15800	12600	11000	9500	10200
Antimony	ug/g	0.20 or 0.10	0.16	<0.10	0.12	0.1	<0.10	<0.10	<0.10	0.33	0.41	0.27	0.22	0.24	0.36	0.29	0.27
Arsenic	ug/g	1.0 or 0.1	15.7	4.51	64.6	36.9	5.26	3.46	15.9	7.08	7.93	6.97	6.82	6.61	4.72	4.69	3.89
Barium	ug/g	0.5	75.0	18.5	366.0	111.0	15.0	13.8	74.0	74.9	84.5	70.5	72.0	53.2	91.1	78.7	74.3
Beryllium	ug/g	0.20 or 0.10	0.37	0.11	0.46	0.26	<0.10	<0.10	0.15	0.42	0.45	0.43	0.42	0.28	0.24	0.22	0.22
Bismuth	ug/g	1.0 or 0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.25	0.27	<0.20	<0.20	<0.20	<0.31	<0.29	<0.30
Boron	ug/g	5	5.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	7.5	8.5	7.4	7.1	5.6	9.1	9.2	9.5
Cadmium	ug/g	0.10 or 0.02	0.22	0.09	0.29	0.17	0.06	0.07	0.11	0.53	0.62	0.43	0.36	0.40	0.78	0.60	0.60
Calcium	ug/g	50	12700	2170	4830	2320	1860	1890	2700	7370	7840	7040	7020	5740	18400	20700	18700
Chromium	ug/g	1.0 or 0.5	31.80	21.90	24.10	62.40	14.20	9.91	27.30	38.00	39.50	36.80	37.00	30.70	26.20	23.20	23.20
Cobalt	ug/g	0.1	8.12	4.06	15.10	8.24	4.02	1.92	4.93	7.07	7.19	7.14	7.30	6.40	10.30	8.58	8.78
Copper	ug/g	0.5	16.80	4.87	11.30	8.06	3.54	3.41	8.73	34.40	36.10	31.80	30.60	21.10	40.40	44.00	44.20
Iron	ug/g	50	24600	12200	85600	49700	12600	5610	21100	17400	17600	17700	18200	15800	15300	12900	13600
Lead	ug/g	1.0 or 0.5	8.51	3.88	5.42	4.33	3.37	3.46	3.32	18.90	22.80	13.80	11.20	13.50	17.30	11.80	10.70
Lithium	ug/g	2	15.9	6.4	9.1	7.4	5.8	2.8	5.6	14.4	15	13.9	13.6	11.1	8.3	7	7.6
Magnesium	ug/g	50 or 20	10000	3160	3140	3920	3220	1320	2220	6170	6260	5930	5840	5180	4300	3410	3540
Manganese	ug/g	1	494.0	180.0	5380.0	1800.0	208.0	122.0	1050.0	218.0	211.0	251.0	417.0	270.0	498.0	447.0	452.0
Mercury	ug/g	0.05	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.08	0.10	0.07	0.06	0.06	0.24	0.21	0.14
Molybdenum	ug/g	0.50 or 0.1	0.66	0.82	2.30	6.28	0.14	0.31	1.68	0.63	0.78	0.68	0.71	0.56	1.08	1.07	1.36
Nickel	ug/g	0.5	20.8	12.9	16.1	36.9	8.3	5.5	15.5	24.5	25.4	23.6	23.8	19.3	24.3	22.5	22.3
Phosphorus	ug/g	50	1010	610	4300	2050	557	495	1160	1110	1100	1140	1160	958	1320	1180	957
Potassium	ug/g	200 or 100	1940	360	1090	280	210	240	650	1740	1890	1630	1620	1230	990	790	850
Selenium	ug/g	0.50 or 0.2	0.34	<0.20	0.45	0.22	<0.20	<0.20	<0.20	1.38	1.56	1.21	1.27	0.91	2	1.94	1.8
Silver	ug/g	0.20 or 0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.12	<0.10	<0.10	<0.10	0.23	0.24	0.25
Sodium	ug/g	50	194	60	98	<50	<50	<50	90	186	189	189	180	147	92	<73	82
Strontium	ug/g	1.0 or 0.5	21.7	7.0	22.3	10.4	7.0	6.2	10.4	25.8	28.5	26.3	26.4	22.2	27.5	29.3	28.3
Sulfur	ug/g	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	2200	2400	2000	2000	1400	5500	5800	6100
Thallium	ug/g	0.05	0.177	<0.050	0.17	0.054	<0.050	<0.050	0.09	0.176	0.175	0.172	0.172	0.13	0.157	0.152	0.17
Tin	ug/g	1.0 or 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<3.1	<2.9	9.4
Titanium	ug/g	5.0 or 1.0	614	245	347	165	266	224	303	525	574	567	586	586	402	326	383
Tungsten	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.77	<0.73	<0.75
Uranium	ug/g	0.05	1.04	0.48	0.87	0.90	0.43	0.40	0.50	1.94	1.92	1.82	1.76	1.28	0.89	0.98	0.88
Vanadium	ug/g	5.0 or 0.2	33.50	19.30	39.80	36.90	20.40	8.96	18.30	32.80	34.70	32.80	32.70	28.10	29.50	24.30	30.40
Zinc	ug/g	5.0 or 2.0	50.0	26.9	47.4	36.3	22.3	14.6	20.9	82.4	86.2	78.5	75.1	64.9	83.1	72.3	78.0
Zirconium	ug/g	1	3.1	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	2.6	2.8	2.3	2.1	1.4	3.9	4.1	4.1
Particle Size (Soil)																	
Gravel (4.75mm - 3in.)	%																
Sand and Gravel (>1.0mm)	%		1.2	7.3	2.4	12.6	45.9	2	20.2	<1.0	<1.0	<1.0	<1.0	3.8	<1.0	<1.0	<1.0
Medium Sand (0.425mm - 2.0mr	%																
Medium Sand (0.425mm - 1.0mr	%		1.9	14.4	3.1	15.7	22.8	1.8	5.7	<1.0	<1.0	<1.0	<1.0	4.9	<1.0	<1.0	<1.0
Coarse Sand (2.0mm - 4.75mm)	%																
Fine Sand (0.075mm - 0.425mm)	%		41.9	62.7	48	51.2	26.6	82.5	58.2	3.7	0.6	5.9	3.4	24.1	0.4	0.1	0.3
Silt (0.002mm - 0.075mm)	%		40.8	13.2	41.2	18.7	3.1	9.7	13.8	86.6	89.5	84.8	84.6	60.4	92.7	96.8	95.6
Silt (0.005mm - 0.075mm)	%																
Clay (<0.002mm)	%		14.2	2.4	5.3	1.8	1.6	4	2.1	9.6	9.7	8.9	11.8	6.8	6.8	3	4
Clay (<0.005mm)	%																
Notes:																	

MDL; Method Detection Limit provided by Bureau Veritas, Miss
'<' indicates that the reported concentration was less than the
'-' indicates that the parameter was not analyzed

Table A-2: Springpole Lake Sediment Quality Laboratory Results

Sample Area			L-16-B4	L-16-B5	L-15-B1	L-15-B2	L-15-B3	L-15-B4	L-15-B5
Sample ID			F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED	F-1 2022 SED
Sample Date (dd-mmm-yy)			10-Oct-2022	10-Oct-2022	10-Oct-2022	10-Oct-2022	10-Oct-2022	10-Oct-2022	10-Oct-2022
Parameter	Unit	MDL							
Physical Tests									
Moisture	%	1	93	93.3	74	84.5	88.7	89.8	89.9
Physical Tests	pH	N/A	5.69	5.83	5.51	5.55	5.49	5.32	5.41
Organic Content									
Leachable Anions & Nutrients									
Nitrate (N)	ug/g	2							
Nitrite (N)	ug/g	0.5							
Nitrate + Nitrite (N)	ug/g	3							
Total Kjeldahl Nitrogen	ug/g	100							
Organic / Inorganic Carbon									
Fraction Organic Carbon	g/g	0.001							
Total Organic Carbon	%	0.05	24.80	24.00	3.75	7.21	10.20	10.80	10.40
Metals									
Aluminum	ug/g	50	9890	10600	13500	15600	19400	18200	18800
Antimony	ug/g	0.20 or 0.10	0.36	0.38	0.19	0.25	0.5	0.53	0.46
Arsenic	ug/g	1.0 or 0.1	9.11	6.25	4.88	4.85	8.51	10.3	7.2
Barium	ug/g	0.5	86.4	77.0	48.8	65.1	97.9	93.4	87.2
Beryllium	ug/g	0.20 or 0.10	0.22	0.24	0.26	0.31	0.41	0.4	0.4
Bismuth	ug/g	1.0 or 0.2	<0.31	<0.30	<0.20	<0.20	0.36	0.37	0.34
Boron	ug/g	5	9.6	8.7	<5.0	6	7.7	7.9	7.2
Cadmium	ug/g	0.10 or 0.02	0.70	0.78	0.23	0.31	0.82	0.92	0.71
Calcium	ug/g	50	16600	17700	4540	6440	7690	7530	7540
Chromium	ug/g	1.0 or 0.5	19.40	23.90	33.50	37.20	45.00	42.80	42.20
Cobalt	ug/g	0.1	8.29	9.32	10.10	9.78	11.80	11.40	11.20
Copper	ug/g	0.5	42.00	39.70	20.10	34.20	50.70	48.20	45.00
Iron	ug/g	50	16000	14600	20700	20100	25100	24800	22900
Lead	ug/g	1.0 or 0.5	20.90	21.80	6.68	10.20	22.30	31.00	27.30
Lithium	ug/g	2	5.9	7.4	13	14.2	16.7	16.2	16.1
Magnesium	ug/g	50 or 20	2900	3730	8180	7610	9070	8490	8710
Manganese	ug/g	1	572.0	494.0	246.0	231.0	268.0	264.0	258.0
Mercury	ug/g	0.05	0.19	0.19	0.04	0.06	0.11	0.12	0.12
Molybdenum	ug/g	0.50 or 0.1	1.73	1.17	1.86	1.18	1.27	1.27	1.23
Nickel	ug/g	0.5	20.1	22.1	25.6	28.0	35.6	33.9	33.5
Phosphorus	ug/g	50	1060	1040	822	896	1120	1120	1080
Potassium	ug/g	200 or 100	830	970	1280	1470	1860	1810	1780
Selenium	ug/g	0.50 or 0.2	1.58	1.84	0.68	1.16	1.58	1.81	1.66
Silver	ug/g	0.20 or 0.10	0.27	0.24	<0.10	0.15	0.23	0.24	0.22
Sodium	ug/g	50	90	96	98	130	149	145	141
Strontium	ug/g	1.0 or 0.5	27.2	28.5	18.7	24.0	26.5	25.9	25.7
Sulfur	ug/g	1000	6700	5700	1300	1900	3400	3100	3200
Thallium	ug/g	0.05	0.2	0.188	0.232	0.227	0.263	0.255	0.247
Tin	ug/g	1.0 or 2.0	<3.1	<3.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	ug/g	5.0 or 1.0	307	384	694	644	557	517	535
Tungsten	ug/g	0.5	<0.77	<0.75	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	ug/g	0.05	0.71	0.86	0.97	1.35	1.64	1.60	1.56
Vanadium	ug/g	5.0 or 0.2	31.80	30.40	42.00	42.60	48.70	46.60	45.70
Zinc	ug/g	5.0 or 2.0	101.0	84.2	74.5	81.0	106.0	104.0	102.0
Zirconium	ug/g	1	3	4	1.5	2.2	4.3	4.3	4.1
Particle Size (Soil)									
Gravel (4.75mm - 3in.)	%								
Sand and Gravel (>1.0mm)	%		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Medium Sand (0.425mm - 2.0mr	%								
Medium Sand (0.425mm - 1.0mr	%		<1.0	<1.0	1	<1.0	<1.0	<1.0	<1.0
Coarse Sand (2.0mm - 4.75mm)	%								
Fine Sand (0.075mm - 0.425mm)	%		0.1	0.1	33.2	6.3	0.4	0.3	0.6
Silt (0.002mm - 0.075mm)	%		89.5	93.6	61.1	85.2	91.1	89.7	89.4
Silt (0.005mm - 0.075mm)	%								
Clay (<0.002mm)	%		10.4	6.2	4.3	8.2	8.5	10	10
Clay (<0.005mm)	%								
Notes:									

MDL; Method Detection Limit provided by Bureau Veritas, Miss
'<' indicates that the reported concentration was less than the
'-' indicates that the parameter was not analyzed

547500 550000 552500 555000 557500 560000 562500 565000

5695000 5692500 5690000 5687500 5685000

Birch Lake
Birch Lake
Keigat Lake
L1-TYPH-04
L1-TYPH-04-SED
L-1
L-18
L-17
L-2
L-19
L2-NYMPH-03-SED
L2-TYPH-02
L2-NYMPH-03
L2-TYPH-02-SED
Dole Lake
L-20
L-3
L-4
L-5
L-6
L-16
L15-ACOR-01
Durkin Lake
L-10
L-12
L-11
L-13
L-14
L15-ACOR-10
L15-ACOR-10-SED
Springpole Lake (North Basin)
L15-POTA-07-SED
L15-POTA-07
L15-POTA-06-SED
L15-POTA-06
L1-TYPH-05-SED
L1-TYPH-05
Birch River
Springpole Lake (Southeast Arm)
Wenasaga Forestry Road
Cromarty Lake
L15-ACOR-09-SED
L15-POTA-08-SED
L15-POTA-08
L15-ACOR-09
Satterly Lake
Seagrave Creek
Seagrave Lake
Seagrave Lake

X:\CA\CAOAK300-OAK\MIS-FS1-Project\P20221\Projects\ONS2104_FMG_Springpole EIS\11 GIS\Human_Health\Technical_Report 2023\MXD\Aq_Plant_Sediment_Sample_Locs_2021_1.mxd

LEGEND

- Proposed Mine Feature
- Proposed 230 kV Transmission Line
- Existng Road
- Contour (10 m intervals)
- Watercourse
- Waterbody
- Flow Direction
- Sediment Sample Locations

Aquatic Plant Sample Locations

- Cattail
- Pond Lily
- Pondweed
- Sweetflag

0 1 2 4 6 8 10 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.

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

2021 Aquatic Plant and Sediment Sample Locations

Datum: NAD83
Projection: UTM Zone 15N

N W E S

PROJECT N°: ONS2104 | **FIGURE: A-3**

SCALE: 1:52,000 | DATE: October 2024

1.4 Country Foods

A baseline assessment of country foods was completed to determine the existing concentrations of metals in vegetation (plants) and fish. The baseline data are used to predict future concentrations of substances as a result of air deposition of particles and effluent emitted from the Project. The sampling methodology and metals chemistry data for plants, collected as part of the HEHRA, are presented below. Details on the methodology and chemistry data results for fish can be found in the *Aquatic Resources Assessments* (Appendix O-1, O-2 and O-3 of the EIS/EA), with data summarized below.

1.4.1 Plants

Field sampling for the aquatic plants was conducted from August 29 to August 31, 2021. Terrestrial plant sampling was conducted from September 5 to September 10, 2021 and on August 29, 2022. Terrestrial sites were accessed either by helicopter or on foot by two qualified field technicians. Aquatic plant and co-located sediment sample locations are presented in Figure A-3. Terrestrial plant sample locations are presented in Figure A-4.

Plant Sampling Methods

Samples of berries and Labrador tea leaves were hand picked with gloved hands from each site. Each plant sampling patch was about 5 m^2 in size. Samples were stored in plastic bags for metals analysis. Samples of Cattail roots were dug at different areas within the site to produce one composite sample per site. Root tubers were picked free of small straggly roots and cleaned with water to remove any soil particles and placed into plastic bags for metals analysis.

Disposable nitrile gloves were worn at all times and changed between samples to avoid cross-contamination. All samples were stored in coolers with icepacks until they could be transferred to a freezer at the end of the sampling day. Samples were packed on ice and transported to ALS Laboratories.

A summary of the baseline data sampling program for plants is displayed in Table A-3.

Table A-3: Summary of Baseline Data Sampling Program for Plants

Plant Type	Species	Number of Samples
Aquatic Plants	Sweet flag	3
	Cattails	3
	Pond lily	1
	Pondweed	3
Terrestrial Plants	Labrador tea	12
	Blue berries	12
	Raspberries	5

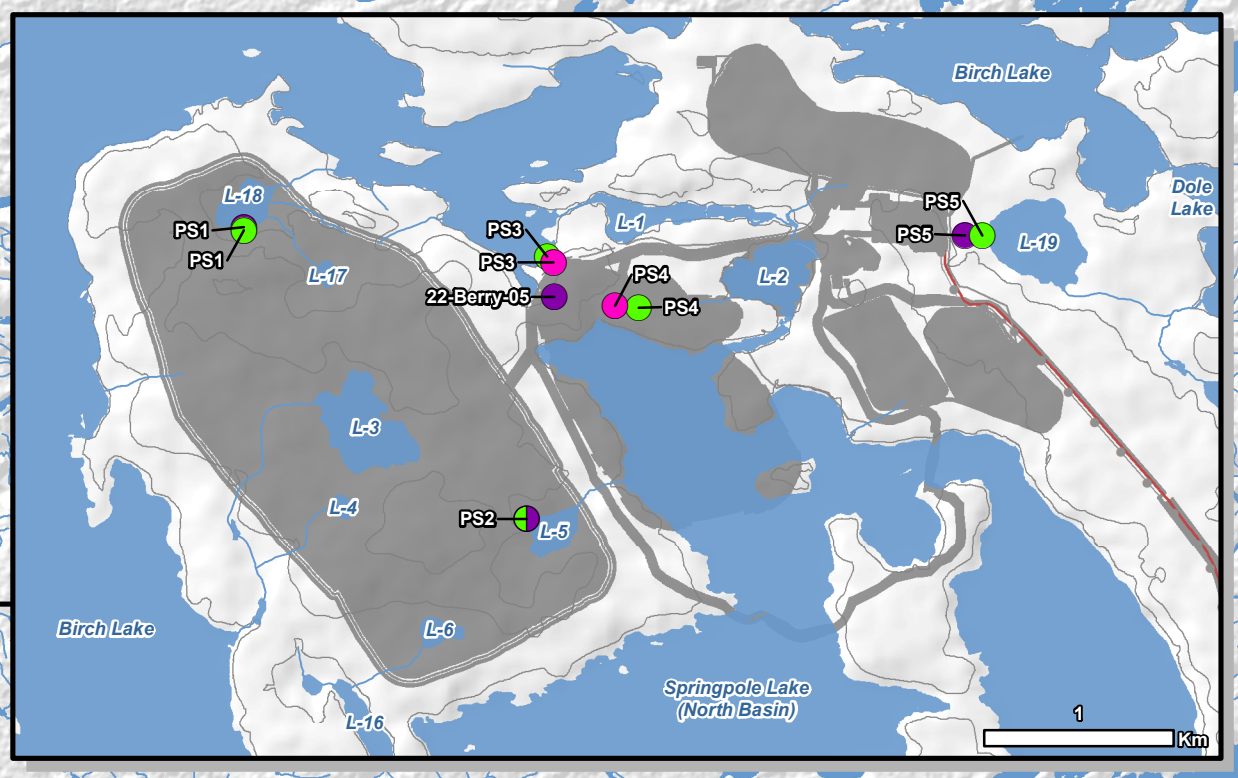
Plant Analytical Results

The baseline metals chemistry results for aquatic plants are displayed in Table A-4, results for terrestrial plants – Labrador tea are displayed in Table A-5 and results for terrestrial plants – berries are displayed in Table A-6. The data were used in the human health risk assessment to assess consumption of plant country foods, and in the ecological risk assessment as surrogates for browse vegetation (Labrador tea) and berries (blue berries and raspberries). The 95th UCLM concentrations of COPCs from the baseline study were used to represent baseline concentrations in plants, prior to examining the potential incremental effects of the Project.

550000 560000 570000

5710000 5700000 5690000 5680000 5670000

Shearstone Lake
Retter Lake
Brownstone Lake
Graham Lake
Richardson Lake
Joneston Lake
Casummit Lake
PS8
Penson Lake
Birch Lake
Dole Lake
PS6
PS7
Springpole Lake (North Basin)
Springpole Lake (Southeast Arm)
Satterly Lake
Cromarty Lake
Superstition Lake
Graydarl Lake
Seagrave Lake
Skingle Lake
PS9
22-Berry-02
Bertha Lake
22-Berry-01
Ruddy Lake
Deaddog Lake
Cavano Lake
Bumpy Lake
Cook Lake
Marsh Lake
Hailstone Lake
PS10
22-Berry-04
Ferdinand Lake
Margaret Lake
Latreille Lake
Tarpley Lake
Sesikinaga Lake
Allison Lake
Keigat Lake
Durkin Lake
Birch River
Gull Lake
Christina Lake
Fawthrop Lake
Zionz Lake



LEGEND

- Proposed Mine Feature
- Proposed 230 kV Transmission Line
- Existing Transmission Line
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Terrestrial Plant Sample Locations*

- Blueberry
- Blueberry / Labrador Tea
- Labrador Tea
- Raspberry
- Raspberry / Labrador Tea

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.

* Labels have ONS2104 prefix removed from 2022 sample IDs

Datum: NAD83
Projection: UTM Zone 15N

0 1 2 4 6 8 10 Kilometres

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

Terrestrial Plant Sample Locations

PROJECT Nº: ONS2104 | **FIGURE: A-4**

SCALE: 1:150,000 | DATE: October 2024

X:\CA\CAOAK300-OAK\MtS-FS1-ProjectF\2021\Projects\ONS2104_FMG_Springpole_EIS\11_GIS\Human_Health\Technical_Report_2023\MXD\Terrestrial_Plant_Sample_Locs_2.mxd

Table A-4: Baseline Aquatic Plants Chemistry Used in the Assessment (mg/kg Dry Weight)

			Sweetflag	Cattail	Pond Lily	Cattail	Cattail	Pondweed	Pondweed	Pondweed	Sweetflag	Sweetflag
Sample ID			L15-ACOR-01	L2-TYPH-02	L2-NYMPH-03	L1-TYPH-04	L1-TYPH-05	L15-POTA-06	L15-POTA-07	L15-POTA-08	L15-ASCOR-09	L15-ASCOR-10
Date Sampled			29-Aug-2021	30-Aug-2021	30-Aug-2021	30-Aug-2021	31-Aug-2021	31-Aug-2021	31-Aug-2021	31-Aug-2021	31-Aug-2021	31-Aug-2021
Parameter	**Lowest Detection Limit**	**Units**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**
Physical Tests (Tissue)												
% Moisture	0.50	%	87.5	84.2	88.4	84.1	74.4	95.1	92.1	83.8	90.0	82.3
Metals (Tissue)												
Aluminum (Al)-Total	2.0	mg/kg	1650	30.7	1270	18.2	19.9	1100	1350	99.3	785	1180
Antimony (Sb)-Total	0.010	mg/kg	0.097	0.020	0.243	<0.010	<0.010	0.066	0.064	0.013	0.046	0.048
Arsenic (As)-Total	0.020	mg/kg	2.47	0.294	1.93	0.105	0.081	7.75	8.77	0.991	2.61	1.89
Barium (Ba)-Total	0.050	mg/kg	24.5	261	13.8	7.10	16.4	165	153	35.4	27.5	31.8
Beryllium (Be)-Total	0.010	mg/kg	0.065	<0.010	0.062	<0.010	<0.010	0.050	0.046	<0.010	0.041	0.032
Bismuth (Bi)-Total	0.010	mg/kg	0.052	<0.010	0.021	<0.010	<0.010	0.030	0.028	<0.010	0.012	0.016
Boron (B)-Total	1.0	mg/kg	6.3	13.7	5.5	5.9	16.9	33.8	27.8	27.0	13.6	11.1
Cadmium (Cd)-Total	0.0050	mg/kg	0.640	0.0188	0.124	0.0164	<0.0050	0.219	0.161	0.107	0.137	0.175
Calcium (Ca)-Total	20	mg/kg	10600	21800	8890	4540	12000	23900	13500	10400	10900	5680
Cesium (Cs)-Total	0.0050	mg/kg	0.565	0.178	0.134	<0.0050	0.0052	0.187	0.216	0.184	0.189	0.394
Chromium (Cr)-Total	0.050	mg/kg	3.69	0.206	2.66	0.118	0.094	3.03	4.53	0.378	1.61	3.49
Cobalt (Co)-Total	0.020	mg/kg	1.96	0.113	1.01	0.127	0.072	1.63	1.63	0.225	1.18	2.65
Copper (Cu)-Total	0.10	mg/kg	17.1	0.57	6.94	1.31	2.20	6.15	5.43	1.91	9.54	10.4
Iron (Fe)-Total	3.0	mg/kg	4230	171	1940	94.0	71.6	3900	3510	350	2610	5600
Lead (Pb)-Total	0.020	mg/kg	5.95	0.094	1.75	0.139	0.050	1.78	1.60	0.153	1.01	0.994
Lithium (Li)-Total	0.50	mg/kg	1.16	<0.50	0.87	<0.50	<0.50	1.48	1.66	<0.50	0.59	1.10
Magnesium (Mg)-Total	2.0	mg/kg	1370	3660	1360	1070	2650	1430	1440	3740	1590	1310
Manganese (Mn)-Total	0.050	mg/kg	32.0	204	48.8	184	983	1300	863	167	225	308
Mercury (Hg)-Total	0.0050	mg/kg	0.0619	0.014	0.0464	<0.0050	0.0059	0.0324	0.0256	0.0067	0.0233	0.0167
Molybdenum (Mo)-Total	0.020	mg/kg	0.885	0.171	1.55	1.51	4.88	0.582	0.682	0.134	0.243	0.425
Nickel (Ni)-Total	0.20	mg/kg	4.48	0.21	3.46	<0.20	<0.20	5.15	7.41	0.80	2.32	2.82
Phosphorus (P)-Total	10	mg/kg	1300	2390	808	1500	3150	1060	1100	2040	792	1230
Potassium (K)-Total	20	mg/kg	2250	14900	9060	23100	13800	9390	6850	19400	8180	6560
Rubidium (Rb)-Total	0.050	mg/kg	10.3	35.6	4.59	9.98	14.3	13.5	10.6	45.8	27.5	24.8
Selenium (Se)-Total	0.050	mg/kg	0.761	<0.050	0.570	<0.050	<0.050	0.263	0.263	0.094	0.397	0.163
Sodium (Na)-Total	20	mg/kg	214	7470	534	2770	186	2990	2380	2990	387	405
Strontium (Sr)-Total	0.050	mg/kg	17.0	279	37.3	16.9	41.8	65.7	48.4	42.4	27.0	16.3
Tellurium (Te)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	0.0020	mg/kg	0.215	0.152	0.0512	0.0285	<0.0020	0.0626	0.0740	0.122	0.0274	0.0533
Tin (Sn)-Total	0.10	mg/kg	0.14	0.23	<0.10	<0.10	<0.10	0.85	0.60	<0.10	<0.10	0.13
Uranium (U)-Total	0.0020	mg/kg	0.410	0.0159	0.630	0.0030	0.0038	0.167	0.141	0.0322	0.239	0.113
Vanadium (V)-Total	0.10	mg/kg	6.44	0.11	5.28	<0.10	<0.10	3.53	4.04	0.38	2.17	4.26
Zinc (Zn)-Total	0.50	mg/kg	18.3	11.2	15.8	13.7	20.0	21.7	21.3	15.1	25.5	26.0
Zirconium (Zr)-Total	0.20	mg/kg	2.16	<0.20	2.39	<0.20	<0.20	1.92	1.85	<0.20	1.36	1.43

Table A-5: 2021 Baseline Vegetation Quality Laboratory Results -Labrador Tea

Sample ID			SPRINGPOLE PS7 LABRADOR TEA- 2-0552037 5690155	SPRINGPOLE PS2 LABRADOR TEA-0548733 5692993	SPRINGPOLE PS8 LABRADOR TEA-0550348 5703460	SPRINGPOLE PS6 LABRADOR TEA-0552713 5691326	SPRINGPOLE PS3 LABRADOR TEA- 2-51.39855- 92.29792	SPRINGPOLE PS1 LABRADOR TEA-0547235 5694523	SPRINGPOLE PS9 LABRADOR TEA-0563743 5685078
Date Sampled			5-Sep-2021	6-Sep-2021	6-Sep-2021	5-Sep-2021	7-Sep-2021	5-Sep-2021	5-Sep-2021
Parameter	**Lowest Detection Limit**	**Units**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**
Physical Tests (Tissue)									
% Moisture	0.50	%	58.5	46.4	47.1	60.9	47.8	52.2	53.2
Metals (Tissue)									
Aluminum (Al)-Total	2.0	mg/kg	20.2	10.7	17.3	21.6	24.7	22.6	65.3
Aluminum (Al)-Total	0.40	mg/kg wwt	8.39	5.75	9.14	8.45	12.9	10.8	30.6
Antimony (Sb)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Antimony (Sb)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	0.0027	<0.0020	<0.0020	<0.0020
Arsenic (As)-Total	0.020	mg/kg	<0.020	<0.020	0.192	<0.020	0.033	<0.020	0.032
Arsenic (As)-Total	0.0040	mg/kg wwt	0.0044	0.0058	0.102	0.0071	0.0172	0.0057	0.0151
Barium (Ba)-Total	0.050	mg/kg	102	70.4	64.1	130	98.3	68.2	111
Barium (Ba)-Total	0.010	mg/kg wwt	42.5	37.7	33.9	50.9	51.3	32.6	51.9
Beryllium (Be)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium (Be)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)-Total	1.0	mg/kg	21.0	20.3	17.2	22.9	21.0	16.7	25.8
Boron (B)-Total	0.20	mg/kg wwt	8.73	10.9	9.12	8.97	11.0	7.99	12.1
Cadmium (Cd)-Total	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0084
Cadmium (Cd)-Total	0.0010	mg/kg wwt	<0.0010	0.0010	<0.0010	0.0016	0.0011	<0.0010	0.0039
Calcium (Ca)-Total	20	mg/kg	5580	5380	4920	6500	5670	4310	6730
Calcium (Ca)-Total	4.0	mg/kg wwt	2320	2880	2600	2540	2960	2060	3150
Cesium (Cs)-Total	0.0050	mg/kg	0.0651	0.201	0.142	0.0564	<0.0050	0.339	0.218
Cesium (Cs)-Total	0.0010	mg/kg wwt	0.0271	0.108	0.0751	0.0220	0.0026	0.162	0.102
Chromium (Cr)-Total	0.050	mg/kg	<0.050	<0.050	<0.050	0.057	<0.050	<0.050	0.061
Chromium (Cr)-Total	0.010	mg/kg wwt	0.010	0.011	<0.010	0.022	0.014	0.012	0.029
Cobalt (Co)-Total	0.020	mg/kg	0.147	<0.020	<0.020	<0.020	<0.020	0.061	0.031
Cobalt (Co)-Total	0.0040	mg/kg wwt	0.0611	<0.0040	0.0058	0.0047	0.0081	0.0292	0.0144
Copper (Cu)-Total	0.10	mg/kg	3.54	3.07	2.49	2.79	3.07	3.00	2.45
Copper (Cu)-Total	0.020	mg/kg wwt	1.47	1.65	1.31	1.09	1.61	1.43	1.15
Iron (Fe)-Total	3.0	mg/kg	39.5	27.0	30.5	50.6	31.3	31.6	54.3
Iron (Fe)-Total	0.60	mg/kg wwt	16.4	14.5	16.1	19.8	16.4	15.1	25.4
Lead (Pb)-Total	0.020	mg/kg	0.031	0.031	0.026	0.045	0.020	0.026	0.048
Lead (Pb)-Total	0.0040	mg/kg wwt	0.0127	0.0168	0.0135	0.0176	0.0106	0.0123	0.0223
Lithium (Li)-Total	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium (Li)-Total	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total	2.0	mg/kg	1460	1310	1000	1560	1260	1170	1270
Magnesium (Mg)-Total	0.40	mg/kg wwt	606	704	530	611	659	559	594
Manganese (Mn)-Total	0.050	mg/kg	846	579	631	304	387	340	897
Manganese (Mn)-Total	0.010	mg/kg wwt	351	310	334	119	202	162	420
Mercury (Hg)-Total	0.0050	mg/kg	0.0068	0.0068	0.0062	0.0098	<0.0050	0.0070	0.0083
Mercury (Hg)-Total	0.0010	mg/kg wwt	0.0028	0.0037	0.0033	0.0038	0.0025	0.0034	0.0039
Molybdenum (Mo)-Total	0.020	mg/kg	<0.020	<0.020	0.052	<0.020	0.025	<0.020	0.023
Molybdenum (Mo)-Total	0.0040	mg/kg wwt	0.0075	0.0091	0.0274	0.0078	0.0129	0.0057	0.0107
Nickel (Ni)-Total	0.20	mg/kg	0.38	<0.20	0.43	<0.20	0.35	1.13	0.30
Nickel (Ni)-Total	0.040	mg/kg wwt	0.156	0.098	0.230	0.059	0.183	0.540	0.139
Phosphorus (P)-Total	10	mg/kg	1190	976	999	1060	1370	718	1050
Phosphorus (P)-Total	2.0	mg/kg wwt	493	523	528	414	715	343	490
Potassium (K)-Total	20	mg/kg	4770	3780	3790	4780	3700	3540	3500
Potassium (K)-Total	4.0	mg/kg wwt	1980	2030	2000	1870	1930	1690	1640
Rubidium (Rb)-Total	0.050	mg/kg	13.6	14.7	15.7	26.9	4.32	13.8	19.1
Rubidium (Rb)-Total	0.010	mg/kg wwt	5.63	7.89	8.29	10.5	2.26	6.57	8.95
Selenium (Se)-Total	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)-Total	0.010	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	<0.010
Sodium (Na)-Total	20	mg/kg	26	<20	<20	<20	<20	<20	27
Sodium (Na)-Total	4.0	mg/kg wwt	10.8	4.9	<4.0	7.1	4.2	4.1	12.7
Strontium (Sr)-Total	0.050	mg/kg	6.58	3.88	5.29	10.3	7.95	6.12	15.2
Strontium (Sr)-Total	0.010	mg/kg wwt	2.73	2.08	2.80	4.03	4.15	2.93	7.10
Tellurium (Te)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Tellurium (Te)-Total	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	0.0020	mg/kg	0.0033	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0095
Thallium (Tl)-Total	0.00040	mg/kg wwt	0.00135	<0.00040	<0.00040	<0.00040	0.00065	<0.00040	0.00443
Tin (Sn)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)-Total	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)-Total	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Uranium (U)-Total	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040	0.00058	<0.00040	<0.00040	0.00071
Vanadium (V)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)-Total	0.020	mg/kg wwt	<0.020	<0.020	<0.020	0.022	<0.020	<0.020	0.029
Zinc (Zn)-Total	0.50	mg/kg	26.5	18.4	12.1	22.9	20.9	10.5	19.7
Zinc (Zn)-Total	0.10	mg/kg wwt	11.0	9.87	6.40	8.97	10.9	5.04	9.20
Zirconium (Zr)-Total	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Zirconium (Zr)-Total	0.040	mg/kg wwt	0.051	<0.040	<0.040	<0.040	<0.040	<0.040	0.041

Table A-5: 2021 Baseline Vegetation Quality Laboratory Resu

Sample ID			SPRINGPOLE PS3 LABRADOR TEA- 1-51.39855- 92.29792	SPRINGPOLE PS4 LABRADOR TEA-0549325 5694113	SPRINGPOLE PS7 LABRADOR TEA- 1-0552037 5690155	SPRINGPOLE PS5 LABRADOR TEA-0551146 5694494	SPRINGPOLE PS10 LABRADOR TEA-0575419 5671383
Date Sampled			**7-Sep-2021**	**5-Sep-2021**	**5-Sep-2021**	**5-Sep-2021**	**10-Sep-2021**
Parameter	**Lowest Detection Limit**	**Units**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**
Physical Tests (Tissue)							
% Moisture	0.50	%	47.1	54.5	58.1	58.0	46.0
Metals (Tissue)							
Aluminum (Al)-Total	2.0	mg/kg	38.8	75.1	18.0	13.3	20.8
Aluminum (Al)-Total	0.40	mg/kg wwt	20.5	34.2	7.54	5.61	11.2
Antimony (Sb)-Total	0.010	mg/kg	<0.010	0.052	<0.010	0.012	<0.010
Antimony (Sb)-Total	0.0020	mg/kg wwt	0.0040	0.0236	<0.0020	0.0051	<0.0020
Arsenic (As)-Total	0.020	mg/kg	0.128	0.078	<0.020	<0.020	<0.020
Arsenic (As)-Total	0.0040	mg/kg wwt	0.0675	0.0356	0.0045	0.0078	0.0057
Barium (Ba)-Total	0.050	mg/kg	114	93.6	60.8	85.2	50.7
Barium (Ba)-Total	0.010	mg/kg wwt	60.3	42.6	25.5	35.8	27.4
Beryllium (Be)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium (Be)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)-Total	1.0	mg/kg	18.6	31.0	18.0	22.2	19.9
Boron (B)-Total	0.20	mg/kg wwt	9.85	14.1	7.53	9.35	10.8
Cadmium (Cd)-Total	0.0050	mg/kg	0.0056	<0.0050	<0.0050	0.0068	<0.0050
Cadmium (Cd)-Total	0.0010	mg/kg wwt	0.0029	0.0018	0.0019	0.0029	<0.0010
Calcium (Ca)-Total	20	mg/kg	5550	6260	5300	5750	4850
Calcium (Ca)-Total	4.0	mg/kg wwt	2930	2850	2220	2420	2620
Cesium (Cs)-Total	0.0050	mg/kg	0.0156	0.0847	0.0376	0.0955	0.0688
Cesium (Cs)-Total	0.0010	mg/kg wwt	0.0083	0.0385	0.0158	0.0401	0.0371
Chromium (Cr)-Total	0.050	mg/kg	0.149	0.186	<0.050	<0.050	<0.050
Chromium (Cr)-Total	0.010	mg/kg wwt	0.079	0.085	0.015	0.015	0.010
Cobalt (Co)-Total	0.020	mg/kg	0.024	0.055	0.061	<0.020	<0.020
Cobalt (Co)-Total	0.0040	mg/kg wwt	0.0128	0.0252	0.0257	0.0042	0.0062
Copper (Cu)-Total	0.10	mg/kg	2.55	3.06	3.41	2.91	3.01
Copper (Cu)-Total	0.020	mg/kg wwt	1.35	1.39	1.43	1.22	1.63
Iron (Fe)-Total	3.0	mg/kg	47.9	126	33.2	31.1	27.0
Iron (Fe)-Total	0.60	mg/kg wwt	25.3	57.5	13.9	13.1	14.5
Lead (Pb)-Total	0.020	mg/kg	0.048	0.082	0.033	0.044	<0.020
Lead (Pb)-Total	0.0040	mg/kg wwt	0.0256	0.0372	0.0137	0.0184	0.0077
Lithium (Li)-Total	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium (Li)-Total	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total	2.0	mg/kg	1140	1420	1040	1360	1070
Magnesium (Mg)-Total	0.40	mg/kg wwt	602	647	438	569	579
Manganese (Mn)-Total	0.050	mg/kg	469	761	627	654	153
Manganese (Mn)-Total	0.010	mg/kg wwt	248	347	263	275	82.8
Mercury (Hg)-Total	0.0050	mg/kg	0.0101	0.0062	0.0072	0.0061	<0.0050
Mercury (Hg)-Total	0.0010	mg/kg wwt	0.0053	0.0028	0.0030	0.0026	0.0020
Molybdenum (Mo)-Total	0.020	mg/kg	0.029	0.032	<0.020	<0.020	0.059
Molybdenum (Mo)-Total	0.0040	mg/kg wwt	0.0155	0.0147	0.0054	0.0073	0.0319
Nickel (Ni)-Total	0.20	mg/kg	0.38	0.30	0.33	0.31	1.17
Nickel (Ni)-Total	0.040	mg/kg wwt	0.200	0.136	0.138	0.131	0.633
Phosphorus (P)-Total	10	mg/kg	958	1120	1010	977	1420
Phosphorus (P)-Total	2.0	mg/kg wwt	507	509	422	410	767
Potassium (K)-Total	20	mg/kg	3350	3680	4230	3280	3960
Potassium (K)-Total	4.0	mg/kg wwt	1770	1670	1770	1380	2140
Rubidium (Rb)-Total	0.050	mg/kg	7.56	10.1	12.1	13.6	16.9
Rubidium (Rb)-Total	0.010	mg/kg wwt	4.00	4.58	5.07	5.71	9.10
Selenium (Se)-Total	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)-Total	0.010	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium (Na)-Total	20	mg/kg	<20	26	25	20	<20
Sodium (Na)-Total	4.0	mg/kg wwt	8.6	11.8	10.6	8.5	<4.0
Strontium (Sr)-Total	0.050	mg/kg	10.1	13.0	5.94	9.03	17.5
Strontium (Sr)-Total	0.010	mg/kg wwt	5.33	5.93	2.49	3.79	9.42
Tellurium (Te)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020
Tellurium (Te)-Total	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	0.0032
Thallium (Tl)-Total	0.00040	mg/kg wwt	0.00087	0.00088	<0.00040	<0.00040	0.00174
Tin (Sn)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)-Total	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)-Total	0.0020	mg/kg	<0.0020	0.0034	<0.0020	<0.0020	<0.0020
Uranium (U)-Total	0.00040	mg/kg wwt	0.00080	0.00157	<0.00040	<0.00040	<0.00040
Vanadium (V)-Total	0.10	mg/kg	<0.10	0.18	<0.10	<0.10	<0.10
Vanadium (V)-Total	0.020	mg/kg wwt	0.031	0.081	<0.020	<0.020	<0.020
Zinc (Zn)-Total	0.50	mg/kg	18.8	24.8	27.4	17.8	17.7
Zinc (Zn)-Total	0.10	mg/kg wwt	9.95	11.3	11.5	7.47	9.57
Zirconium (Zr)-Total	0.20	mg/kg	<0.20	0.27	<0.20	<0.20	<0.20
Zirconium (Zr)-Total	0.040	mg/kg wwt	0.094	0.122	0.065	<0.040	<0.040

Table A-6: 2021-2022 Baseline Vegetation Quality Laboratory Results - Berries

Sample ID			SPRINGPOLE PS7 RED RASPBERRY-1- 0552037 5690155	SPRINGPOLE PS2 BLUEBERRY - 0548733 5692993	SPRINGPOLE PS4 RED RASPBERRY- 0549201 5694121	SPRINGPOLE PS7 RED RASPBERRY-1- 0552037 5690155	SPRINGPOLE PS8 BLUEBERRY- 0550348 5703460	SPRINGPOLE PS1 BLUEBERRY- 0547237 5694539	SPRINGPOLE PS6 BLUEBERRY- 0552713 5691326	SPRINGPOLE PS9 BLUEBERRY- 0563743 5685078	SPRINGPOLE PS10 BLUEBERRY- 0575419 5671383
Date Sampled			5-Sep-2021	6-Sep-2021	5-Sep-2021	5-Sep-2021	6-Sep-2021	5-Sep-2021	5-Sep-2021	5-Sep-2021	5-Sep-2021
Parameter	**Lowest Detection Limit**	**Units**	**Raspberry**	**Tissue**	**Raspberry**	**Raspberry**	**Blueberry**	**Blueberry**	**Blueberry**	**Blueberry**	**Blueberry**
Physical Tests (Tissue)											
% Moisture	0.50	%	68.1	57.8	65.4	69.7	55.4	49.7	65.2	60.9	53.8
Metals (Tissue)											
Aluminum (Al)-Total	2.0	mg/kg	24.4	73.8	55.9	29.9	103	144	82.5	231	77.2
Aluminum (Al)-Total	0.40	mg/kg wwt	7.77	31.1	19.3	9.08	45.8	72.6	28.7	90.5	35.7
Antimony (Sb)-Total	0.010	mg/kg	<0.010	<0.010	0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Antimony (Sb)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	0.0069	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020
Arsenic (As)-Total	0.020	mg/kg	0.031	0.027	0.072	<0.020	0.128	0.031	<0.020	0.073	0.053
Arsenic (As)-Total	0.0040	mg/kg wwt	0.0098	0.0115	0.0249	0.0046	0.0573	0.0154	0.0057	0.0285	0.0244
Barium (Ba)-Total	0.050	mg/kg	9.87	83.9	14.5	10.9	81.3	76.4	76.9	81.7	63.3
Barium (Ba)-Total	0.010	mg/kg wwt	3.14	35.4	5.03	3.30	36.3	38.4	26.8	32.0	29.3
Beryllium (Be)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium (Be)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)-Total	1.0	mg/kg	43.3	67.2	46.1	30.8	37.1	63.1	45.4	44.7	51.2
Boron (B)-Total	0.20	mg/kg wwt	13.8	28.4	15.9	9.34	16.6	31.7	15.8	17.5	23.7
Cadmium (Cd)-Total	0.0050	mg/kg	0.0789	0.0056	0.0580	0.123	0.0058	0.0145	0.0056	0.0178	<0.0050
Cadmium (Cd)-Total	0.0010	mg/kg wwt	0.0251	0.0024	0.0200	0.0372	0.0026	0.0073	0.0020	0.0070	0.0021
Calcium (Ca)-Total	20	mg/kg	9110	6620	9470	8330	6200	6540	7160	5750	4710
Calcium (Ca)-Total	4.0	mg/kg wwt	2900	2790	3270	2530	2770	3290	2490	2250	2180
Cesium (Cs)-Total	0.0050	mg/kg	0.0983	0.837	0.0252	0.0836	0.225	0.315	1.08	0.231	0.193
Cesium (Cs)-Total	0.0010	mg/kg wwt	0.0313	0.353	0.0087	0.0254	0.101	0.158	0.376	0.0904	0.0891
Chromium (Cr)-Total	0.050	mg/kg	0.080	<0.050	0.152	<0.050	<0.050	0.075	<0.050	0.260	<0.050
Chromium (Cr)-Total	0.010	mg/kg wwt	0.026	0.017	0.052	0.012	0.014	0.038	0.013	0.102	0.017
Cobalt (Co)-Total	0.020	mg/kg	0.150	0.041	0.077	0.116	0.066	0.115	0.092	0.125	0.040
Cobalt (Co)-Total	0.0040	mg/kg wwt	0.0477	0.0174	0.0266	0.0352	0.0296	0.0576	0.0321	0.0491	0.0184
Copper (Cu)-Total	0.10	mg/kg	5.28	5.16	5.29	4.72	3.55	4.58	5.95	4.77	3.31
Copper (Cu)-Total	0.020	mg/kg wwt	1.68	2.18	1.83	1.43	1.58	2.30	2.07	1.87	1.53
Iron (Fe)-Total	3.0	mg/kg	82.0	57.6	134	86.4	50.4	60.0	58.2	200	54.0
Iron (Fe)-Total	0.60	mg/kg wwt	26.1	24.3	46.3	26.2	22.5	30.2	20.3	78.3	25.0
Lead (Pb)-Total	0.020	mg/kg	0.066	0.047	0.173	0.061	0.050	0.058	0.054	0.122	0.050
Lead (Pb)-Total	0.0040	mg/kg wwt	0.0210	0.0200	0.0598	0.0184	0.0225	0.0292	0.0189	0.0477	0.0231
Lithium (Li)-Total	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium (Li)-Total	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10
Magnesium (Mg)-Total	2.0	mg/kg	3450	2680	3900	2700	2480	1840	2240	1590	2330
Magnesium (Mg)-Total	0.40	mg/kg wwt	1100	1130	1350	818	1110	927	781	623	1080
Manganese (Mn)-Total	0.050	mg/kg	440	1140	474	831	2070	2260	1410	4800	326
Manganese (Mn)-Total	0.010	mg/kg wwt	140	480	164	252	925	1140	492	1880	151
Mercury (Hg)-Total	0.0050	mg/kg	0.0104	0.0121	0.0094	0.0112	0.0115	0.0085	0.0146	0.0062	0.0101
Mercury (Hg)-Total	0.0010	mg/kg wwt	0.0033	0.0051	0.0032	0.0034	0.0051	0.0043	0.0051	0.0024	0.0047
Molybdenum (Mo)-Total	0.020	mg/kg	0.604	0.056	0.571	0.338	1.15	0.079	0.074	0.099	0.315
Molybdenum (Mo)-Total	0.0040	mg/kg wwt	0.193	0.0236	0.197	0.103	0.513	0.0399	0.0258	0.0387	0.145
Nickel (Ni)-Total	0.20	mg/kg	0.57	1.02	0.39	0.54	1.13	1.96	1.35	0.56	2.03
Nickel (Ni)-Total	0.040	mg/kg wwt	0.180	0.432	0.135	0.163	0.504	0.987	0.469	0.218	0.940
Phosphorus (P)-Total	10	mg/kg	1510	901	2020	1140	1160	861	940	1430	1190
Phosphorus (P)-Total	2.0	mg/kg wwt	480	380	700	345	518	433	327	559	552
Potassium (K)-Total	20	mg/kg	13100	5670	8890	12100	4400	3370	5100	4780	3890
Potassium (K)-Total	4.0	mg/kg wwt	4160	2390	3070	3690	1960	1690	1780	1870	1800
Rubidium (Rb)-Total	0.050	mg/kg	22.8	20.1	2.46	21.0	10.8	8.16	27.2	21.0	17.0
Rubidium (Rb)-Total	0.010	mg/kg wwt	7.25	8.49	0.850	6.37	4.81	4.10	9.49	8.23	7.84
Selenium (Se)-Total	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)-Total	0.010	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	0.011	0.014	<0.010	<0.010	0.018
Sodium (Na)-Total	20	mg/kg	<20	<20	58	<20	<20	<20	25	<20	<20
Sodium (Na)-Total	4.0	mg/kg wwt	<4.0	6.4	20.1	4.1	7.4	7.4	8.6	4.3	7.3
Strontium (Sr)-Total	0.050	mg/kg	12.4	3.07	27.2	11.4	5.26	3.90	4.09	4.34	7.99
Strontium (Sr)-Total	0.010	mg/kg wwt	3.95	1.30	9.40	3.47	2.35	1.96	1.42	1.70	3.69
Tellurium (Te)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Tellurium (Te)-Total	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	0.0020	mg/kg	0.0025	<0.0020	0.0025	0.0022	<0.0020	0.0021	<0.0020	<0.0020	<0.0020
Thallium (Tl)-Total	0.00040	mg/kg wwt	0.00079	<0.00040	0.00085	0.00067	0.00089	0.00105	0.00050	0.00070	0.00063
Tin (Sn)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)-Total	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)-Total	0.0020	mg/kg	<0.0020	<0.0020	0.0028	<0.0020	<0.0020	<0.0020	<0.0020	0.0173	0.0023
Uranium (U)-Total	0.00040	mg/kg wwt	0.00042	0.00047	0.00097	0.00042	0.00057	0.00061	0.00048	0.00676	0.00107
Vanadium (V)-Total	0.10	mg/kg	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	0.33	<0.10
Vanadium (V)-Total	0.020	mg/kg wwt	<0.020	0.020	0.046	<0.020	0.030	0.030	<0.020	0.128	0.025
Zinc (Zn)-Total	0.50	mg/kg	30.2	10.5	30.0	38.3	8.85	9.22	11.6	9.30	11.1
Zinc (Zn)-Total	0.10	mg/kg wwt	9.61	4.45	10.4	11.6	3.95	4.64	4.04	3.64	5.15
Zirconium (Zr)-Total	0.20	mg/kg	<0.20	<0.20	0.21	0.47	<0.20	<0.20	<0.20	<0.20	<0.20
Zirconium (Zr)-Total	0.040	mg/kg wwt	<0.040	<0.040	0.074	0.142	0.051	0.047	<0.040	0.066	0.046
Speciated Metals (Matrix: Biota)											
arsenate [As V]	0.025	mg/kg									
arsenate [As V]	0.005	mg/kg wwt									
arsenite [As III]	0.005	mg/kg									
arsenite [As III]	0.001	mg/kg wwt									
arsenobetaine [AsB], (as As)	0.005	mg/kg									
arsenobetaine [AsB], (as As)	0.001	mg/kg wwt									
arsenocholine [AsC], (as As)	0.005	mg/kg									
arsenocholine [AsC], (as As)	0.001	mg/kg wwt									
dimethylarsinic acid [DMA], (as As)	0.005	mg/kg									
dimethylarsinic acid [DMA], (as As)	0.001	mg/kg wwt									
monomethylarsonic acid [MMA], (as As)	0.005	mg/kg									
monomethylarsonic acid [MMA], (as As)	0.001	mg/kg wwt									

Table A-6: 2021-2022 Baseline Vegetation Quality Laboratory Results - Berries

Sample ID			SPRINGPOLE PS3 RASPBERRY- 1- 51.398285-92.297426	SPRINGPOLE PS5 BLUEBERRY- 0551054 5674494	SPRINGPOLE PS3 RASPBERRY- 2- 51.398285- 92.297426	ONS2104-22-Berry-01 150 054 1684 5678061	ONS2104-22-Berry-02 150 0563475 5682505	ONS2104-22-Berry-03 150 0606778 5624762	ONS2104-22-Berry-04 150 2578742 5670945	ONS2104-22-Berry-05 150 0548880 5694168
Date Sampled			7-Sep-2021	5-Sep-2021	7-Sep-2021	29-Aug-2022	29-Aug-2022	29-Aug-2022	29-Aug-2022	29-Aug-2022
Parameter	**Lowest Detection Limit**	**Units**	**Raspberry**	**Blueberry**	**Raspberry**	**Blueberry**	**Blueberry**	**Blueberry**	**Blueberry**	**Blueberry**
Physical Tests (Tissue)										
% Moisture	0.50	%	60.1	67.7	57.9	85.6	87.5	87.6	84.8	85.5
Metals (Tissue)										
Aluminum (Al)-Total	2.0	mg/kg	129	96.1	53.8	12.9	8.0	16.0	4.7	25.8
Aluminum (Al)-Total	0.40	mg/kg wwt	51.7	31.1	22.7	1.85	1.00	1.98	0.71	3.75
Antimony (Sb)-Total	0.010	mg/kg	<0.010	0.063	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Antimony (Sb)-Total	0.0020	mg/kg wwt	0.0026	0.0205	0.0028	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)-Total	0.020	mg/kg	0.091	0.033	0.043	0.053	<0.020	0.047	<0.020	0.028
Arsenic (As)-Total	0.0040	mg/kg wwt	0.0363	0.0106	0.0179	0.0076	<0.0040	0.0059	<0.0040	0.0041
Barium (Ba)-Total	0.050	mg/kg	28.0	61.6	33.7	20.8	13.8	12.4	14.1	15.8
Barium (Ba)-Total	0.010	mg/kg wwt	11.2	19.9	14.2	2.99	1.73	1.54	2.14	2.29
Beryllium (Be)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium (Be)-Total	0.0020	mg/kg wwt	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)-Total	1.0	mg/kg	31.2	86.3	31.9	7.0	6.8	4.9	7.0	10.8
Boron (B)-Total	0.20	mg/kg wwt	12.4	27.9	13.4	1.01	0.85	0.61	1.06	1.56
Cadmium (Cd)-Total	0.0050	mg/kg	0.0535	0.0163	0.118	0.0513	<0.0050	<0.0050	<0.0050	0.0081
Cadmium (Cd)-Total	0.0010	mg/kg wwt	0.0214	0.0053	0.0499	0.0074	<0.0010	<0.0010	<0.0010	0.0012
Calcium (Ca)-Total	20	mg/kg	10200	7540	11300	1490	1030	875	1310	2370
Calcium (Ca)-Total	4.0	mg/kg wwt	4060	2440	4780	214	129	109	199	344
Cesium (Cs)-Total	0.0050	mg/kg	0.0237	0.0375	0.0130	0.922	0.101	0.470	0.390	0.192
Cesium (Cs)-Total	0.0010	mg/kg wwt	0.0094	0.0121	0.0055	0.133	0.0126	0.0584	0.0593	0.0280
Chromium (Cr)-Total	0.050	mg/kg	0.401	0.126	0.151	<0.050	<0.050	<0.050	<0.050	0.051
Chromium (Cr)-Total	0.010	mg/kg wwt	0.160	0.041	0.064	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt (Co)-Total	0.020	mg/kg	0.107	0.023	0.081	0.029	<0.020	0.024	<0.020	0.036
Cobalt (Co)-Total	0.0040	mg/kg wwt	0.0426	0.0075	0.0340	0.0041	<0.0040	<0.0040	<0.0040	0.0053
Copper (Cu)-Total	0.10	mg/kg	4.22	4.68	3.67	2.34	3.40	3.90	3.40	3.11
Copper (Cu)-Total	0.020	mg/kg wwt	1.68	1.51	1.55	0.336	0.427	0.484	0.516	0.453
Iron (Fe)-Total	3.0	mg/kg	210	64.2	94.8	18.4	11.4	16.7	9.0	32.1
Iron (Fe)-Total	0.60	mg/kg wwt	83.8	20.8	39.9	2.64	1.43	2.08	1.37	4.67
Lead (Pb)-Total	0.020	mg/kg	0.122	0.119	0.091	<0.020	<0.020	<0.020	<0.020	<0.020
Lead (Pb)-Total	0.0040	mg/kg wwt	0.0489	0.0386	0.0385	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Lithium (Li)-Total	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium (Li)-Total	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total	2.0	mg/kg	3600	2740	4100	639	408	504	481	694
Magnesium (Mg)-Total	0.40	mg/kg wwt	1440	887	1730	91.9	51.2	62.6	73.1	101
Manganese (Mn)-Total	0.050	mg/kg	218	1800	369	371	130	59.1	90.2	441
Manganese (Mn)-Total	0.010	mg/kg wwt	86.9	582	156	53.4	16.4	7.35	13.7	64.2
Mercury (Hg)-Total	0.0050	mg/kg	0.0125	0.0147	0.0106	<0.0054	<0.0050	<0.0054	<0.0058	<0.0060
Mercury (Hg)-Total	0.0010	mg/kg wwt	0.0050	0.0047	0.0045	<0.0011	<0.0010	<0.0011	<0.0012	<0.0012
Molybdenum (Mo)-Total	0.020	mg/kg	0.860	0.074	1.77	0.259	0.266	0.069	0.430	0.193
Molybdenum (Mo)-Total	0.0040	mg/kg wwt	0.344	0.0238	0.745	0.0373	0.0333	0.0085	0.0654	0.0281
Nickel (Ni)-Total	0.20	mg/kg	0.46	0.84	0.81	0.46	0.32	0.84	0.55	1.38
Nickel (Ni)-Total	0.040	mg/kg wwt	0.183	0.273	0.343	0.067	<0.040	0.105	0.084	0.201
Phosphorus (P)-Total	10	mg/kg	3330	1130	4340	1000	998	429	925	1700
Phosphorus (P)-Total	2.0	mg/kg wwt	1330	364	1830	144	125	53.4	140	247
Potassium (K)-Total	20	mg/kg	10700	6390	6930	5370	4610	5810	5190	7270
Potassium (K)-Total	4.0	mg/kg wwt	4260	2070	2920	773	577	722	789	1060
Rubidium (Rb)-Total	0.050	mg/kg	7.05	13.2	3.36	31.3	20.9	40.4	48.5	31.0
Rubidium (Rb)-Total	0.010	mg/kg wwt	2.82	4.27	1.42	4.51	2.62	5.02	7.37	4.50
Selenium (Se)-Total	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)-Total	0.010	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium (Na)-Total	20	mg/kg	<20	55	<20	<20	<20	<20	<20	23
Sodium (Na)-Total	4.0	mg/kg wwt	6.6	17.8	6.0	<4.0	<4.0	<4.0	<4.0	<4.0
Strontium (Sr)-Total	0.050	mg/kg	48.3	4.11	47.1	1.90	1.56	6.77	2.53	2.05
Strontium (Sr)-Total	0.010	mg/kg wwt	19.3	1.33	19.8	0.273	0.196	0.842	0.384	0.298
Tellurium (Te)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Tellurium (Te)-Total	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	0.0020	mg/kg	0.0029	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Thallium (Tl)-Total	0.00040	mg/kg wwt	0.00115	<0.00040	0.00057	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Tin (Sn)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	3.86	2.73	1.41	0.98	8.56
Tin (Sn)-Total	0.020	mg/kg wwt	<0.020	<0.020	<0.020	0.556	0.342	0.176	0.148	1.24
Uranium (U)-Total	0.0020	mg/kg	0.0059	0.0021	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Uranium (U)-Total	0.00040	mg/kg wwt	0.00235	0.00066	0.00101	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Vanadium (V)-Total	0.10	mg/kg	0.33	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)-Total	0.020	mg/kg wwt	0.133	<0.020	0.048	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc (Zn)-Total	0.50	mg/kg	11.4	14.5	40.9	7.24	4.05	3.76	4.35	10.6
Zinc (Zn)-Total	0.10	mg/kg wwt	4.57	4.68	17.3	1.04	0.51	0.47	0.66	1.55
Zirconium (Zr)-Total	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Zirconium (Zr)-Total	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals (Matrix: Biota)										
arsenate [As V]	0.025	mg/kg				<0.025	<0.025	0.028	<0.025	0.026
arsenate [As V]	0.005	mg/kg wwt				<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
arsenite [As III]	0.005	mg/kg				0.0207	<0.0050	<0.0050	<0.0050	0.005
arsenite [As III]	0.001	mg/kg wwt				0.003	<0.0010	<0.0010	<0.0010	<0.0010
arsenobetaine [AsB], (as As)	0.005	mg/kg				<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
arsenobetaine [AsB], (as As)	0.001	mg/kg wwt				<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenocholine [AsC], (as As)	0.005	mg/kg				<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
arsenocholine [AsC], (as As)	0.001	mg/kg wwt				<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
dimethylarsinic acid [DMA], (as As)	0.005	mg/kg				<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
dimethylarsinic acid [DMA], (as As)	0.001	mg/kg wwt				<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
monomethylarsonic acid [MMA], (as As)	0.005	mg/kg				<0.0050	<0.0050	0.0174	<0.0050	<0.0050
monomethylarsonic acid [MMA], (as As)	0.001	mg/kg wwt				<0.0010	<0.0010	0.0022	<0.0010	<0.0010

1.4.2 Small Mammals

Field sampling for the small mammals was conducted on September 24, 2022. Terrestrial sites were accessed either by helicopter or on foot by two qualified field technicians. Small mammal and co-located soil sample locations are presented in Figure A-1.

Small Mammal Sampling Methods

At each of the co-located soil sampling locations, a series of 5 snap traps were set. Traps were checked each morning during the field work. Wearing nitrile gloves any small mammal carcasses which were trapped were collected for potential chemistry analysis. A total of 20 small mammals were trapped and submitted for analysis. Fifteen of the small mammal samples were submitted as whole body samples for metals, mercury and moisture analyses. The remaining 5 small mammal samples had their kidney dissected, with the kidney and whole body (minus kidney) submitted for separate metals, mercury and moisture analyses.

Disposable nitrile gloves were worn at all times and changed between samples to avoid cross-contamination. All small mammal samples were stored in coolers with icepacks until they could be transferred to a freezer at the end of the sampling day. Samples were packed on ice and transported to ALS Laboratories with a completed Chain of Custody listing the sample IDs and requested analyses.

A summary of the baseline data sampling program for small mammals is displayed in Table A-7.

Table A-7: Summary of Baseline Data Sampling Program for Small Mammals

	Species	Number of Samples - Whole Body Analyses	Number of Samples – Kidney Analyses	Number of Samples – Whole Body minus Kidney Analyses
Small mammals	Deer mouse	7	1	1
	Red back vole	7	2	2
	Shrew	1	1	1

Small Mammal Analytical Results

The metals chemistry for small mammals is displayed in Table A-8. Based on a review of the data, the whole-body analyses data (15 samples) were used in the human health risk assessment as a surrogate to assess consumption of small mammal (hare) country foods, and in the ecological risk assessment. The 95th UCLM concentrations of COPCs from the baseline study were used to represent baseline concentrations in small mammals, prior to examining the potential incremental effects of the Project.

Table A-8: 2021-2022 Baseline Laboratory Results - Small Mammals

		species	deer mouse	red back vole	red back vole	shrew	red back vole	deer mouse	red back vole	red back vole	deer mouse	red back vole	deer mouse	deer mouse	red back vole	deer mouse
Sample ID			**ONS2104-22-SM-01-WholeBody (T5-01-2)**	**ONS2104-22-SM-02-WholeBody (T3-04-1)**	**ONS2104-22-SM-03-WholeBody (T2-05-1)**	**ONS2104-22-SM-04-WholeBody (T3-01-1)**	**ONS2104-22-SM-05-WholeBody (T5-05-1)**	**ONS2104-22-SM-06-WholeBody (T6-01-1)**	**ONS2104-22-SM-07-WholeBody (T1-01-1)**	**ONS2104-22-SM-08-WholeBody (T4-02-1)**	**ONS2104-22-SM-09-WholeBody (T8-03-1)**	**ONS2104-22-SM-10-WholeBody (T1-03-1)**	**ONS2104-22-SM-11-WholeBody (T6-02-1)**	**ONS2104-22-SM-12-WholeBody (T7-01-1)**	**ONS2104-22-SM-13-WholeBody (T2-03-1)**	**ONS2104-22-SM-14-WholeBody (T8-04-1)**
Date Sampled			**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**
Parameter	**Lowest Detection Limit**	**Units**														
moisture	0.5	%	55.5	62.6	61.4	65.2	69.3	58.4	68.4	67	59.2	64.4	60	60.7	61.4	56
aluminum	2	mg/kg	82.2	30.3	13.2	7.4	23	34.1	13.6	43.9	122	16.8	51.9	179	15.1	48.6
aluminum	0.4	mg/kg wwt	36.6	11.3	5.11	2.56	7.07	14.2	4.31	14.5	49.6	5.97	20.8	70.4	5.83	21.4
antimony	0.01	mg/kg	0.165	0.042	0.017	<0.010	0.012	0.115	0.023	0.034	0.09	0.036	0.017	0.018	0.027	0.086
antimony	0.002	mg/kg wwt	0.0734	0.0157	0.0067	0.0024	0.0038	0.0478	0.0074	0.0114	0.0366	0.0128	0.0067	0.0071	0.0104	0.0377
arsenic	0.02	mg/kg	0.113	0.116	0.065	0.142	0.259	0.179	0.071	0.267	0.314	0.056	0.194	0.377	0.068	0.15
arsenic	0.004	mg/kg wwt	0.0504	0.0432	0.0252	0.0496	0.0794	0.0745	0.0224	0.0883	0.128	0.0199	0.0777	0.148	0.0264	0.0658
barium	0.05	mg/kg	9.39	18.9	59.6	4.11	8.04	19.3	15.9	12.8	28	20	7.45	11.5	38	12.7
barium	0.01	mg/kg wwt	4.18	7.08	23	1.43	2.46	8.04	5.01	4.22	11.4	7.1	2.98	4.54	14.7	5.58
beryllium	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0064	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0025
boron	1	mg/kg	2.6	1.1	1.2	<1.0	3.2	10.4	1.7	1.2	2.1	2.2	4.4	3.6	4.1	2
boron	0.2	mg/kg wwt	1.16	0.42	0.48	0.25	0.99	4.31	0.53	0.39	0.86	0.78	1.76	1.42	1.59	0.9
cadmium	0.005	mg/kg	0.029	0.0422	0.164	0.173	0.0341	0.0248	0.0441	0.106	0.0433	0.0505	0.0659	0.0492	0.0464	0.039
cadmium	0.001	mg/kg wwt	0.0129	0.0157	0.0633	0.0603	0.0104	0.0103	0.0139	0.035	0.0177	0.018	0.0264	0.0193	0.0179	0.0172
calcium	20	mg/kg	17900	24100	20500	24700	14100	23000	25300	17800	27100	29300	23400	25200	31800	20600
calcium	4	mg/kg wwt	7980	9010	7930	8600	4340	9560	7990	5880	11100	10400	9360	9920	12300	9070
cesium	0.005	mg/kg	0.0585	2.7	3.54	0.609	0.131	0.0386	0.648	1.61	0.0627	0.696	0.109	0.124	1.4	0.142
cesium	0.001	mg/kg wwt	0.026	1.01	1.37	0.212	0.0402	0.0161	0.204	0.532	0.0256	0.248	0.0435	0.0487	0.54	0.0627
chromium	0.05	mg/kg	0.342	0.293	0.055	0.09	0.089	0.393	0.164	0.138	0.826	0.066	0.356	0.396	0.071	0.345
chromium	0.01	mg/kg wwt	0.152	0.11	0.021	0.031	0.027	0.163	0.052	0.046	0.337	0.023	0.142	0.155	0.027	0.152
cobalt	0.02	mg/kg	0.106	0.187	0.122	0.062	0.436	0.074	0.146	0.189	0.2	0.139	0.107	0.263	0.144	0.108
cobalt	0.004	mg/kg wwt	0.0472	0.07	0.0473	0.0214	0.134	0.0307	0.0462	0.0624	0.0817	0.0495	0.0427	0.103	0.0555	0.0476
copper	0.1	mg/kg	7.73	6.38	7.38	9.88	6.92	5.71	7.87	8.04	8.81	8.22	8.26	11	8.18	8.33
copper	0.02	mg/kg wwt	3.44	2.38	2.85	3.44	2.12	2.38	2.48	2.66	3.6	2.93	3.3	4.32	3.16	3.67
iron	3	mg/kg	295	200	327	330	303	177	282	211	512	219	263	688	173	290
iron	0.6	mg/kg wwt	131	74.6	126	115	93	73.7	89	69.8	209	77.9	105	270	66.8	128
lead	0.02	mg/kg	0.64	0.312	0.119	0.087	0.066	0.886	0.082	0.144	0.977	0.119	1.77	0.168	0.098	1.01
lead	0.004	mg/kg wwt	0.285	0.116	0.0461	0.0303	0.0204	0.369	0.0258	0.0474	0.399	0.0422	0.708	0.0662	0.0379	0.444
lithium	0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.1	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2	mg/kg	917	1060	987	1110	1100	899	1240	1100	1250	1290	1200	1570	1220	1020
magnesium	0.4	mg/kg wwt	408	398	381	388	338	374	391	364	512	461	482	618	473	448
manganese	0.05	mg/kg	8.4	39.4	28.5	25.7	80.6	4.31	32	22.6	14.8	23	9.32	20.9	37.5	7.61
manganese	0.01	mg/kg wwt	3.74	14.7	11	8.93	24.7	1.8	10.1	7.48	6.05	8.18	3.73	8.22	14.5	3.35
mercury	0.005	mg/kg	0.0098	0.148	0.164	0.103	0.0083	0.0155	0.171	0.366	0.0151	0.196	0.0118	0.0086	0.168	0.0136
mercury	0.001	mg/kg wwt	0.0044	0.0552	0.0635	0.0359	0.0026	0.0064	0.0539	0.121	0.0062	0.0697	0.0047	0.0034	0.0649	0.006
molybdenum	0.02	mg/kg	0.451	0.364	0.378	0.418	1.16	0.454	0.379	0.654	0.572	0.42	0.532	0.686	0.37	0.664
molybdenum	0.004	mg/kg wwt	0.2	0.136	0.146	0.145	0.357	0.189	0.12	0.216	0.234	0.15	0.213	0.269	0.143	0.292
nickel	0.2	mg/kg	0.29	0.38	0.22	<0.20	0.45	<0.20	0.32	0.32	0.56	0.3	0.35	1.05	0.3	1.29
nickel	0.04	mg/kg wwt	0.13	0.141	0.084	<0.040	0.138	0.074	0.1	0.108	0.227	0.106	0.14	0.414	0.116	0.568
phosphorus	10	mg/kg	14800	18400	17700	20200	14300	18200	23000	18000	22500	21300	19300	20900	25800	16400
phosphorus	2	mg/kg wwt	6560	6880	6830	7030	4400	7590	7270	5960	9210	7580	7720	8220	9940	7210
potassium	20	mg/kg	6950	9120	8940	9160	11000	7410	11600	11200	7550	10500	8510	8440	9850	7400
potassium	4	mg/kg wwt	3090	3400	3450	3190	3370	3080	3660	3690	3080	3730	3400	3310	3800	3260
rubidium	0.05	mg/kg	16.4	70.6	55.4	33.1	35.1	14.8	60.6	74.7	24	42.4	22.3	17.6	59.7	19.4
rubidium	0.01	mg/kg wwt	7.31	26.4	21.4	11.5	10.8	6.14	19.1	24.7	9.79	15.1	8.93	6.92	23.1	8.55
selenium	0.05	mg/kg	0.562	0.797	0.867	1.81	0.162	0.666	0.842	1.31	0.577	0.768	0.687	0.672	0.668	0.632
selenium	0.01	mg/kg wwt	0.25	0.298	0.335	0.631	0.05	0.277	0.266	0.434	0.236	0.273	0.275	0.264	0.258	0.278
sodium	20	mg/kg	3070	3640	3570	4210	4210	3000	3800	3780	3300	3660	3530	3380	3620	3250
sodium	4	mg/kg wwt	1370	1360	1380	1460	1290	1250	1200	1250	1350	1300	1410	1330	1400	1430
strontium	0.05	mg/kg	8.77	6.74	10.5	7.22	11.2	10.9	15.5	13.9	12.3	9.72	10.3	10.6	9.7	11.2
strontium	0.01	mg/kg wwt	3.9	2.52	4.04	2.51	3.45	4.54	4.9	4.6	5.04	3.46	4.12	4.14	3.74	4.92
tellurium	0.02	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.002	mg/kg	0.0038	0.0144	0.0079	0.034	0.0078	0.006	0.0044	0.0117	0.0047	0.0056	0.0031	0.01	0.0068	0.0034
thallium	0.0004	mg/kg wwt	0.00167	0.00537	0.00305	0.0118	0.00238	0.00251	0.0014	0.00386	0.00194	0.00201	0.00124	0.00393	0.00261	0.00152
tin	0.1	mg/kg	0.76	0.55	0.69	0.89	0.63	<0.10	0.61	0.68	0.56	0.38	0.55	0.47	0.53	0.41
tin	0.02	mg/kg wwt	0.339	0.205	0.266	0.31	0.194	0.027	0.192	0.225	0.23	0.134	0.219	0.184	0.204	0.181
uranium	0.002	mg/kg	0.004	0.0027	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	0.0026	0.0054	<0.0020	0.0033	0.0038	<0.0020	0.0027
uranium	0.0004	mg/kg wwt	0.00178	0.00102	<0.00040	<0.00040	<0.00040	0.00097	<0.00040	0.00086	0.0022	0.00056	0.00133	0.00147	0.00052	0.00119
vanadium	0.1	mg/kg	0.24	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	0.45	<0.10	0.18	0.56	<0.10	0.14
vanadium	0.02	mg/kg wwt	0.109	0.029	<0.020	<0.020	0.02	0.03	<0.020	0.041	0.183	<0.020	0.07	0.219	<0.020	0.064
zinc	0.5	mg/kg	71.3	85.3	80.3	103	76.3	69.1	88.4	81	111	84	81.6	87.4	83.4	95.2
zinc	0.1	mg/kg wwt	31.7	31.9	31	35.8	23.4	28.8	27.9	26.8	45.5	29.9	32.6	34.3	32.2	41.9
zirconium	0.2	mg/kg	0.47	<0.25	<0.25	<1.20	<0.25	<0.85	<0.80	0.3	<0.70	<0.20	<0.30	<0.55	0.25	<0.45
zirconium	0.04	mg/kg wwt	0.211	<0.090	<0.100	<0.350	<0.070	<0.340	<0.240	0.1	<0.280	0.048	<0.110	<0.220	0.098	<0.110

Table A-8: 2021-2022 Baseline Laboratory Results - Small Mammals

		species	deer mouse	shrew	shrew	red back vole	red back vole	deer mouse	deer mouse	red back vole	red back vole	red back vole	red back vole
Sample ID			**ONS2104-22-SM-15-WholeBody (T8-04-1)**	**ONS2104-22-SM-16-WholeBody minus Kidney (T6-04-1)**	**ONS2104-22-SM-16-Kidney (T6-04-1)**	**ONS2104-22-SM-17-WholeBody minus Kidney (T4-05-1)**	**ONS2104-22-SM-17-Kidney (T4-05-1)**	**ONS2104-22-SM-18-WholeBody minus Kidney (T5-03-1)**	**ONS2104-22-SM-18-Kidney (T5-03-1)**	**ONS2104-22-SM-19-WholeBody minus Kidney (T3-02-1)**	**ONS2104-22-SM-19-Kidney (T3-02-1)**	**ONS2104-22-SM-20-WholeBody minus Kidney (T2-02-1)**	**ONS2104-22-SM-20-Kidney (T2-02-1)**
Date Sampled			**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**	**24-Sep-2022**
Parameter	**Lowest Detection Limit**	**Units**											
moisture	0.5	%	58.2	57.9	67.6	68.1	70.6	62.2	69.7	63.7	69.3	67.3	67.3
aluminum	2	mg/kg	25.2	50.8	7.6	413	<5.0	51.8	10.3	18	<5.0	24.3	<5.0
aluminum	0.4	mg/kg wwt	10.5	21.4	2.5	132	<1.0	19.6	3.1	6.55	1.5	7.95	1.2
antimony	0.01	mg/kg	<0.010	0.036	<0.010	0.119	0.013	0.041	<0.020	0.052	<0.020	0.03	<0.020
antimony	0.002	mg/kg wwt	0.0042	0.0154	0.002	0.0381	0.0037	0.0157	<0.0040	0.0191	<0.0040	0.01	<0.0040
arsenic	0.02	mg/kg	0.055	0.231	0.142	0.567	0.258	0.138	0.098	0.08	<0.050	0.097	0.055
arsenic	0.004	mg/kg wwt	0.0231	0.0974	0.0461	0.181	0.0757	0.0523	0.03	0.029	0.011	0.0316	0.018
barium	0.05	mg/kg	16.8	9.99	0.14	16.6	0.285	15.6	0.233	12.2	0.223	19.2	0.215
barium	0.01	mg/kg wwt	7.03	4.21	0.045	5.3	0.084	5.9	0.071	4.44	0.068	6.26	0.07
beryllium	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	0.0032	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.02	<0.010	0.014
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	0.0061	<0.0020	0.0047
boron	1	mg/kg	3.9	2.6	<1.0	3.1	<1.0	2.3	1.4	1.5	<1.0	2	1.4
boron	0.2	mg/kg wwt	1.62	1.08	0.21	0.99	<0.20	0.87	0.43	0.56	<0.20	0.64	0.45
cadmium	0.005	mg/kg	0.0508	0.169	2.04	0.322	5.2	0.0536	0.859	0.0358	0.772	0.0603	0.614
cadmium	0.001	mg/kg wwt	0.0212	0.0711	0.662	0.103	1.53	0.0203	0.261	0.013	0.237	0.0197	0.201
calcium	20	mg/kg	18600	44000	246	14300	211	27900	218	25500	246	46700	268
calcium	4	mg/kg wwt	7800	18500	79.6	4550	62	10600	66.2	9260	75.6	15300	87.8
cesium	0.005	mg/kg	0.0416	0.0591	0.0593	0.719	0.684	0.0934	0.126	0.882	1.16	1.3	1.7
cesium	0.001	mg/kg wwt	0.0174	0.0249	0.0192	0.23	0.201	0.0354	0.0382	0.32	0.357	0.424	0.555
chromium	0.05	mg/kg	0.098	0.178	<0.20	1.46	<0.20	0.216	<0.20	0.119	<0.20	0.079	<0.20
chromium	0.01	mg/kg wwt	0.041	0.075	<0.040	0.466	<0.040	0.082	<0.040	0.043	<0.040	0.026	<0.040
cobalt	0.02	mg/kg	0.097	0.113	0.402	0.551	0.378	0.106	0.311	0.134	0.141	0.164	0.107
cobalt	0.004	mg/kg wwt	0.0404	0.0478	0.13	0.176	0.111	0.0402	0.0944	0.0488	0.0432	0.0538	0.035
copper	0.1	mg/kg	8.82	6.44	25.2	10.8	18.5	9.41	24	8.61	17.6	7.73	17.9
copper	0.02	mg/kg wwt	3.69	2.71	8.15	3.46	5.42	3.56	7.28	3.13	5.42	2.53	5.86
iron	3	mg/kg	178	337	261	886	209	306	358	268	396	203	283
iron	0.6	mg/kg wwt	74.6	142	84.6	283	61.4	116	109	97.3	122	66.4	92.7
lead	0.02	mg/kg	0.734	0.396	0.176	0.416	0.407	1.52	0.391	0.12	0.114	0.22	0.059
lead	0.004	mg/kg wwt	0.307	0.167	0.057	0.133	0.12	0.576	0.119	0.0438	0.035	0.0718	0.019
lithium	0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.1	mg/kg wwt	<0.10	<0.10	<0.10	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2	mg/kg	1290	1380	643	1330	805	1370	856	1500	782	1740	830
magnesium	0.4	mg/kg wwt	540	584	208	425	236	520	260	544	240	570	272
manganese	0.05	mg/kg	13.9	10	3.81	28.9	7.75	13.6	4.68	40.1	9.61	58	9.54
manganese	0.01	mg/kg wwt	5.8	4.22	1.23	9.22	2.28	5.16	1.42	14.6	2.95	19	3.12
mercury	0.005	mg/kg	0.0073	0.131	0.522	0.2	0.355	0.0131	0.167	0.179	1.88	0.184	2.15
mercury	0.001	mg/kg wwt	0.0031	0.0553	0.169	0.0637	0.104	0.005	0.0507	0.0649	0.578	0.0603	0.705
molybdenum	0.02	mg/kg	0.85	0.746	2.67	0.862	3	0.511	1.86	0.411	1.95	0.409	1.86
molybdenum	0.004	mg/kg wwt	0.356	0.314	0.866	0.275	0.880	0.193	0.563	0.149	0.598	0.134	0.608
nickel	0.2	mg/kg	1.06	<0.20	<0.20	1.17	<0.20	0.25	<0.20	0.30	<0.20	0.32	<0.20
nickel	0.04	mg/kg wwt	0.445	0.047	<0.040	0.373	<0.040	0.094	<0.040	0.107	<0.040	0.103	<0.040
phosphorus	10	mg/kg	16300	28200	13100	14000	14900	22200	15500	20500	14900	31100	15100
phosphorus	2	mg/kg wwt	6810	11900	4250	4470	4380	8410	4710	7450	4570	10200	4950
potassium	20	mg/kg	8270	6890	8110	11100	10200	9180	10100	10000	10300	10600	11100
potassium	4	mg/kg wwt	3460	2900	2630	3530	3000	3470	3060	3650	3170	3470	3620
rubidium	0.05	mg/kg	12.5	14.1	18.3	40.2	37.6	33.9	38.9	51.4	58.0	64.6	73.4
rubidium	0.01	mg/kg wwt	5.21	5.96	5.94	12.8	11.0	12.8	11.8	18.7	17.8	21.1	24.0
selenium	0.05	mg/kg	0.516	1.25	5.32	1.18	4.99	0.650	5.50	0.727	4.03	0.742	5.03
selenium	0.01	mg/kg wwt	0.216	0.528	1.72	0.376	1.46	0.246	1.67	0.264	1.23	0.242	1.65
sodium	20	mg/kg	3080	3440	4330	3880	4930	3900	6560	3190	3700	4210	4590
sodium	4	mg/kg wwt	1290	1450	1400	1240	1450	1480	1990	1160	1130	1380	1500
strontium	0.05	mg/kg	9.07	15.1	<0.10	12.6	0.24	12.7	<0.10	13.3	0.10	12.4	0.11
strontium	0.01	mg/kg wwt	3.79	6.36	0.032	4.03	0.069	4.81	0.027	4.84	0.031	4.05	0.035
tellurium	0.02	mg/kg	<0.020	<0.020	0.025	<0.020	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	0.0082	<0.0040	0.0060	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.002	mg/kg	0.0024	0.0112	0.162	0.0118	0.0127	0.0049	0.0277	0.0092	0.0234	0.0076	0.0284
thallium	0.0004	mg/kg wwt	0.00101	0.00470	0.0527	0.00377	0.00374	0.00184	0.00839	0.00333	0.00718	0.00248	0.00929
tin	0.1	mg/kg	0.57	0.30	<0.10	0.35	<0.10	0.43	<0.10	0.36	<0.10	0.55	<0.10
tin	0.02	mg/kg wwt	0.238	0.125	<0.020	0.111	<0.020	0.161	<0.020	0.130	<0.020	0.179	<0.020
uranium	0.002	mg/kg	<0.0020	0.0048	0.0054	0.0204	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	0.0022	<0.0020
uranium	0.0004	mg/kg wwt	0.00059	0.00200	0.00175	0.00651	<0.00040	0.00081	<0.00040	0.00059	<0.00040	0.00072	<0.00040
vanadium	0.1	mg/kg	<0.10	0.18	<0.10	1.31	<0.10	0.15	<0.10	<0.10	<0.10	<0.10	<0.10
vanadium	0.02	mg/kg wwt	0.03	0.077	<0.020	0.419	<0.020	0.057	<0.020	<0.020	<0.020	0.023	<0.020
zinc	0.5	mg/kg	74.4	96.8	69.2	93.9	75.3	95.6	73.0	87.8	72.0	120	78.7
zinc	0.1	mg/kg wwt	31.1	40.8	22.4	30.0	22.1	36.2	22.2	31.9	22.1	39.1	25.8
zirconium	0.2	mg/kg	<0.30	<0.20	<0.20	0.54	<0.20	0.22	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.04	mg/kg wwt	<0.110	0.079	<0.040	0.174	<0.040	0.083	<0.040	0.058	<0.040	0.058	<0.040

1.4.3 Fish Tissue

1.4.3.1 Metals

Fish sampling methodology and analytical results are presented in the Aquatic Resources Assessments (Appendix O-1, O-2 and O-3 in the EIS/EA). Tissue samples were collected from several species of fish, including Northern Pike, Lake Trout, Lake Whitefish, Walleye and foraging fish (e.g., Northern Pearl Dace) to support the baseline data collection for the Project. Aquatic sampling locations are shown in Figure A-2. Analytical data for metals in fish data are presented in:

- Table A-9 (2019 Baseline Fish Tissue Quality Laboratory Results – Fillets);
- Table A-10 (2022 Baseline Fish Tissue Quality Laboratory Results – Fillets);
- Table A-11 (2019 Baseline Fish Tissue Quality Laboratory Results - Small Bodied Fish);
- Table A-12 (2021 Baseline Fish Tissue Quality Laboratory Results - Small Bodied Fish); and
- Table A-13 (2022 Baseline Fish Tissue Quality Laboratory Results - Small Bodied Fish).

The analytical data for Walleye and Lake Whitefish were selected for use in the HHRA since they were identified by the local Indigenous communities as well as in Chan (et al 2014) to be preferred by Indigenous communities in the area. Walleye and Lake Whitefish are carnivorous fish that feed on smaller fish.

Table A-9: 2019 Baseline Fish Tissue Quality Laboratory Results - Fillets

Species			Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike
Sample ID			SPL-AN1-F1	SPL-AN1-F2	SPL-AN1-F3	SPL-AN1-F4	SPL-AN1-F5	SPL-AN1-F6	SPL-AN2-F1	SPL-AN2-F2	SPL-AN2-F3	SPL-AN2-F4	SPL-AN3-F1	SPL-AN3-F2	SPL-AN3-F3	SPL-AN4-F1	SPL-AN4-F2	SPL-AN4-F3	SPL-AN4-F4	SPL-AN5-F1	SPL-AN5-F2	SPL-AN5-F3
Date Sampled			10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	11-Sep-19	11-Sep-19	11-Sep-19	11-Sep-19	12-Sep-19	12-Sep-19	12-Sep-19	13-Sep-19	13-Sep-19	13-Sep-19	13-Sep-19	14-Sep-19	13-Sep-19	13-Sep-19
Parameter	**Lowest Detection Limit**	**Units**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**
Physical Tests (Tissue)																						
% Moisture	0.50	%	79.2	78.5	78.3	77.9	77.0	78.5	77.9	81.6	79.8	78.4	79.4	79.5	79.4	78.6	79.3	79.4	80.9	77.5	80.1	80.4
Metals (Tissue)																						
Aluminum (Al)-Total	2.0	mg/kg	2.1	3.0	<2.0	<2.0	<2.0	<2.0	4.0	8.8	2.7	2.3	2.6	5.6	7.5	<2.0	24.2	<2.0	<2.0	4.7	<2.0	<2.0
Antimony (Sb)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (As)-Total	0.020	mg/kg	0.200	0.317	0.211	0.123	0.305	0.192	0.133	0.609	0.399	0.356	0.542	0.336	0.123	0.059	0.089	0.740	0.157	0.069	0.151	0.150
Arsenic (As)-Total		mg/kg wwt	0.042	0.068	0.046	0.027	0.070	0.041	0.029	0.112	0.081	0.077	0.112	0.069	0.025	0.013	0.018	0.152	0.030	0.016	0.030	0.029
Barium (Ba)-Total	0.050	mg/kg	0.133	0.162	0.092	0.272	0.163	0.212	0.194	0.557	0.311	0.179	0.366	0.175	0.470	0.177	0.407	0.111	0.403	0.282	0.189	0.604
Beryllium (Be)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total	0.010	mg/kg	<0.010	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Boron (B)-Total	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium (Cd)-Total	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	0.0055	<0.0050	<0.0050	<0.0050	0.0189	0.0069	<0.0050	0.0077	<0.0050	<0.0050	<0.0050	<0.0050	0.0076	<0.0050	<0.0050	<0.0050	0.0109
Calcium (Ca)-Total	20	mg/kg	1660	1680	1670	6290	2790	3550	2990	4450	4380	1990	3110	1800	2580	5910	5450	1470	6930	7110	3680	5810
Cesium (Cs)-Total	0.0050	mg/kg	0.364	0.363	0.333	0.296	0.305	0.337	0.360	0.462	0.361	0.342	0.432	0.386	0.315	0.269	0.378	0.414	0.483	0.239	0.398	0.410
Chromium (Cr)-Total	0.050	mg/kg	0.060	<0.050	<0.050	<0.050	0.053	<0.050	0.091	0.081	0.057	0.056	<0.050	<0.050	0.073	0.106	0.116	<0.050	<0.050	<0.050	<0.050	0.069
Cobalt (Co)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Cobalt (Co)-Total	0.004	mg/kg wwt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper (Cu)-Total	0.10	mg/kg	0.80	0.98	0.75	0.76	0.72	0.75	0.60	0.78	0.76	0.66	0.86	0.85	0.88	0.69	0.62	0.61	0.52	0.61	0.61	0.70
Iron (Fe)-Total	3.0	mg/kg	39.2	21.9	9.5	8.8	8.3	11.5	15.0	29.8	14.8	13.3	15.3	17.4	24.1	6.0	45.5	13.7	6.5	11.3	11.3	13.9
Lead (Pb)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.023	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Lithium (Li)-Total	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)-Total	2.0	mg/kg	1590	1410	1660	1740	1630	1720	1630	1530	1670	1500	1690	1560	1650	1650	1660	1500	1500	1650	1580	1770
Manganese (Mn)-Total	0.050	mg/kg	0.914	0.735	0.832	1.85	0.974	1.26	2.55	2.25	1.85	1.35	1.49	1.24	1.24	1.79	2.10	0.794	1.91	2.45	1.21	2.96
Mercury (Hg)-Total	0.0050	mg/kg	2.02	1.67	1.02	0.530	0.865	1.49	0.981	3.49	2.04	1.88	2.15	1.65	0.645	0.389	0.625	1.97	3.83	0.646	1.52	3.60
Mercury (Hg)-Total		mg/kg wwt	0.42	0.36	0.22	0.12	0.20	0.32	0.22	0.64	0.41	0.41	0.44	0.34	0.13	0.08	0.13	0.41	0.73	0.15	0.30	0.71
Molybdenum (Mo)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Molybdenum (Mo)-Total		mg/kg wwt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel (Ni)-Total	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus (P)-Total	10	mg/kg	12400	11900	13500	16300	13200	14100	13300	13600	14400	12200	14500	12500	13600	14900	14400	12100	14700	15300	14200	15400
Potassium (K)-Total	20	mg/kg	22900	19900	23100	23300	21300	22400	21400	20200	21500	19700	23200	21500	23200	22100	21200	20400	18700	20600	23100	21900
Rubidium (Rb)-Total	0.050	mg/kg	69.6	61.5	69.7	78.5	71.1	75.8	74.1	68.6	65.8	70.8	78.8	74.0	72.4	74.3	67.7	69.3	59.7	57.7	79.3	66.8
Selenium (Se)-Total	0.050	mg/kg	1.21	1.32	1.51	1.48	1.31	1.23	1.10	1.39	1.19	1.16	1.24	1.07	1.22	1.09	1.30	1.37	1.13	0.932	1.19	1.21
Selenium (Se)-Total		mg/kg wwt	0.25	0.28	0.33	0.33	0.30	0.26	0.24	0.26	0.24	0.25	0.26	0.22	0.25	0.23	0.27	0.28	0.22	0.21	0.24	0.24
Sodium (Na)-Total	20	mg/kg	1320	1470	1420	1780	1270	1480	1470	1820	1700	1660	1760	1500	1550	1420	1680	1510	1100	1580	1550	1940
Strontium (Sr)-Total	0.050	mg/kg	0.500	0.635	0.465	2.24	0.778	1.13	0.856	1.81	1.82	0.748	1.13	0.561	0.766	1.52	1.88	0.420	2.47	2.74	1.17	2.54
Tellurium (Te)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	0.0020	mg/kg	0.0190	0.0176	0.0240	0.0194	0.0210	0.0203	0.0195	0.0154	0.0286	0.0268	0.0255	0.0172	0.0170	0.0141	0.0195	0.0174	0.0143	0.0147	0.0203	0.0168
Tin (Sn)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium (U)-Total	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium (V)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc (Zn)-Total	0.50	mg/kg	37.2	29.8	25.0	29.5	36.5	34.0	22.9	31.8	37.1	21.8	37.0	34.2	27.7	24.1	24.8	24.4	25.7	38.6	25.2	42.9
Zirconium (Zr)-Total	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Speciated Metals (Tissue)																						
Methylmercury (as MeHg)	0.0050	mg/kg	2.19	1.10	0.610	0.504	0.391	1.41	0.970	3.88	2.11	1.13	2.10	1.34	0.344	0.333	0.653	1.64	4.47	0.611	1.29	3.91
		mg/kg wwt	0.46	0.24	0.13	0.11	0.09	0.30	0.21	0.71	0.43	0.24	0.43	0.27	0.07	0.07	0.14	0.34	0.85	0.14	0.26	0.77
Aggregate Organics (Tissue)																						
Lipid Content	0.5	% wwt	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	0.6	0.5	0.7	0.5	0.6

Table A-10: 2022 Baseline Fish Tissue Quality Laboratory Results - Fillets

			Lake Whitefish	Lake Whitefish	Lake Whitefish	Lake Whitefish	Lake Whitefish	Lake Whitefish	Walleye	Walleye	Walleye	Walleye	Walleye	Walleye	Walleye	Walleye	Walleye	Walleye	Walleye	Walleye
Sample ID			**NB-LG-12-20-G1-LKWH-F7**	**NB-LG-20-35-G2-LKWH-F2**	**NB-LG-12-20-G1-LKWH-F4**	**NB-LG-20-35-G2-LKWH-F3**	**NB-LG-20-35-G2-LKWH-F4**	**NB-LG-12-20-G1-LKWH-F1**	**NB-LG-1-3-GN1-WALL-F-2-15**	**NB-LG-1-3-GN1-WALL-F-2-29**	**NB-LG-1-3-GN1-WALL-F16**	**NB-LG-1-3-GN1-WALL-F-2-26**	**NB-LG-1-3-GN1-WALL-F-2-16**	**NB-SM-3-6-G1-WALL-F-6**	**NB-LM-1-3-GN1-WALL-F-3**	**NB-SM-3-6-G1-WALL-F-4**	**NB-SM-3-6-G1-WALL-F-3**	**NB-LM-1-3-GN1-WALL-F-2**	**NB-SM-3-6-G1-WALL-F-2**	**NB-SM-3-6-GN1-WALL-F-8**
Date Sampled			**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**	**17-Aug-2022**
Analyte	**Lowest Detection Limit**	**Units**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**
Physical Tests (Matrix: Biota)																				
Moisture	0.50	%	77.2	76	75	77.2	73.4	73.9	78.1	75.7	77.7	77.6	77.5	77.7	79.1	79.4	77.6	77	76.9	78.6
Metals (Matrix: Biota)																				
aluminum	2.0	mg/kg	4.3	2.3	10.0	6.7	5.6	29.2	3.1	<2.0	<2.0	3.7	3.6	<2.0	2.2	3.7	3.3	2.2	5.4	3.6
aluminum	0.40	mg/kg wwt	0.98	0.56	2.50	1.53	1.47	7.61	0.69	0.47	<0.40	0.83	0.82	0.44	0.46	0.76	0.74	0.51	1.25	0.77
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	2.32	1.76	0.495	0.427	0.925	0.957	0.196	0.164	0.224	0.184	0.316	0.204	0.256	0.292	0.250	0.209	0.258	0.258
arsenic	0.0040	mg/kg wwt	0.529	0.423	0.123	0.0973	0.246	0.25	0.0429	0.0399	0.0498	0.0412	0.0711	0.0455	0.0534	0.0602	0.0561	0.0481	0.0595	0.0551
barium	0.050	mg/kg	0.16	0.052	0.183	0.202	0.12	0.177	0.108	0.108	0.06	0.148	0.1	0.071	<0.050	0.488	0.094	0.077	0.194	0.104
barium	0.010	mg/kg wwt	0.037	0.012	0.046	0.046	0.032	0.046	0.024	0.026	0.013	0.033	0.022	0.016	<0.010	0.101	0.021	0.018	0.045	0.022
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0024	<0.0020
boron	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
boron	0.20	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cadmium	0.0010	mg/kg wwt	0.0011	<0.0010	<0.0010	<0.0010	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
calcium	20	mg/kg	2300	395	498	1500	1280	1130	1510	2190	427	2370	1010	1030	577	7250	926	452	2460	452
calcium	4.0	mg/kg wwt	527	94.7	124	342	339	296	332	531	95.0	532	228	229	120	1500	207	104	567	96.7
cesium	0.0050	mg/kg	0.154	0.103	0.105	0.102	0.105	0.174	0.309	0.322	0.381	0.322	0.439	0.325	0.285	0.336	0.344	0.365	0.323	0.350
cesium	0.0010	mg/kg wwt	0.0351	0.0247	0.0263	0.0232	0.0280	0.0453	0.0677	0.0780	0.0847	0.0722	0.0988	0.0723	0.0595	0.0693	0.0770	0.0838	0.0746	0.0749
chromium	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	0.058	0.154	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
chromium	0.010	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	0.011	0.015	0.034	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
cobalt	0.020	mg/kg	<0.020	0.022	<0.020	<0.020	0.028	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
cobalt	0.0040	mg/kg wwt	<0.0040	0.0052	0.0047	<0.0040	0.0074	0.0047	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
copper	0.10	mg/kg	0.60	0.67	0.74	0.75	0.75	0.67	1.12	0.88	0.76	0.83	0.75	0.76	0.65	0.95	0.62	0.74	0.93	0.67
copper	0.020	mg/kg wwt	0.138	0.161	0.184	0.171	0.199	0.174	0.244	0.213	0.169	0.186	0.170	0.170	0.135	0.196	0.138	0.170	0.214	0.144
iron	3.0	mg/kg	14.3	18.3	28.4	22.1	18.9	36.7	14.4	9.0	7.2	13.5	13.1	8.9	9.2	14.0	10.5	13.4	15.7	9.8
iron	0.60	mg/kg wwt	3.27	4.39	7.07	5.03	5.02	9.57	3.15	2.19	1.60	3.02	2.96	1.98	1.92	2.89	2.34	3.07	3.62	2.10
lead	0.020	mg/kg	0.039	<0.020	0.076	0.093	0.034	<0.020	<0.020	<0.020	<0.020	0.020	0.023	<0.020	0.059	0.027	0.026	0.040	0.143	<0.020
lead	0.0040	mg/kg wwt	0.0090	<0.0040	0.0190	0.0212	0.0092	0.0047	0.0040	<0.0040	<0.0040	0.0046	0.0053	<0.0040	0.0122	0.0056	0.0058	0.0091	0.0330	<0.0040
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	1220	1200	1310	1480	1120	1460	1410	1530	1480	1500	1520	1540	1370	1830	1540	1320	1600	1540
magnesium	0.40	mg/kg wwt	279	287	326	338	297	380	309	371	330	337	343	342	286	378	345	304	370	330
manganese	0.050	mg/kg	1.61	0.511	2.08	1.07	1.16	0.996	0.809	0.566	0.461	0.796	0.747	0.522	0.472	1.35	0.728	0.493	1.86	0.856
manganese	0.010	mg/kg wwt	0.369	0.122	0.518	0.244	0.309	0.260	0.177	0.137	0.103	0.178	0.168	0.116	0.098	0.278	0.163	0.113	0.430	0.183
mercury	0.0050	mg/kg	0.313	0.602	0.494	0.596	0.841	0.188	0.879	0.897	1.08	0.826	1.06	1.78	0.922	0.769	0.920	1.48	0.964	0.813
mercury	0.0010	mg/kg wwt	0.0716	0.144	0.123	0.136	0.223	0.0490	0.192	0.218	0.240	0.185	0.239	0.396	0.193	0.159	0.206	0.340	0.222	0.174
molybdenum	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
molybdenum	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
nickel	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
nickel	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
phosphorus	10	mg/kg	12000	10600	10200	12500	10600	11000	10400	11900	10800	12100	11400	11900	11000	15500	11300	10600	11500	11200
phosphorus	2.0	mg/kg wwt	2740	2540	2560	2860	2830	2880	2280	2890	2400	2710	2580	2660	2300	3200	2540	2440	2650	2400
potassium	20	mg/kg	18700	18300	17400	21700	16800	18300	18800	19900	20400	21200	20900	21700	21000	22600	21200	20800	19700	21600
potassium	4.0	mg/kg wwt	4270	4390	4340	4950	4450	4770	4120	4840	4550	4760	4700	4830	4390	4660	4740	4760	4550	4620
rubidium	0.050	mg/kg	38.7	27.8	23.8	30.4	22.7	33.5	91.0	96.0	108	103	126	107	105	111	109	102	102	118
rubidium	0.010	mg/kg wwt	8.84	6.68	5.93	6.93	6.03	8.73	19.9	23.3	24.1	23.1	28.3	23.8	22.0	22.9	24.4	23.4	23.6	25.2
selenium	0.050	mg/kg	2.51	2.37	2.20	2.15	2.18	2.66	1.34	1.14	1.54	1.14	1.50	1.56	1.35	1.44	1.32	1.31	1.53	1.19
selenium	0.010	mg/kg wwt	0.573	0.569	0.548	0.489	0.580	0.693	0.293	0.278	0.343	0.257	0.338	0.348	0.282	0.296	0.296	0.301	0.354	0.254
sodium	20	mg/kg	1510	1160	1270	1800	1230	886	1990	1640	1950	2280	1990	1520	1610	2590	1370	1430	2230	1000
sodium	4.0	mg/kg wwt	346	279	317	410	326	231	436	398	434	510	447	340	336	536	307	328	515	214
strontium	0.050	mg/kg	2.00	0.179	0.267	0.770	0.873	0.937	0.466	0.619	0.076	0.705	0.304	0.271	0.124	2.49	0.279	0.082	0.822	0.082
strontium	0.010	mg/kg wwt	0.458	0.043	0.066	0.175	0.232	0.244	0.102	0.150	0.017	0.158	0.068	0.060	0.026	0.515	0.062	0.019	0.190	0.017
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	0.0074	0.0137	0.0128	0.0082	0.0130	0.0161	0.0202	0.0239	0.0237	0.0207	0.0290	0.0237	0.0219	0.0260	0.0224	0.0274	0.0259	0.0281
thallium	0.00040	mg/kg wwt	0.00168	0.00329	0.00321	0.00188	0.00346	0.00420	0.00442	0.00579	0.00528	0.00464	0.00653	0.00529	0.00457	0.00537	0.00502	0.00628	0.00597	0.00600
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19	<0.10	<0.10	0.14	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.040	<0.020	<0.020	0.033	<0.020	<0.020
uranium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
uranium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
vanadium	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
vanadium	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	0.022	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
zinc	0.50	mg/kg	14.4	13.9	12.7	20.8	16.2	13.6	24.6	23.0	20.0	21.5	20.5	20.3	18.5	24.1	19.1	16.9	20.6	16.6
zinc	0.10	mg/kg wwt	3.29	3.33	3.17	4.74	4.30	3.54	5.40	5.58	4.46	4.82	4.62	4.52	3.87	4.97	4.28	3.88	4.75	3.56
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals (Matrix: Biota)																				
methylmercury (as MeHg)	5.0	µg/kg	346	585	480	527	766	186	840	577	1120	801	891	1200	575	651	821	650	812	687
methylmercury (as MeHg)	1.0	µg/kg wwt	79.1	140	120	120	204	48.4	184	140	249	180	200	267	120	134	184	149	188	147
Aggregate Organics (Matrix: Biota)																				
lipid content	0.50	% wwt	2.42	1.74	1.18	<0.50	1.47	1.17	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

Table A-10: 2022 Baseline Fish Tissue Quality Laboratory Results - Fillets

			Walleye	Walleye	Lake Trout	Lake Trout	Lake Trout	Lake Trout	Lake Trout	Lake Whitefish	Lake Whitefish	Lake Whitefish	Lake Trout	Northern Pike	Lake Whitefish	Walleye	Lake Whitefish	Lake Whitefish	Walleye	Walleye
Sample ID			NB-SM-3-6-G1-WALL-F-7	NB-LM-1-3-GN1-WALL-F-1	NB-LG-12-20-G1-LKTR-F-6	NB-LG-12-20-G1-LKRT-F-2	NB-LG-20-35-G2-LKTR-F-1	NB-LG-20-35-GN1-LKTR-F-5	NB-LG-GN5-LKTR-F26	NB-LG-GN5-LKWH-F25	NB-LG-GN5-LKWH-F14	NB-LG-GN5-LKWH-F13	EB-LG-GN1-LKTR-F39	EB-SM-GN2-NRPK-F-2	EB-LG-GN1-LKWH-F-37	EB-LM-GN2-WALL-F-4	EB-LG-GN1-LKWH-F-34	EB-LG-GN1-LKWH-F-38	EB-LG-GN1-WALL-F-25	EB-LG-GN1-WALL-F-24
Date Sampled			17-Aug-2022	17-Aug-2022	17-Aug-2022	17-Aug-2022	17-Aug-2022	17-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022
Analyte	**Lowest Detection Limit**	**Units**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**
Physical Tests (Matrix: Biota)																				
Moisture	0.50	%	77	76.2	76.2	74.1	76.8	75.9	77	78.9	76	78	70.9	75.9	74.7	78.2	74.2	75.8	78.9	78.4
Metals (Matrix: Biota)																				
aluminum	2.0	mg/kg	<2.0	<2.0	2.7	<2.0	2.4	12.8	4.2	2.6	3.1	<2.0	2.7	4.9	3.6	5.1	4.5	2.4	3.1	2.8
aluminum	0.40	mg/kg wwt	<0.40	<0.40	0.64	<0.40	0.56	3.09	0.97	0.54	0.74	0.43	0.79	1.18	0.90	1.10	1.16	0.57	0.65	0.61
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.301	0.225	2.09	0.218	3.99	1.22	0.145	1.31	0.498	0.232	0.166	0.160	0.162	0.245	0.195	0.193	0.220	0.388
arsenic	0.0040	mg/kg wwt	0.0693	0.0535	0.497	0.0564	0.925	0.296	0.0333	0.277	0.12	0.0511	0.0485	0.0385	0.0409	0.0533	0.0505	0.0467	0.0463	0.0836
barium	0.050	mg/kg	0.172	<0.050	0.058	<0.050	<0.050	0.144	0.1	0.368	0.13	0.067	<0.050	6.17	<0.050	<0.050	0.077	0.078	0.065	<0.050
barium	0.010	mg/kg wwt	0.040	0.012	0.014	<0.010	<0.010	0.035	0.023	0.078	0.031	0.015	<0.010	1.49	0.011	<0.010	0.020	0.019	0.014	0.010
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0038	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
boron	0.20	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.44	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0277	<0.0050	<0.0050	0.0055	<0.0050	<0.0050	<0.0050
cadmium	0.0010	mg/kg wwt	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0067	<0.0010	<0.0010	0.0014	<0.0010	<0.0010	<0.0010
calcium	20	mg/kg	3310	463	763	230	300	419	492	525	408	667	733	34000	641	444	1510	1260	1100	435
calcium	4.0	mg/kg wwt	763	110	181	59.5	69.7	101	113	111	97.8	147	213	8210	162	96.6	389	306	233	93.7
cesium	0.0050	mg/kg	0.317	0.350	0.297	0.260	0.269	0.251	0.296	0.200	0.139	0.277	0.881	0.0849	0.156	0.491	0.209	0.169	0.643	0.695
cesium	0.0010	mg/kg wwt	0.0729	0.0831	0.0707	0.0674	0.0624	0.0606	0.0678	0.0423	0.0332	0.0611	0.256	0.0205	0.0394	0.107	0.0539	0.0408	0.136	0.150
chromium	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.217	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
chromium	0.010	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	0.052	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
cobalt	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.02	<0.020	<0.020	0.06	<0.020	<0.020	0.02	0.021	<0.020	<0.020
cobalt	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0047	<0.0040	<0.0040	0.0049	<0.0040	<0.0040	0.0144	0.0043	<0.0040	0.0052	0.0051	<0.0040	<0.0040
copper	0.10	mg/kg	0.77	0.93	1.10	0.71	0.63	0.99	1.01	0.92	0.69	0.71	0.94	1.87	0.86	0.59	0.60	0.64	0.68	0.69
copper	0.020	mg/kg wwt	0.177	0.221	0.261	0.184	0.146	0.239	0.233	0.195	0.166	0.156	0.275	0.450	0.218	0.129	0.154	0.155	0.144	0.149
iron	3.0	mg/kg	7.8	9.8	10.4	8.4	8.3	37.0	14.8	24.3	43.0	19.6	14.6	58.6	19.9	22.3	15.4	14.0	12.0	9.3
iron	0.60	mg/kg wwt	1.81	2.32	2.48	2.18	1.93	8.92	3.39	5.13	10.3	4.33	4.26	14.1	5.04	4.84	3.98	3.39	2.54	2.00
lead	0.020	mg/kg	0.021	0.031	<0.020	<0.020	<0.020	0.038	<0.020	<0.020	0.020	<0.020	<0.020	0.084	<0.020	0.021	<0.020	<0.020	<0.020	<0.020
lead	0.0040	mg/kg wwt	0.0048	0.0074	<0.0040	<0.0040	<0.0040	0.0092	<0.0040	<0.0040	0.0049	0.0042	<0.0040	0.0204	<0.0040	0.0046	<0.0040	<0.0040	<0.0040	<0.0040
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	1500	1370	1340	1040	1280	1290	1160	1540	1240	1430	1000	1850	1240	1400	1150	1360	1220	1320
magnesium	0.40	mg/kg wwt	346	325	319	270	296	310	266	324	299	315	292	445	314	305	296	330	258	285
manganese	0.050	mg/kg	0.800	0.456	0.680	0.293	0.469	0.773	1.52	5.08	2.45	0.669	0.324	37.8	0.450	0.421	0.402	0.593	0.424	0.513
manganese	0.010	mg/kg wwt	0.184	0.108	0.162	0.076	0.109	0.186	0.350	1.07	0.587	0.147	0.094	9.11	0.114	0.092	0.104	0.143	0.089	0.110
mercury	0.0050	mg/kg	0.802	1.39	0.963	0.819	4.76	3.72	3.10	0.198	0.323	0.247	3.74	0.303	0.189	3.93	0.509	0.528	8.38	6.09
mercury	0.0010	mg/kg wwt	0.185	0.330	0.229	0.212	1.10	0.897	0.712	0.0419	0.0775	0.0545	1.09	0.0730	0.0478	0.855	0.131	0.128	1.77	1.31
molybdenum	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.048	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
molybdenum	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0116	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
nickel	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
nickel	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
phosphorus	10	mg/kg	12600	10700	11200	9420	10400	10400	10400	12500	10500	11900	8640	27800	10200	10500	10400	11400	11000	11800
phosphorus	2.0	mg/kg wwt	2900	2540	2650	2440	2410	2510	2380	2640	2520	2620	2520	6710	2580	2290	2690	2770	2320	2540
potassium	20	mg/kg	20700	20800	18800	15600	17600	18300	17700	22100	18300	20300	14500	12800	16600	19800	16300	18200	19400	22500
potassium	4.0	mg/kg wwt	4770	4930	4460	4030	4080	4410	4050	4660	4400	4470	4220	3080	4210	4300	4210	4400	4090	4840
rubidium	0.050	mg/kg	100	110	83.6	50.1	66.0	59.6	112	50.2	26.2	45.1	105	34.3	36.8	79.6	28.9	32.9	112	133
rubidium	0.010	mg/kg wwt	23.0	26.1	19.9	13.0	15.3	14.4	25.6	10.6	6.30	9.94	30.5	8.27	9.31	17.3	7.46	7.96	23.7	28.7
selenium	0.050	mg/kg	1.29	1.31	2.10	0.950	2.25	2.07	1.40	2.38	1.89	1.72	1.66	0.610	1.92	1.46	2.78	1.83	1.23	1.34
selenium	0.010	mg/kg wwt	0.297	0.312	0.498	0.246	0.522	0.499	0.321	0.502	0.453	0.380	0.483	0.147	0.485	0.318	0.718	0.442	0.259	0.290
sodium	20	mg/kg	1860	1500	1210	1120	1450	1400	1190	1380	962	1090	1020	3300	1180	1720	1730	1130	1560	1420
sodium	4.0	mg/kg wwt	428	355	287	290	335	339	273	292	230	240	298	796	298	374	447	274	330	306
strontium	0.050	mg/kg	1.01	0.092	0.265	<0.050	0.058	0.167	0.274	0.316	0.218	0.418	0.251	32.3	0.442	0.087	0.949	0.901	0.376	0.089
strontium	0.010	mg/kg wwt	0.233	0.022	0.063	<0.010	0.014	0.040	0.063	0.067	0.052	0.092	0.073	7.79	0.112	0.019	0.245	0.218	0.079	0.019
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	0.0277	0.0260	0.0337	0.0200	0.0330	0.0412	0.0194	0.0157	0.0111	0.0081	0.0116	0.0538	0.0135	0.0194	0.0073	0.0087	0.0322	0.0393
thallium	0.00040	mg/kg wwt	0.00638	0.00616	0.00801	0.00520	0.00765	0.00994	0.00446	0.00331	0.00266	0.00178	0.00337	0.0130	0.00341	0.00422	0.00189	0.00211	0.00680	0.00847
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	4.88	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	1.18	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
uranium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
vanadium	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
vanadium	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
zinc	0.50	mg/kg	19.0	18.0	13.9	9.67	13.0	17.2	11.6	16.2	12.3	16.3	11.1	194	13.7	16.1	21.6	16.1	17.9	14.7
zinc	0.10	mg/kg wwt	4.38	4.28	3.30	2.51	3.02	4.14	2.66	3.43	2.96	3.58	3.22	46.8	3.47	3.50	5.57	3.90	3.78	3.16
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals (Matrix: Biota)																				
methylmercury (as MeHg)	5.0	µg/kg	761	1560	1010	1030	6340	2050	3440	220	343	248	4560		154	4310	449	373	9220	8070
methylmercury (as MeHg)	1.0	µg/kg wwt	175	372	241	268	1470	494	789	46.5	82.2	54.7	1330		39.0	938	116	90.3	1940	1740
Aggregate Organics (Matrix: Biota)																				
lipid content	0.50	% wwt	<0.50	<0.50	0.98	5.21	0.74	0.71	1.65	0.86	2.02	0.52	4.45	<0.50	1.19	<0.50	1.71	1.04	<0.50	<0.50

Table A-10: 2022 Baseline Fish Tissue Quality Laboratory Results - Fillets

			Walleye	Walleye	Walleye	Walleye	Walleye	Lake Whitefish	Lake Trout	Northern Pike	Northern Pike	Northern Pike		Northern Pike	Northern Pike		Northern Pike	Northern Pike	Northern Pike	Northern Pike
Sample ID			EB-LG-GN1-WALL-F-26	EB-SM-GN1-WALL-F-1	EB-SM-GN1-WALL-F-2	EB-LG-GN1-WALL-F-27	EB-SM-GN1-WALL-F-3	EB-LG-GN1-LKWH-F-36	NB-SM-GN4-LKTR-F-1	NB-SM-GN4-NRPK-F-35	NB-SM-GN4-NRPK-F-36	NB-SM-GN4-NRPK-F-61	NB-LG-GN8-LKTR-F-23	NB-LG-GN7-NRPK-F-20	NB-LG-GN7-NRPK-F-21	NB-LG-GN7-LKWH-F-18	EB-LG-GN7-NRPK-F30	EB-LG-GN7-NRPK-F-28	EB-LG-GN6-NRPK-F-36	EB-LG-GN6-NRPK-F-38
Date Sampled			18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	18-Aug-2022	19-Aug-2022	19-Aug-2022	19-Aug-2022	19-Aug-2022	19-Aug-2022	19-Aug-2022	19-Aug-2022	19-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022
Analyte	**Lowest Detection Limit**	**Units**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**
Physical Tests (Matrix: Biota)																				
Moisture	0.50	%	78.6	77.9	74.9	78.6	79	75.2	76.7	73.1 73.1	85.9	79.9	77.7	78.5	78.1	77.1	78.8	79.9	78.7	78.9
Metals (Matrix: Biota)																				
aluminum	2.0	mg/kg	3.0	5.4	4.0	3.6	6.5	2.3	12.2	32.6	128	6.2	2.5	2.8	2.0	2.7	<2.0	<2.0	<2.0	2.6
aluminum	0.40	mg/kg wwt	0.63	1.19	1.01	0.77	1.37	0.58	2.84	8.8	18.0	1.24	0.55	0.61	0.45	0.61	<0.40	<0.40	<0.40	0.56
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.052	0.060	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0139	0.0084	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.267	0.481	0.233	0.336	0.260	0.736	0.698	0.163	0.263	0.106	0.345	0.149	0.239	0.390	0.283	0.205	0.221	0.299
arsenic	0.0040	mg/kg wwt	0.057	0.106	0.0584	0.0719	0.0546	0.182	0.162	0.044	0.037	0.0213	0.0769	0.0321	0.0525	0.0891	0.06	0.0412	0.0471	0.063
barium	0.050	mg/kg	<0.050	0.084	0.151	<0.050	0.15	<0.050	1.07	1.1	2.79	0.103	0.539	0.169	0.166	<0.050	0.182	0.086	0.098	<0.050
barium	0.010	mg/kg wwt	<0.010	0.018	0.038	<0.010	0.032	<0.010	0.250	0.295	0.392	0.021	0.120	0.036	0.036	0.011	0.039	0.017	0.021	<0.010
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
boron	0.20	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.27	0.30	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.012	0.0208	<0.0050	<0.0050	0.0054	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cadmium	0.0010	mg/kg wwt	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0033	0.0029	<0.0010	0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
calcium	20	mg/kg	470	866	472	413	598	293	863	2460	2550	1400	360	1860	2880	411	2390	1190	3160	1060
calcium	4.0	mg/kg wwt	100	191	118	88.4	126	72.6	201	662	359	281	80.2	401	631	94.0	506	240	674	222
cesium	0.0050	mg/kg	0.551	0.328	0.211	0.488	0.204	0.136	0.137	0.106	0.191	0.237	0.262	0.355	0.414	0.181	0.908	0.262	0.323	0.355
cesium	0.0010	mg/kg wwt	0.118	0.0725	0.0529	0.104	0.0429	0.0339	0.0318	0.0286	0.0268	0.0476	0.0583	0.0764	0.0908	0.0414	0.192	0.0528	0.0689	0.0748
chromium	0.050	mg/kg	<0.050	0.111	<0.050	<0.050	0.053	<0.050	0.058	<0.20	0.735	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
chromium	0.010	mg/kg wwt	<0.010	0.024	0.012	<0.010	0.011	<0.010	0.014	0.051	0.103	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
cobalt	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.040	0.088	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
cobalt	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0120	0.0123	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
copper	0.10	mg/kg	0.72	1.19	1.16	0.62	1.08	0.65	0.73	2.40	2.86	0.60	1.17	0.68	0.63	0.87	0.46	0.80	0.68	0.52
copper	0.020	mg/kg wwt	0.154	0.263	0.290	0.132	0.227	0.161	0.171	0.647	0.402	0.120	0.260	0.146	0.137	0.199	0.098	0.162	0.144	0.109
iron	3.0	mg/kg	13.2	47.8	36.3	13.4	45.9	10.0	27.8	53.4	168	16.6	26.4	15.0	9.2	13.7	6.6	8.3	8.8	7.4
iron	0.60	mg/kg wwt	2.82	10.6	9.09	2.87	9.65	2.48	6.48	14.4	23.7	3.34	5.88	3.23	2.02	3.13	1.40	1.68	1.87	1.57
lead	0.020	mg/kg	<0.020	0.029	0.030	<0.020	0.046	<0.020	0.077	0.205	0.724	<0.020	0.024	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
lead	0.0040	mg/kg wwt	<0.0040	0.0064	0.0075	<0.0040	0.0096	<0.0040	0.0178	0.055	0.102	<0.0040	0.0053	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	1350	1460	1440	1410	1260	1170	1170	1570	2240	1560	1240	1360	1760	1370	1650	1370	1420	1530
magnesium	0.40	mg/kg wwt	288	322	361	302	265	290	272	424	315	313	277	294	387	314	350	276	303	322
manganese	0.050	mg/kg	0.434	0.753	0.730	0.403	0.789	0.317	0.707	3.23	6.50	1.12	0.447	0.872	1.02	0.526	1.29	0.779	1.24	0.719
manganese	0.010	mg/kg wwt	0.093	0.166	0.183	0.086	0.166	0.079	0.164	0.870	0.914	0.226	0.100	0.188	0.224	0.120	0.273	0.157	0.265	0.151
mercury	0.0050	mg/kg	6.29	1.17	0.702	4.74	0.664	0.582	2.36	0.681	0.740	0.638	2.19	1.93	2.21	0.187	4.27	3.44	1.81	1.38
mercury	0.0010	mg/kg wwt	1.34	0.259	0.176	1.02	0.140	0.144	0.549	0.183	0.104	0.128	0.487	0.415	0.484	0.0427	0.904	0.693	0.386	0.290
molybdenum	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.040	0.034	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
molybdenum	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0080	0.0049	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
nickel	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.35	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
nickel	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.049	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
phosphorus	10	mg/kg	11600	11400	9600	11000	9040	10600	9790	8920	14800	11200	11600	11000	13000	12300	13200	10600	11900	11500
phosphorus	2.0	mg/kg wwt	2470	2510	2410	2360	1900	2630	2280	2400	2080	2260	2580	2370	2860	2820	2810	2140	2540	2420
potassium	20	mg/kg	21600	21000	18100	21200	17200	17300	16300	13400	21800	19700	20400	19400	23500	21400	21800	17900	20100	20200
potassium	4.0	mg/kg wwt	4610	4650	4550	4530	3610	4290	3800	3610	3070	3960	4540	4170	5160	4900	4620	3610	4290	4260
rubidium	0.050	mg/kg	113	97.9	79.8	109	77.8	31.8	39.2	41.0	59.9	58.2	68.2	56.2	70.8	38.3	104	46.1	64.2	66.9
rubidium	0.010	mg/kg wwt	24.1	21.6	20.0	23.4	16.4	7.89	9.14	11.0	8.42	11.7	15.2	12.1	15.5	8.77	22.0	9.28	13.7	14.1
selenium	0.050	mg/kg	1.32	1.16	0.939	1.39	0.846	2.20	1.37	0.94	1.66	1.20	1.35	1.27	1.43	2.25	1.12	0.985	1.15	1.17
selenium	0.010	mg/kg wwt	0.281	0.256	0.235	0.298	0.178	0.546	0.320	0.254	0.233	0.241	0.300	0.272	0.313	0.514	0.238	0.198	0.245	0.247
sodium	20	mg/kg	1440	1570	1840	1530	1730	1350	1400	1990	2650	1340	1460	1000	1460	1480	1670	1880	2010	2050
sodium	4.0	mg/kg wwt	307	346	462	328	364	335	327	535	372	270	326	215	320	340	354	379	429	432
strontium	0.050	mg/kg	0.075	0.234	0.143	0.076	0.182	0.141	0.298	1.33	1.44	0.415	0.125	0.663	0.877	0.188	0.940	0.436	1.01	0.319
strontium	0.010	mg/kg wwt	0.016	0.052	0.036	0.016	0.038	0.035	0.069	0.359	0.203	0.083	0.028	0.143	0.192	0.043	0.199	0.088	0.216	0.067
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	0.0336	0.0185	0.0178	0.0244	0.0188	0.0072	0.0225	0.0111	0.0193	0.0223	0.0256	0.0160	0.0318	0.0072	0.0214	0.0127	0.0224	0.0209
thallium	0.00040	mg/kg wwt	0.00718	0.00409	0.00446	0.00521	0.00396	0.00179	0.00524	0.00298	0.00271	0.00448	0.00570	0.00344	0.00698	0.00165	0.00454	0.00257	0.00478	0.00440
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0028	0.0051	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
uranium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00074	0.00072	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
vanadium	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.28	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
vanadium	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.023	0.039	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
zinc	0.50	mg/kg	18.4	19.4	19.2	18.1	16.8	12.1	14.9	35.1	37.9	42.5	15.5	21.4	27.6	14.2	17.6	26.3	28.3	28.5
zinc	0.10	mg/kg wwt	3.94	4.29	4.80	3.88	3.53	3.01	3.48	9.46	5.33	8.53	3.45	4.60	6.05	3.24	3.74	5.29	6.04	6.00
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.29	0.46	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.079	0.064	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals (Matrix: Biota)																				
methylmercury (as MeHg)	5.0	µg/kg	6610	1240	638	5480	531	476	1620	763	675	564	1870	1520	1800	160	4500	3750	1660	1330
methylmercury (as MeHg)	1.0	µg/kg wwt	1410	275	160	1170	112	118	376	205	95.0	113	416	328	394	36.5	952	756	354	280
Aggregate Organics (Matrix: Biota)																				
lipid content	0.50	% wwt	<0.50	<0.50	<0.50	<0.50	<0.50	2.13	1.02	<0.50	1.68	<0.50	1.05	<0.50	<0.50	0.84	<0.50	<0.50	<0.50	<0.50

Table A-10: 2022 Baseline Fish Tissue Quality Laboratory Results - Fillets

			Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Northern Pike	Lake Whitefish	Walleye	Northern Pike	Northern Pike
Sample ID			EB-LG-GN6-NRPK-F-33	EB-LG-GN6-NRPK-F-34	NB-LG-GN9-NRPK-F-15	EB-LG-GN6-NRPK-F-35	NB-SM-GN5-LKTR-F-8	EB-LG-GN5-NRPK-F-16	EB-LG-GN6-NRPK-F-37	EB-LG-GN5-NRPK-F-14	EB-LG-GN5-NRPK-F-15	EB-LG-GN7-NRPK-F-29	EB-LG-GN5-NRPK-F-17	EB-LG-GN7-NRPK-F-30	EB-SM-GN3-NRPK-F59	EB-SM-GN3-NRPK-F-1	NB-LG-GN11-LKWF-F1	NB-LG-GN12-WALL-F5	NB-SM-GN7-NRPK-F19	NB-SM-GN7-NRPK-F18
Date Sampled			20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	20-Aug-2022	21-Aug-2022	21-Aug-2022	22-Aug-2022	22-Aug-2022	22-Aug-2022	22-Aug-2022
Analyte	**Lowest Detection Limit**	**Units**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**
Physical Tests (Matrix: Biota)																				
Moisture	0.50	%	76	78	77.5	78.6	73.4	80.4	76.9	78.4	77.5	81.8	79.7	77.7	78.2	78.2	77.1	77.3	78.2	79.7
Metals (Matrix: Biota)																				
aluminum	2.0	mg/kg	4.4	<2.0	2.5	3.4	<2.0	3.5	<2.0	4.2	<2.0	<2.0	<2.0	<2.0	23.8	6.2	<2.0	3.9	10.1	26.0
aluminum	0.40	mg/kg wwt	1.06	0.40	0.56	0.72	0.50	0.68	0.44	0.91	0.42	<0.40	<0.40	<0.40	5.18	1.36	<0.40	0.89	2.20	5.28
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.208	0.314	0.295	0.166	1.08	0.168	0.351	0.110	0.095	0.200	0.182	0.227	0.132	0.121	1.42	0.436	0.060	0.113
arsenic	0.0040	mg/kg wwt	0.0501	0.0691	0.0664	0.0356	0.287	0.033	0.081	0.0238	0.0214	0.0366	0.037	0.0505	0.0288	0.0265	0.325	0.0991	0.013	0.023
barium	0.050	mg/kg	0.073	0.056	0.083	<0.050	<0.050	<0.050	0.08	0.186	0.151	0.247	0.07	2.16	2.17	1.43	0.064	0.064	2.46	2.92
barium	0.010	mg/kg wwt	0.018	0.012	0.019	0.010	0.010	<0.010	0.018	0.040	0.034	0.045	0.014	0.482	0.473	0.312	0.015	0.014	0.536	0.592
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	0.0028	<0.0020	<0.0020
boron	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
boron	0.20	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0080	0.0068	0.0084	0.0295	0.0209	<0.0050	0.0056	0.0298	0.0308
cadmium	0.0010	mg/kg wwt	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	0.0014	0.0019	0.0064	0.0046	<0.0010	0.0013	0.0065	0.0062
calcium	20	mg/kg	1040	567	1460	600	281	613	1600	3160	3010	3290	712	28700	39100	32100	679	348	39900	38700
calcium	4.0	mg/kg wwt	251	125	327	128	74.7	120	370	682	678	601	144	6380	8530	7000	156	79.1	8690	7840
cesium	0.0050	mg/kg	0.444	0.366	0.338	0.618	0.281	0.360	0.328	0.364	0.325	0.498	0.566	0.799	0.100	0.144	0.124	0.501	0.0413	0.104
cesium	0.0010	mg/kg wwt	0.107	0.0805	0.0761	0.132	0.0746	0.0705	0.0758	0.0786	0.0731	0.0909	0.115	0.178	0.0219	0.0315	0.0285	0.114	0.0090	0.0212
chromium	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.083	0.140	0.125	<0.050	<0.050	0.081	0.152
chromium	0.010	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.018	0.030	0.027	<0.010	<0.010	0.018	0.031
cobalt	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.07	0.035	0.023	<0.020	0.033	0.053
cobalt	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0153	0.0076	0.0052	<0.0040	0.0072	0.0107
copper	0.10	mg/kg	0.55	0.42	0.69	0.48	1.00	0.48	0.54	0.54	0.50	0.74	0.64	0.71	1.74	1.76	0.65	1.15	1.61	2.11
copper	0.020	mg/kg wwt	0.132	0.093	0.155	0.103	0.267	0.095	0.124	0.118	0.112	0.135	0.130	0.158	0.379	0.384	0.149	0.261	0.351	0.428
iron	3.0	mg/kg	9.2	7.4	9.5	10.4	16.3	10.3	7.1	13.6	7.0	7.2	14.2	9.1	58.6	33.9	10.8	28.5	40.9	110
iron	0.60	mg/kg wwt	2.21	1.63	2.14	2.24	4.34	2.02	1.64	2.94	1.58	1.31	2.88	2.02	12.8	7.40	2.47	6.48	8.91	22.2
lead	0.020	mg/kg	0.025	<0.020	0.028	0.029	0.040	<0.020	<0.020	0.030	<0.020	<0.020	<0.020	<0.020	0.237	0.147	<0.020	<0.020	0.188	0.153
lead	0.0040	mg/kg wwt	0.0060	<0.0040	0.0064	0.0062	0.0108	<0.0040	<0.0040	0.0065	<0.0040	<0.0040	<0.0040	<0.0040	0.0516	0.0320	<0.0040	<0.0040	0.0409	0.0310
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	1510	1510	1350	1490	1180	1480	1560	1540	1540	1430	1420	1810	1730	1680	1150	1110	1620	1960
magnesium	0.40	mg/kg wwt	364	333	304	319	314	290	361	333	347	261	288	404	377	367	263	253	352	398
manganese	0.050	mg/kg	0.736	0.511	0.733	0.739	0.424	0.670	0.843	1.69	2.16	1.83	0.683	12.3	16.2	11.2	0.488	0.437	13.8	43.4
manganese	0.010	mg/kg wwt	0.177	0.112	0.165	0.158	0.113	0.131	0.194	0.364	0.488	0.334	0.138	2.73	3.52	2.45	0.112	0.099	3.01	8.80
mercury	0.0050	mg/kg	2.54	4.34	2.29	2.48	3.84	3.91	2.59	1.94	0.739	4.28	4.53	3.52	0.382	0.388	0.662	4.46	0.355	0.447
mercury	0.0010	mg/kg wwt	0.610	0.955	0.516	0.532	1.02	0.766	0.598	0.419	0.166	0.780	0.918	0.784	0.0833	0.0846	0.152	1.02	0.0773	0.0907
molybdenum	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.034	0.027	<0.020	<0.020	0.023	0.048
molybdenum	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0074	0.0058	<0.0040	<0.0040	0.0050	0.0098
nickel	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
nickel	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
phosphorus	10	mg/kg	10400	10600	10300	11200	8530	11400	10800	11800	12200	11900	10600	25600	29500	26300	10900	9700	25200	29600
phosphorus	2.0	mg/kg wwt	2490	2320	2320	2410	2270	2240	2490	2560	2740	2170	2150	5700	6420	5730	2510	2200	5470	6000
potassium	20	mg/kg	19100	20800	18800	19300	15600	20800	19400	18900	20800	19100	19200	20000	12800	16200	17800	17800	4870	13100
potassium	4.0	mg/kg wwt	4580	4580	4240	4130	4140	4080	4490	4080	4670	3480	3890	4460	2790	3540	4080	4060	1060	2650
rubidium	0.050	mg/kg	67.9	54.5	57.9	61.6	57.4	58.4	55.1	53.4	57.6	71.4	60.1	85.1	35.0	48.8	34.6	97.0	14.2	39.6
rubidium	0.010	mg/kg wwt	16.3	12.0	13.0	13.2	15.2	11.5	12.7	11.5	13.0	13.0	12.2	18.9	7.62	10.6	7.95	22.0	3.09	8.04
selenium	0.050	mg/kg	1.08	0.944	1.27	1.06	1.61	1.02	1.06	1.08	0.963	0.951	1.10	1.02	0.956	0.974	2.38	1.97	0.925	1.00
selenium	0.010	mg/kg wwt	0.259	0.208	0.286	0.227	0.427	0.199	0.246	0.234	0.217	0.174	0.223	0.227	0.208	0.212	0.546	0.447	0.201	0.203
sodium	20	mg/kg	1330	1370	1500	1630	1090	1150	1600	1900	1550	1660	1560	2020	3460	4220	1190	1420	1480	3000
sodium	4.0	mg/kg wwt	320	301	338	349	291	225	368	411	350	303	317	451	753	920	273	322	323	608
strontium	0.050	mg/kg	0.332	0.119	0.481	0.127	0.063	0.196	0.582	1.17	1.07	1.41	0.230	13.2	14.8	13.0	0.468	0.099	14.4	17.7
strontium	0.010	mg/kg wwt	0.080	0.026	0.108	0.027	0.017	0.038	0.134	0.254	0.240	0.257	0.047	2.93	3.23	2.84	0.107	0.022	3.15	3.60
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	0.0179	0.0212	0.0251	0.0161	0.0519	0.0124	0.0287	0.0149	0.0196	0.0187	0.0133	0.0308	0.0164	0.0170	0.0116	0.0239	0.0102	0.0163
thallium	0.00040	mg/kg wwt	0.00430	0.00467	0.00565	0.00346	0.0138	0.00243	0.00663	0.00321	0.00442	0.00342	0.00269	0.00685	0.00357	0.00370	0.00267	0.00544	0.00221	0.00331
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	1.30	<0.10	<0.10	<0.10	1.37	1.05
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.030	0.284	<0.020	<0.020	<0.020	0.299	0.214
uranium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0036
uranium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00072
vanadium	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11
vanadium	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.022
zinc	0.50	mg/kg	18.1	15.4	41.3	38.3	12.3	51.6	19.9	35.3	25.4	29.1	25.7	60.2	187	128	14.0	16.9	144	166
zinc	0.10	mg/kg wwt	4.35	3.39	9.29	8.22	3.27	10.1	4.59	7.62	5.73	5.32	5.20	13.4	40.7	27.8	3.20	3.85	31.2	33.7
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals (Matrix: Biota)																				
methylmercury (as MeHg)	5.0	µg/kg	2470	4560	1800		3240	4640	2040	2260	922	5220	3520	2280	325	234	771	3870	383	288
methylmercury (as MeHg)	1.0	µg/kg wwt	594	1000	405		862	911	470	490	208	954	714	508	70.8	51.1	177	880	83.4	58.5
Aggregate Organics (Matrix: Biota)																				
lipid content	0.50	% wwt	<0.50	<0.50	<0.50	<0.50	2.47	<0.50	<0.50	<0.50	<0.50	0.58	<0.50	<0.50	<0.50	1.11	1.19	<0.50	<0.50	0.75

Table A-10: 2022 Baseline Fish Tissue Quality Laboratory Results - Fillets

			Northern Pike	Lake Whitefish	Northern Pike	Northern Pike	Lake Trout	Lake Whitefish	Northern Pike	Lake Trout	Lake Whitefish	Lake Trout	Lake Trout	Lake Trout
Sample ID			NB-SM-GN7-NRPK-F20	NB-SM-GN8-LKWF-F12	NB-SM-GN7-NRPK-F21	NB-SM-GN7-NRPK-F12	NB-LG-GN13-LKTR-F10	NB-LG-GN14-LKWF-F10	EB-SM-GN7-NRPK-F-4	NB-LG-GN15-LKTR-F-3	NB-LG-GN14-LKWF-F1	NB-LG-GN15-LKTR-F-2	NB-LG-GN15-LKTR-F-1	NB-LG-GN5 LKTR-F27
Date Sampled			22-Aug-2022	22-Aug-2022	22-Aug-2022	22-Aug-2022	22-Aug-2022	22-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022	22-Aug-2022
Analyte	**Lowest Detection Limit**	**Units**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Animal Tissue**
Physical Tests (Matrix: Biota)														
Moisture	0.50	%	78.8	76.1	79.2	79.7	73.5	81.2	78	77.7	78.9	79.7	79.2	75.2
Metals (Matrix: Biota)														
aluminum	2.0	mg/kg	14.4	<2.0	19.9	20.9	9.9	10.6	12.0	9.7	<2.0	6.2	4.0	2.2
aluminum	0.40	mg/kg wwt	3.07	<0.40	4.12	4.24	2.63	1.99	2.64	2.15	<0.40	1.26	0.83	0.55
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.117	0.736	0.077	0.160	2.11	2.82	0.135	0.405	0.783	0.857	0.433	0.178
arsenic	0.0040	mg/kg wwt	0.0248	0.176	0.0159	0.0324	0.56	0.531	0.0298	0.0902	0.165	0.174	0.0899	0.0442
barium	0.050	mg/kg	4.11	<0.050	2.25	2.72	0.190	0.498	2.10	0.072	<0.050	0.070	0.052	0.062
barium	0.010	mg/kg wwt	0.873	0.01	0.467	0.552	0.050	0.094	0.462	0.016	<0.010	0.014	0.011	0.015
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
boron	0.20	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	0.21	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium	0.0050	mg/kg	0.0449	<0.0050	0.0295	0.0493	<0.0050	<0.0050	0.0319	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cadmium	0.0010	mg/kg wwt	0.0095	<0.0010	0.0061	0.0100	<0.0010	<0.0010	0.0070	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
calcium	20	mg/kg	39900	452	42600	42200	1090	2550	36000	358	494	418	373	270
calcium	4.0	mg/kg wwt	8480	108	8830	8590	289	480	7910	79.7	104	85.1	77.4	67.0
cesium	0.0050	mg/kg	0.0800	0.178	0.122	0.123	0.166	0.186	0.112	0.242	0.185	0.287	0.270	0.322
cesium	0.0010	mg/kg wwt	0.0170	0.0426	0.0253	0.0251	0.0440	0.0349	0.0246	0.0538	0.0390	0.0583	0.0559	0.0797
chromium	0.050	mg/kg	0.097	<0.050	0.151	0.092	0.051	<0.050	0.097	<0.050	<0.050	<0.050	<0.050	<0.050
chromium	0.010	mg/kg wwt	0.021	<0.010	0.031	0.019	0.014	<0.010	0.021	<0.010	<0.010	<0.010	<0.010	<0.010
cobalt	0.020	mg/kg	0.059	<0.020	0.054	0.064	<0.020	<0.020	0.047	<0.020	<0.020	<0.020	<0.020	<0.020
cobalt	0.0040	mg/kg wwt	0.0125	<0.0040	0.0113	0.0129	0.0043	<0.0040	0.0104	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
copper	0.10	mg/kg	2.12	0.66	1.76	2.22	0.83	1.14	1.89	1.18	0.68	1.06	0.90	0.80
copper	0.020	mg/kg wwt	0.450	0.158	0.366	0.451	0.219	0.214	0.415	0.262	0.143	0.215	0.188	0.199
iron	3.0	mg/kg	60.6	9.6	62.0	65.2	31.4	32.7	64.0	31.2	18.0	27.2	18.2	16.6
iron	0.60	mg/kg wwt	12.9	2.29	12.8	13.3	8.32	6.15	14.1	6.95	3.80	5.53	3.78	4.12
lead	0.020	mg/kg	0.078	<0.020	0.109	0.504	0.037	0.048	0.052	0.033	<0.020	0.028	0.022	<0.020
lead	0.0040	mg/kg wwt	0.0165	<0.0040	0.0226	0.102	0.0099	0.0091	0.0114	0.0073	<0.0040	0.0057	0.0045	<0.0040
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	1890	1260	1880	1880	968	1420	1740	1310	1480	1350	1240	1090
magnesium	0.40	mg/kg wwt	402	302	389	383	257	268	383	291	312	274	258	270
manganese	0.050	mg/kg	40.9	0.288	25.9	25.4	1.10	1.65	20.7	0.780	0.339	0.611	0.588	0.672
manganese	0.010	mg/kg wwt	8.68	0.069	5.38	5.16	0.291	0.310	4.55	0.174	0.072	0.124	0.122	0.167
mercury	0.0050	mg/kg	0.436	0.598	0.268	0.380	1.23	0.364	0.439	1.36	0.691	4.52	3.60	1.16
mercury	0.0010	mg/kg wwt	0.0926	0.143	0.0556	0.0772	0.326	0.0684	0.0966	0.304	0.146	0.918	0.746	0.287
molybdenum	0.020	mg/kg	0.049	<0.020	0.046	0.054	<0.020	<0.020	0.034	<0.020	<0.020	<0.020	<0.020	<0.020
molybdenum	0.0040	mg/kg wwt	0.0104	<0.0040	0.0096	0.0110	<0.0040	<0.0040	0.0076	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
nickel	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
nickel	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
phosphorus	10	mg/kg	28400	11200	31000	29800	9430	14400	29100	11700	11800	11600	10900	9100
phosphorus	2.0	mg/kg wwt	6030	2680	6420	6060	2500	2710	6410	2600	2480	2360	2260	2260
potassium	20	mg/kg	11700	17200	15100	13400	15100	23500	16700	20000	21200	20400	19400	15600
potassium	4.0	mg/kg wwt	2480	4120	3140	2730	4000	4420	3670	4460	4470	4140	4020	3860
rubidium	0.050	mg/kg	28.8	37.5	43.5	36.3	57.7	61.7	43.7	59.5	36.0	64.2	74.9	55.6
rubidium	0.010	mg/kg wwt	6.12	8.98	9.02	7.38	15.3	11.6	9.62	13.2	7.58	13.0	15.5	13.8
selenium	0.050	mg/kg	0.900	1.71	0.868	1.08	1.92	2.55	1.14	1.29	2.45	2.56	1.10	1.53
selenium	0.010	mg/kg wwt	0.191	0.409	0.180	0.219	0.510	0.480	0.250	0.287	0.517	0.521	0.229	0.379
sodium	20	mg/kg	2790	1190	3320	3010	1090	2640	4790	1570	1630	1630	1460	979
sodium	4.0	mg/kg wwt	592	284	689	611	290	497	1050	350	344	332	304	243
strontium	0.050	mg/kg	18.1	0.286	17.3	17.2	0.462	2.49	13.4	0.112	0.227	0.164	0.091	0.062
strontium	0.010	mg/kg wwt	3.84	0.068	3.59	3.50	0.122	0.468	2.95	0.025	0.048	0.033	0.019	0.015
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	0.0176	0.0072	0.0164	0.0177	0.0205	0.0228	0.0200	0.0266	0.0081	0.0279	0.0191	0.0190
thallium	0.00040	mg/kg wwt	0.00373	0.00172	0.00340	0.00360	0.00544	0.00428	0.00439	0.00592	0.00170	0.00568	0.00397	0.00472
tin	0.10	mg/kg	1.34	<0.10	0.98	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19
tin	0.020	mg/kg wwt	0.284	<0.020	0.204	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.048
uranium	0.0020	mg/kg	<0.0020	<0.0020	0.0020	0.0020	<0.0020	<0.0020	<0.0020	0.0048	<0.0020	<0.0020	<0.0020	<0.0020
uranium	0.00040	mg/kg wwt	0.00040	<0.00040	0.00042	0.00041	<0.00040	<0.00040	<0.00040	0.00108	<0.00040	<0.00040	<0.00040	<0.00040
vanadium	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
vanadium	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
zinc	0.50	mg/kg	170	12.2	162	184	14.6	22.8	223	16.6	15.4	19.1	13.5	13.5
zinc	0.10	mg/kg wwt	36.0	2.91	33.7	37.5	3.88	4.28	49.1	3.70	3.24	3.88	2.80	3.35
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals (Matrix: Biota)														
methylmercury (as MeHg)	5.0	µg/kg	247	584	347	372	1600	399	430	1490	694	4420	2560	648
methylmercury (as MeHg)	1.0	µg/kg wwt	52.4	140	71.9	75.7	423	75.0	94.5	331	146	899	530	161
Aggregate Organics (Matrix: Biota)														
lipid content	0.50	% wwt	1.82	3.26	<0.50	0.99	3.83	0.96	0.97	1.17	<0.50	1.36	<0.50	3.36

Table A-11: 2019 Baseline Fish Tissue Quality Laboratory Results - Small Bodied Fish

Sample ID			S-9-MT1-COMP1	S-9-MT1-COMP2	S-9-MT1-COMP3	S-9-US02-MT1-COMP 1	S-9-US02-MT1-COMP 2	S-9-US02-MT1-COMP 3	S-9-US02-MT1-COMP 4	S-9-US02-MT1-COMP 5	WB05-OUT-MT1-COMP 1	WB05-OUT-MT1-COMP 2	WB05-OUT-MT1-COMP 3
Date Sampled			12-Sep-2019	12-Sep-2019	12-Sep-2019	12-Sep-2019	12-Sep-2019	12-Sep-2019	12-Sep-2019	12-Sep-2019	13-Sep-2019	13-Sep-2019	13-Sep-2019
Parameter	**Lowest Detection Limit**	**Units**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**
Physical Tests (Tissue)													
% Moisture	0.50	%	74.3	75.2	76.6	75.3	73.9	73.7	76.7	75.6	79.0	77.2	76.6
Metals (Tissue)													
Aluminum (Al)-Total	2.0	mg/kg	4.1	8.9	3.8	2.5	<2.0	<2.0	21.5	<2.0	9.7	4.2	5.9
Antimony (Sb)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (As)-Total	0.020	mg/kg	0.070	0.098	0.085	0.128	0.087	0.063	0.135	0.112	0.214	0.160	0.152
Arsenic (As)-Total		mg/kg wwt	0.018	0.024	0.020	0.032	0.023	0.017	0.031	0.027	0.045	0.036	0.036
Barium (Ba)-Total	0.050	mg/kg	14.1	30.1	19.2	4.70	3.68	6.55	51.9	5.90	6.78	4.70	4.98
Beryllium (Be)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Boron (B)-Total	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium (Cd)-Total	0.0050	mg/kg	0.0109	0.0108	0.0186	0.0121	0.0070	0.0160	0.0148	0.0074	0.0252	0.0157	0.0128
Cadmium (Cd)-Total		mg/kg wwt	0.0028	0.0027	0.0044	0.0030	0.0018	0.0042	0.0034	0.0018	0.0053	0.0036	0.0030
Calcium (Ca)-Total	20	mg/kg	34300	30600	38600	38700	29600	47400	41800	47700	42200	28100	34300
Cesium (Cs)-Total	0.0050	mg/kg	0.0463	0.0390	0.0433	0.0391	0.0419	0.0351	0.0554	0.0510	0.123	0.137	0.112
Chromium (Cr)-Total	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.068	<0.050	0.075	<0.050	<0.050
Chromium (Cr)-Total	Sample specific	mg/kg wwt	<0.013	<0.012	<0.012	<0.012	<0.013	<0.013	0.016	<0.012	0.016	<0.011	<0.012
Cobalt (Co)-Total	0.020	mg/kg	0.094	0.187	0.118	0.052	0.048	0.049	0.276	0.053	0.058	0.057	0.046
Cobalt (Co)-Total	0.004	mg/kg wwt	0.024	0.046	0.028	0.013	0.013	0.013	0.064	0.013	0.012	0.013	0.011
Copper (Cu)-Total	0.10	mg/kg	3.40	2.83	4.65	8.07	6.40	6.66	3.39	9.84	7.08	6.18	6.10
Copper (Cu)-Total		mg/kg wwt	0.87	0.70	1.09	1.99	1.67	1.75	0.79	2.40	1.49	1.41	1.43
Iron (Fe)-Total	3.0	mg/kg	155	142	195	94.1	84.4	79.0	231	92.3	174	159	140
Lead (Pb)-Total	0.020	mg/kg	0.057	0.062	0.061	0.227	0.036	0.042	0.096	0.077	0.046	0.025	0.039
Lead (Pb)-Total		mg/kg wwt	0.015	0.015	0.014	0.056	0.009	0.011	0.022	0.019	0.010	0.006	0.009
Lithium (Li)-Total	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)-Total	2.0	mg/kg	1540	1480	1700	1630	1440	1720	1760	1840	1760	1440	1490
Manganese (Mn)-Total	0.050	mg/kg	26.2	21.5	30.2	14.2	12.9	15.2	55.5	21.1	31.2	23.6	27.3
Manganese (Mn)-Total		mg/kg wwt	6.7	5.3	7.1	3.5	3.4	4.0	12.9	5.1	6.6	5.4	6.4
Mercury (Hg)-Total	0.0050	mg/kg	0.155	0.0873	0.166	0.127	0.116	0.197	0.0802	0.112	0.203	0.184	0.143
Mercury (Hg)-Total		mg/kg wwt	0.040	0.022	0.039	0.031	0.030	0.052	0.019	0.027	0.043	0.042	0.033
Molybdenum (Mo)-Total	0.020	mg/kg	0.145	0.134	0.173	0.141	0.115	0.109	0.213	0.162	0.179	0.145	0.147
Molybdenum (Mo)-Total		mg/kg wwt	0.037	0.033	0.040	0.035	0.030	0.029	0.050	0.040	0.038	0.033	0.034
Nickel (Ni)-Total	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nickel (Ni)-Total	Sample specific	mg/kg wwt	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.04	<0.05	<0.05
Phosphorus (P)-Total	10	mg/kg	28000	25400	30900	30500	25900	34800	30100	37500	32200	23400	26100
Potassium (K)-Total	20	mg/kg	12000	12600	14200	12900	12800	12700	13800	13800	13600	13000	12100
Rubidium (Rb)-Total	0.050	mg/kg	22.3	24.1	23.1	22.7	23.0	21.8	25.1	28.0	30.1	27.9	27.6
Selenium (Se)-Total	0.050	mg/kg	0.596	0.432	0.688	0.676	0.655	0.690	0.515	0.721	0.704	0.785	0.658
Selenium (Se)-Total		mg/kg wwt	0.153	0.107	0.161	0.167	0.171	0.181	0.120	0.176	0.148	0.179	0.154
Sodium (Na)-Total	20	mg/kg	3520	3660	4060	3710	3370	3720	4040	3790	4070	3590	3390
Strontium (Sr)-Total	0.050	mg/kg	26.9	41.5	30.5	18.6	14.3	22.8	62.9	24.5	21.8	14.5	16.8
Tellurium (Te)-Total	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total	0.0020	mg/kg	0.0106	0.0080	0.0138	0.0196	0.0201	0.0131	0.0114	0.0229	0.0172	0.0155	0.0144
Tin (Sn)-Total	0.10	mg/kg	0.10	0.14	0.19	0.19	0.23	<0.10	0.39	0.14	0.23	0.20	0.19
Uranium (U)-Total	0.0020	mg/kg	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	0.0036	0.0022	0.0038	<0.0020	0.0026
Vanadium (V)-Total	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc (Zn)-Total	0.50	mg/kg	191	166	185	154	135	119	225	176	212	159	187
Zinc (Zn)-Total		mg/kg wwt	49	41	43	38	35	31	52	43	45	36	44
Zirconium (Zr)-Total	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Speciated Metals (Tissue)													
Methylmercury (as MeHg)	0.0050	mg/kg	0.152	0.112	0.221	0.189	0.109	0.267	0.0992	0.157	0.264	0.229	0.176
Methylmercury (as MeHg)		mg/kg wwt	0.039	0.028	0.052	0.047	0.028	0.070	0.023	0.038	0.055	0.052	0.041
Aggregate Organics (Tissue)													
Lipid Content	0.5	% wwt	4.5	5.1	3.5	4.7	4.6	5.1	5.1	5.0	3.5	4.0	3.2

Table A-12: 2021 Baseline Fish Tissue Quality Laboratory Results - Small Bodied Fish

Client Sample ID			BIRCH-COMP-1-BNM	BIRCH-COMP-2-BNM	BIRCH-COMP-3-BNM	BIRCH-COMP-1-YLP	BIRCH-COMP-2-YLP	BIRCH-COMP-3-YLP	BIRCH-COMP-4-YLP	BIRCH-COMP-5-YLP	BIRCH-COMP-6-YLP	BIRCH-COMP-7-YLP	L-15-COMP-1-BNS	L-15-COMP-2-BNS	L-15-COMP-3-BNS	L-15-COMP-4-BNS	L-15-COMP-5-BNS	L-15-COMP-1-MS	L-15-COMP-2-MS	L-15-COMP-3-MS	L-15-COMP-4-MS	L-15-COMP-5-MS	L-15-COMP-1-STS	L-15-COMP-2-STS	L-15-COMP-3-STS	L-15-COMP-4-STS	L-15-COMP-5-STS	L-15-COMP-6-STS	L-15-COMP-7-STS	L-17-COMP-1-FDS	L-17-COMP-2-FDS	L-17-COMP-3-FDS	L-17-COMP-4-FDS	L-17-COMP-5-FDS	L-18-COMP-1-BSB	L-18-COMP-2-BSB	L-18-COMP-3-BSB
Date Sampled			02-Dec-21	02-Dec-21	02-Dec-21

Table A-12: 2021 Baseline Fish Tissue Quality Laboratory Results - Small Bodied Fish

Client Sample ID			L-18-COMP-4-BSB	L-18-COMP-5-NRD	L-19-COMP-1-FHM	L-19-COMP-2-FHM	L-19-COMP-3-FHM	L-19-COMP-4-FHM	L-19-COMP-5-FHM
Date Sampled			02-Dec-21	02-Dec-21	02-Dec-21	02-Dec-21	02-Dec-21	02-Dec-21	02-Dec-21
Time Sampled			0:00	0:00	0:00	0:00	0:00	0:00	0:00
ALS Sample ID			L2669591-36	L2669591-37	L2669591-38	L2669591-39	L2669591-40	L2669591-41	L2669591-42
Parameter	**Lowest Detection Limit**	**Units**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**	**Tissue**
Physical Tests (Tissue)									
% Moisture	0.5	%	78.2	78.2	73.2	79.1	72.8	80	79.6
Metals (Tissue)									
Aluminum (Al)-Total	2	mg/kg	6	17.6	6.3	10.3	17	14	31.4
Aluminum (Al)-Total	0.4	mg/kg wwt	1.32	3.84	1.69	2.15	4.62	2.79	6.4
Antimony (Sb)-Total	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Antimony (Sb)-Total	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)-Total	0.02	mg/kg	0.139	0.165	0.117	0.12	0.144	0.149	0.164
Arsenic (As)-Total	0.004	mg/kg wwt	0.0302	0.0361	0.0313	0.025	0.0392	0.0299	0.0335
Barium (Ba)-Total	0.05	mg/kg	5.03	28.3	8.75	8.16	6.92	10.9	13
Barium (Ba)-Total	0.01	mg/kg wwt	1.1	6.17	2.34	1.71	1.88	2.17	2.66
Beryllium (Be)-Total	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium (Be)-Total	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)-Total	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)-Total	1	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron (B)-Total	0.2	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)-Total	0.005	mg/kg	0.0245	0.0306	0.0173	0.027	0.021	0.0293	0.0319
Cadmium (Cd)-Total	0.001	mg/kg wwt	0.0053	0.0067	0.0046	0.0056	0.0057	0.0059	0.0065
Calcium (Ca)-Total	20	mg/kg	37000	43800	44500	38000	29700	48300	49500
Calcium (Ca)-Total	4	mg/kg wwt	8060	9540	11900	7960	8070	9680	10100
Cesium (Cs)-Total	0.005	mg/kg	0.251	0.128	0.0567	0.0743	0.0575	0.0785	0.0824
Cesium (Cs)-Total	0.001	mg/kg wwt	0.0548	0.028	0.0152	0.0155	0.0156	0.0157	0.0168
Chromium (Cr)-Total	0.05	mg/kg	0.068	0.14	0.078	<0.050	0.054	0.073	0.103
Chromium (Cr)-Total	0.01	mg/kg wwt	0.015	0.03	0.021	<0.010	0.015	0.015	0.021
Cobalt (Co)-Total	0.02	mg/kg	0.055	0.057	0.022	0.032	0.025	0.039	0.052
Cobalt (Co)-Total	0.004	mg/kg wwt	0.012	0.0124	0.0058	0.0068	0.0069	0.0078	0.0106
Copper (Cu)-Total	0.1	mg/kg	10.7	8.89	4.03	4.96	4.09	4.82	5.74
Copper (Cu)-Total	0.02	mg/kg wwt	2.32	1.94	1.08	1.04	1.11	0.965	1.17
Iron (Fe)-Total	3	mg/kg	115	199	146	154	141	177	236
Iron (Fe)-Total	0.6	mg/kg wwt	25.1	43.4	39	32.2	38.4	35.4	48.2
Lead (Pb)-Total	0.02	mg/kg	0.042	0.064	0.048	0.063	0.063	0.069	0.098
Lead (Pb)-Total	0.004	mg/kg wwt	0.0093	0.0139	0.0128	0.0131	0.0171	0.0137	0.02
Lithium (Li)-Total	0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium (Li)-Total	0.1	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total	2	mg/kg	1620	1420	1360	1480	1220	1690	1800
Magnesium (Mg)-Total	0.4	mg/kg wwt	353	309	365	310	332	338	367
Manganese (Mn)-Total	0.05	mg/kg	32.2	24.8	5.7	8.14	5.55	8.8	12.8
Manganese (Mn)-Total	0.01	mg/kg wwt	7.03	5.4	1.53	1.7	1.51	1.76	2.62
Mercury (Hg)-Total	0.005	mg/kg	0.265	0.275	0.145	0.139	0.138	0.151	0.143
Mercury (Hg)-Total	0.001	mg/kg wwt	0.0577	0.0599	0.0389	0.029	0.0376	0.0302	0.0292
Molybdenum (Mo)-Total	0.02	mg/kg	0.106	0.142	0.085	0.09	0.07	0.1	0.111
Molybdenum (Mo)-Total	0.004	mg/kg wwt	0.0232	0.031	0.0228	0.0188	0.0191	0.0201	0.0227
Nickel (Ni)-Total	0.2	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nickel (Ni)-Total	0.04	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Phosphorus (P)-Total	10	mg/kg	28200	28400	28400	27600	22100	33700	35100
Phosphorus (P)-Total	2	mg/kg wwt	6150	6200	7590	5780	6000	6750	7160
Potassium (K)-Total	20	mg/kg	12700	8350	8460	11600	9040	11800	12900
Potassium (K)-Total	4	mg/kg wwt	2770	1820	2260	2420	2460	2360	2630
Rubidium (Rb)-Total	0.05	mg/kg	47.4	19.5	19.7	25.8	21.2	26.6	27.3
Rubidium (Rb)-Total	0.01	mg/kg wwt	10.3	4.26	5.28	5.4	5.76	5.33	5.57
Selenium (Se)-Total	0.05	mg/kg	1.04	0.719	1.13	1.37	1.06	1.39	1.55
Selenium (Se)-Total	0.01	mg/kg wwt	0.227	0.157	0.302	0.286	0.287	0.279	0.316
Sodium (Na)-Total	20	mg/kg	4460	2350	2660	3370	2620	3730	4260
Sodium (Na)-Total	4	mg/kg wwt	972	512	711	705	712	747	869
Strontium (Sr)-Total	0.05	mg/kg	28.9	28.9	35.6	31	26.2	42.5	43.5
Strontium (Sr)-Total	0.01	mg/kg wwt	6.29	6.3	9.52	6.48	7.12	8.5	8.88
Tellurium (Te)-Total	0.02	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Tellurium (Te)-Total	0.004	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	0.002	mg/kg	0.0126	0.0059	0.0126	0.0136	0.0109	0.0152	0.0145
Thallium (Tl)-Total	0.0004	mg/kg wwt	0.00275	0.00128	0.00337	0.00285	0.00296	0.00304	0.00295
Tin (Sn)-Total	0.1	mg/kg	0.16	<0.10	<0.10	0.18	<0.10	<0.10	<0.10
Tin (Sn)-Total	0.02	mg/kg wwt	0.034	<0.020	<0.020	0.038	0.02	<0.020	<0.020
Uranium (U)-Total	0.002	mg/kg	<0.0020	0.0116	0.0022	0.0033	0.0051	0.0037	0.0059
Uranium (U)-Total	0.0004	mg/kg wwt	<0.00040	0.00254	0.00059	0.00069	0.00138	0.00074	0.00121
Vanadium (V)-Total	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14
Vanadium (V)-Total	0.02	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	0.022	<0.020	0.028
Zinc (Zn)-Total	0.5	mg/kg	161	303	109	123	99.8	136	161
Zinc (Zn)-Total	0.1	mg/kg wwt	35.1	66.1	29.2	25.7	27.1	27.3	32.8
Zirconium (Zr)-Total	0.2	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Zirconium (Zr)-Total	0.04	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Speciated Metals (Tissue)									
Arsenate (As V)	0.025	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Arsenite (As III)	0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dimethylarsinic Acid (DMA, as As)	0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Monomethylarsonic Acid (MMA, as As)	0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenobetaine (AsB, as As)	0.005	mg/kg	0.0324	0.0122	<0.0050	0.0052	<0.0050	<0.0050	0.0052
Arsenocholine (AsC, as As)	0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Methylmercury (as MeHg)	0.005	mg/kg	0.228	0.332	0.177	0.149	0.122	0.176	0.139
Methylmercury (as MeHg)	0.001	mg/kg wwt	0.0498	0.0723	0.0475	0.0312	0.0331	0.0352	0.0284

Table A-13: 2022 Baseline Fish Tissue Quality Laboratory Results - Small Bodied Fish

Sample ID			BIRCH-1-GN1-COMP1	BIRCH-1-GN1-COMP2	BIRCH-1-GN1-COMP3	BIRCH-1-GN1-COMP4	BIRCH-1-GN1-COMP5	BIRCH-2-GN1-COMP1	BIRCH-2-GN1-COMP2	BIRCH-2-GN1-COMP3	BIRCH-2-GN1-COMP4	BIRCH-2-GN1-COMP5	07A-DN1-COMP1	07A-DN1-COMP2	08A-GN1-COMP1
Date Sampled			13-Jun-22	13-Jun-22	13-Jun-22	13-Jun-22	13-Jun-22	13-Jun-22	13-Jun-22	13-Jun-22	13-Jun-22	13-Jun-22	12-Jun-22	12-Jun-22	10-Jun-22
Analyte	**Lowest Detection Limit**	**Units**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**	**Sub-Matrix: Tissue**
Physical Tests (Matrix: Biota)															
Moisture	0.5	%	76.2	77.9	76.8	76.4	76.1	74.7	75.7	75.1	75.3	76.8	70.6	71	
Metals (Matrix: Biota)															
Aluminum	2	mg/kg	2.4	2	2.3	<2.0	2.2	2.4	3	2.2	<2.0	2.2	4.3	5.8	
Aluminum	0.4	mg/kg wwt	0.57	0.45	0.52	0.45	0.51	0.62	0.72	0.56	0.47	0.52	1.26	1.7	
Antimony	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Antimony	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	
Arsenic	0.02	mg/kg	0.534	0.599	0.483	0.529	0.699	0.54	0.566	0.522	0.536	0.616	0.343	0.438	
Arsenic	0.004	mg/kg wwt	0.127	0.132	0.112	0.125	0.167	0.137	0.137	0.13	0.132	0.143	0.101	0.127	
Barium	0.05	mg/kg	5.14	4.89	3.94	4.32	5.51	4.67	6.46	4.7	4.98	5.53	10.9	16.2	
Barium	0.01	mg/kg wwt	1.22	1.08	0.913	1.02	1.32	1.18	1.57	1.17	1.23	1.28	3.21	4.7	
Beryllium	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Beryllium	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	
Bismuth	0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	
Boron	1	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Boron	0.2	mg/kg wwt	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	
Cadmium	0.005	mg/kg	0.0978	0.107	0.0787	0.0817	0.112	0.0825	0.114	0.0862	0.075	0.101	0.0842	0.0832	
Cadmium	0.001	mg/kg wwt	0.0232	0.0236	0.0182	0.0193	0.0267	0.0209	0.0276	0.0215	0.0185	0.0235	0.0248	0.0241	
Calcium	20	mg/kg	55200	60300	44600	50100	63600	47300	71100	58800	60500	65400	44000	58000	
Calcium	4	mg/kg wwt	13100	13300	10300	11800	15200	12000	17300	14700	14900	15200	12900	16800	
Cesium	0.005	mg/kg	0.0494	0.0595	0.0524	0.0519	0.0528	0.0528	0.0586	0.0534	0.0531	0.0544	0.0525	0.058	
Cesium	0.001	mg/kg wwt	0.0117	0.0131	0.0121	0.0123	0.0126	0.0133	0.0142	0.0133	0.0131	0.0126	0.0154	0.0168	
Chromium	0.05	mg/kg	0.069	<0.050	<0.050	<0.050	0.098	0.055	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Chromium	0.01	mg/kg wwt	0.016	0.01	<0.010	0.011	0.023	0.014	0.011	<0.010	0.011	<0.010	<0.010	0.01	
Cobalt	0.02	mg/kg	0.034	0.037	0.029	0.03	0.036	0.032	0.035	0.031	0.033	0.033	0.04	0.04	
Cobalt	0.004	mg/kg wwt	0.0081	0.0082	0.0068	0.0072	0.0085	0.008	0.0086	0.0077	0.0081	0.0077	0.0116	0.0118	
Copper	0.1	mg/kg	2	2.19	1.87	2.06	2.14	1.98	2	1.84	1.94	2.11	2.34	2.35	
Copper	0.02	mg/kg wwt	0.476	0.483	0.433	0.487	0.512	0.5	0.485	0.459	0.478	0.49	0.687	0.681	
Iron	3	mg/kg	57	55.7	44.6	46.6	59.6	48.2	63.8	49.4	53.9	56.7	64.3	82.1	
Iron	0.6	mg/kg wwt	13.5	12.3	10.3	11	14.2	12.2	15.5	12.3	13.3	13.1	18.9	23.8	
Lead	0.02	mg/kg	0.03	0.026	0.027	<0.020	0.023	0.024	0.037	0.021	<0.020	0.025	0.026	0.038	
Lead	0.004	mg/kg wwt	0.0071	0.0057	0.0064	0.004	0.0054	0.006	0.0089	0.0053	0.0048	0.0059	0.0078	0.0109	
Lithium	0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
Lithium	0.1	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Magnesium	2	mg/kg	1960	2080	1640	1850	2150	1700	2240	1840	1990	2040	1670	2030	
Magnesium	0.4	mg/kg wwt	464	458	380	438	513	431	544	458	492	473	490	589	
Manganese	0.05	mg/kg	23.3	21.2	15.8	16.9	27	19.4	32.3	20.5	21	23.8	10.5	13.5	
Manganese	0.01	mg/kg wwt	5.53	4.68	3.65	3.99	6.45	4.89	7.84	5.11	5.17	5.52	3.08	3.92	
Mercury	0.005	mg/kg	0.142	0.16	0.169	0.165	0.143	0.15	0.139	0.149	0.156	0.144	0.245	0.203	
Mercury	0.001	mg/kg wwt	0.0336	0.0354	0.0392	0.039	0.0342	0.038	0.0338	0.0372	0.0385	0.0335	0.0721	0.0588	
Molybdenum	0.02	mg/kg	0.075	0.081	0.07	0.078	0.094	0.072	0.078	0.07	0.072	0.081	0.061	0.068	
Molybdenum	0.004	mg/kg wwt	0.0179	0.0179	0.0161	0.0185	0.0225	0.0182	0.019	0.0173	0.0178	0.0188	0.0179	0.0196	
Nickel	0.2	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	
Nickel	0.04	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	
Phosphorus	10	mg/kg	39100	40500	31400	35700	43400	33200	45600	35200	39100	41800	31600	38600	
Phosphorus	2	mg/kg wwt	9290	8950	7260	8440	10400	8410	11100	8760	9660	9690	9300	11200	
Potassium	20	mg/kg	10000	11700	10600	10800	11300	10500	11700	10300	10300	10700	11200	11800	
Potassium	4	mg/kg wwt	2390	2590	2470	2550	2700	2640	2830	2560	2540	2490	3310	3420	
Rubidium	0.05	mg/kg	36	40.6	37.6	37.5	38.4	36	40.1	36	36.6	37.4	22.5	24	
Rubidium	0.01	mg/kg wwt	8.55	8.96	8.7	8.86	9.17	9.09	9.75	8.98	9.03	8.67	6.62	6.95	
Selenium	0.05	mg/kg	1.53	1.92	1.58	1.55	1.67	1.55	1.57	1.47	1.49	1.68	1.66	1.84	
Selenium	0.01	mg/kg wwt	0.362	0.423	0.366	0.367	0.4	0.391	0.381	0.367	0.367	0.391	0.488	0.533	
Sodium	20	mg/kg	2370	2590	2340	2580	2700	2510	2870	2520	2630	2990	2950	3290	
Sodium	4	mg/kg wwt	562	573	543	609	644	634	697	629	650	694	868	953	
Strontium	0.05	mg/kg	27	28.4	19.1	24.9	29.3	22.1	32.4	28.8	29.9	32.5	34.6	49.5	
Strontium	0.01	mg/kg wwt	6.4	6.27	4.42	5.89	7.01	5.59	7.87	7.17	7.37	7.55	10.2	14.3	
Tellurium	0.02	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	
Thallium	0.002	mg/kg	0.0168	0.0182	0.0162	0.0158	0.017	0.0154	0.0188	0.0158	0.017	0.0178	0.0114	0.0146	
Thallium	0.0004	mg/kg wwt	0.00398	0.00401	0.00376	0.00373	0.00407	0.0039	0.00456	0.00395	0.00419	0.00414	0.00336	0.00422	
Tin	0.1	mg/kg	1.04	0.71	0.51	0.58	1.02	0.53	0.66	0.59	0.69	1.02	0.43	0.47	
Tin	0.02	mg/kg wwt	0.247	0.158	0.118	0.136	0.242	0.134	0.159	0.147	0.172	0.236	0.128	0.136	
Uranium	0.002	mg/kg	0.0059	0.0058	0.0071	0.0048	0.0065	0.0059	0.0074	0.0054	0.0046	0.0058	0.0022	0.0031	
Uranium	0.0004	mg/kg wwt	0.00141	0.00129	0.00164	0.00114	0.00155	0.00149	0.00178	0.00136	0.00114	0.00135	0.00064	0.00089	
Vanadium	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Vanadium	0.02	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Zinc	0.5	mg/kg	163	168	132	145	176	142	183	150	165	172	425	484	
Zinc	0.1	mg/kg wwt	38.6	37	30.6	34.4	42.1	35.9	44.4	37.3	40.8	39.9	125	140	
Zirconium	0.2	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	
Zirconium	0.04	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	
Speciated Metals (Matrix: Biota)															
MeHg)	5	µg/kg	80.5	85.8	70.1	77.3	77.4	59.6	70.9	76.4	81.8	80.9	130	119	
MeHg)	1	µg/kg wwt	19.1	18.9	16.2	18.3	18.5	15.1	17.2	19	20.2	18.8	38.1	34.4	
MeHg)		mg/kg wwt	0.0191	0.0189	0.0162	0.0183	0.0185	0.0151	0.0172	0.019	0.0202	0.0188	0.0381	0.0344	
Aggregate Organics (Matrix: Biota)															
Lipid content	0.5	% wwt	2.48	2.7	2.1	2.86	3.29	2.66	2.3	2.52	2.16	2.46	3.15	3.07	

A summary (displayed in Table A-14) of the output from ProUCL for fillets is compared to the regional concentrations that were identified by other fish tissue studies conducted in Ontario, to support First Nations country foods consumption studies.

Table A-14: Metals Chemical of Potential Concern Concentration Statistics for Fish Species Used in the Human Health Risk Assessment and Food Web Model (mg/kg wet weight)

Substance (lake in baseline investigation area)	Baseline Investigation Area			Chan et al. 2014	
	Minimum	Maximum	UCLM	Maximum	Average
Large Bodied Species (Fillet Analyses)					
Walleye:					
Arsenic (Springpole Lake)	0.0399	0.106	0.0659	0.743	0.144
Cobalt (Springpole Lake)	<0.004	<0.004	NC	NR	NR
Mercury (Springpole Lake)	0.14	1.77	0.656	0.823	0.319
Mercury (Birch Lake)	0.2	1.5	0.885		
Lake Whitefish:					
Arsenic (Springpole Lake)	0.0409	0.531	0.292	2.77	0.662
Cobalt (Springpole Lake)	<0.004	0.0074	0.00485	NR	NR
Mercury (Springpole Lake)	0.0419	0.223	0.125	0.084	0.154
Northern Pike:					
Arsenic (Springpole Lake)	0.0126	0.152	0.0523	0.633	0.12
Cobalt (Springpole Lake)	<0.004	0.0108	0.00771	NR	NR
Mercury (Springpole Lake)	0.0832	0.732	0.411	2.75	0.633
Mercury (Birch Lake)	0.29	0.81	0.579		
Lake Trout:					
Arsenic (Springpole Lake)	0.0333	0.925	0.361	0.411	0.151
Cobalt (Springpole Lake)	<0.004	0.0047	NC	NR	NR
Mercury (Springpole Lake)	0.212	1.1	0.791	0.533	0.301
Mercury (Birch Lake)	0.37	1.3	0.912		

NC = not calculated, insufficient number of detected concentrations; NR = not reported.

It is noted that there is a provincial fish consumption advisory for Birch Lake based on baseline mercury levels measured in fish, which indicates that people are recommended to eat no more than what is outlined here:

- Walleye – Eight to zero meals per month (depending on length) for general population and four to zero meals per month (depending on length) for sensitive population (children and pregnant / breast feeding mothers);
- Lake Whitefish – 32 to 16 meals per month (depending on length) for general population and for sensitive population (children and pregnant / breast feeding mothers);
- Northern Pike – 12 to 4 meals per month (depending on length) for general population and 4 to 0 meals per month (depending on length) for sensitive population (children and pregnant / breast feeding mothers); and
- Lake Trout - Four meals per month for general population and zero meals per month (depending on length) for sensitive population (children and pregnant / breast feeding mothers).

The provincial fish consumption advisory could also be applied to Springpole Lake, given the comparable results of the fish tissue sampling programs and the flow connectivity between the two lakes. Following the fish consumption advisory for both lakes would act to reduce health risk from exposure to arsenic or mercury from consumption of some fish species.

1.4.3.2 Arsenic and Mercury Speciation in Fish

More than 100 different arsenic species of diverse characteristics are present in the environment and biological systems (ATSDR 2007). A summary of the recent arsenic and methylmercury assessment, which was conducted on December 2, 2021, is included as part of this baseline assessment. For the current study, the following species of arsenic were assessed in fish to help understand the potential risk to human health:

- Arsenate (As V) are salts or esters of arsenic acid. This is an inorganic species of arsenic and commonly associated with water or groundwater;
- Arsenite (As III) are salts or esters of arsenic acid. This is an inorganic species of arsenic and commonly associated with water or groundwater;
- Methylated organic forms of arsenic (MMA and DMA);
- Other organic arsenic (AsB and AsC) Arsenobetaine is an organoarsenic compound that is the main form of arsenic commonly found in fish; and
- Total arsenic (acid digestion) is conducted by dissolving tissue in an acid an assessing all the arsenic which is bound in the tissue it is a combination or inorganic and organic arsenic.

The speciated arsenic results are compared to the total to identify an estimate of the potential exposure to inorganic arsenic in Table A-15 to A-18. Similarly, mercury is compared to methyl mercury in Tables A-15 to A-18.

The following observations are made about the arsenic speciation:

- Inorganic arsenic (As V and As III) was below the analytical detection limit for all of the samples collected. The full detection limit was assumed for the analysis.
- Arsenic V is reduced to arsenic III, and a portion of this is subsequently methylated to monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA).
- Arsenobetaine and Arsenocholine are both organic arsenics which are associated with fish.
- Most of the speciated arsenic is organic arsenic with 20% of total arsenic being organic arsenic.
- Detected concentrations of organic arsenic were most common at Birch Lake and Springpole Lake (L-15) with most of the speciation of arsenic in L-17 and L-19 being below the detection limit.
- The UCLM for inorganic arsenic from Birch Lake and Springpole Lake (L-15) was 7.7% and therefore 10% was used as an upper limit in fish for the Human Health Model.

Based on these results, it is conservative to assume that total mercury concentrations in small-bodied fish are 90% methylmercury. For large-bodied fish, the % methylmercury versus mercury was assessed in the 2022 fillet data and total mercury concentrations in large-bodied fish are 92% methylmercury.

Table A-15: Summary of Arsenic and Mercury Speciation for Birch Lake

Parameter	BIRCH-COMP-1-BNM (1)	BIRCH-COMP-2-BNM (1)	BIRCH-COMP-3-BNM	BIRCH-COMP-1-YLP (2)	BIRCH-COMP-2-YLP (2)	BIRCH-COMP-3-YLP (2)	BIRCH-COMP-4-YLP (2)	BIRCH-COMP-5-YLP (2)	BIRCH-COMP-6-YLP (2)	BIRCH-COMP-7-YLP (2)
Arsenate (As V) (mg/kg dw)	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Arsenite (As III) (mg/kg dw)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Dimethylarsinic Acid (DMA)	0.0173	0.0214	0.02	0.0145	0.0173	0.0119	0.0107	0.0098	0.0063	0.006
Monomethylarsonic Acid (MMA)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Arsenobetaine (AsB) (mg/kg dw)	0.0478	0.0452	0.0394	0.0956	0.0969	0.0528	0.0473	0.0455	0.0483	0.0441
Arsenocholine (AsC) (mg/kg dw)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Total Arsenic (mg/kg dw)	0.367	0.640	0.598	0.570	0.664	0.504	0.476	0.453	0.304	0.331
AsV + As III (%)	8.1	4.7	5.0	5.3	4.5	6.0	6.3	6.6	9.9	9.0
DMA and MMA (%)	6.1	4.1	4.1	3.4	3.4	3.3	3.3	3.3	3.7	3.3
AsB+AsC (%)	14.4	7.8	7.4	17.7	15.4	11.5	11	11.1	17.5	14.8
total Hg (mg/kg ww)	0.0216	0.0298	0.0286	0.0330	0.0290	0.0447	0.0365	0.0350	0.0370	0.0404
MeHg (mg/kg ww)	0.0268	0.0289	0.024	0.0285	0.0299	0.0288	0.0317	0.0333	0.0236	0.028
Percent meHg (%)	124	97.0	83.9	86.4	103	64.4	86.8	95.1	63.8	69.3

Notes:
Red font indicates non detect with upper of the detection limit (DL) used in assessment.
(1) Bluntnose Minnow.
(2) Yellow Perch.

Table A-16: Summary of Arsenic and Mercury Speciation for Springpole Lake

Parameter	L-15-COMP-1-BNS (1)	L-15-COMP-2-BNS (1)	L-15-COMP-3-BNS (1)	L-15-COMP-4-BNS (1)	L-15-COMP-5-BNS (1)	L-15-COMP-1-MS (2)	L-15-COMP-2-MS (2)	L-15-COMP-3-MS (2)	L-15-COMP-4-MS (2)	L-15-COMP-5-MS (2)
Arsenate (As V) (mg/kg dw)	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Arsenite (As III) (mg/kg dw)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Dimethylarsinic Acid (DMA)	0.0404	0.0482	0.0359	0.0463	0.0455	0.0243	0.0271	0.0341	0.043	0.0244
Monomethylarsonic Acid (MMA)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Arsenobetaine (AsB) (mg/kg dw)	0.0293	0.0262	0.025	0.0293	0.028	0.0377	0.0341	0.0282	0.0279	0.0283
Arsenocholine (AsC) (mg/kg dw)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Total Arsenic (mg/kg dw)	0.373	0.403	0.335	0.330	0.306	0.385	0.401	0.348	0.355	0.387
AsV + As III (%)	8.0	7.4	9.0	9.0	9.8	7.8	7.5	8.6	8.5	7.8
DMA and MMA (%)	12.1	13.2	12.2	15.5	16.5	7.6	8.0	11.3	13.5	7.6
AsB+AsC (%)	9.2	7.7	9.0	10.4	10.8	11.1	9.8	9.5	9.3	8.6
total Hg (mg/kg ww)	0.0538	0.0400	0.0473	0.0490	0.102	0.0500	0.0616	0.0701	0.0874	0.0933
MeHg (mg/kg ww)	0.0458	0.0385	0.0444	0.0365	0.0641	0.0463	0.052	0.0492	0.0613	0.0868
Percent meHg (%)	85.	96.3	93.9	74.5	62.8	92.6	84.4	70.2	70.1	93.0

Note:
Red font indicates non detect with upper of the detection limit (DL) used in assessment.
(1) Bluntnose Minnow.
(2) Mimic Shiner.

Table A-17: Summary of Arsenic and Mercury Speciation for L-15 and L-17

Parameter	L-15-COMP-1-STS[1]	L-15-COMP-2-STS[1]	L-15-COMP-3-STS[1]	L-15-COMP-4-STS[1]	L-15-COMP-5-STS[1]	L-15-COMP-6-STS[1]	L-15-COMP-7-STS[1]	L-17-COMP-1-FDS[2]	L-17-COMP-2-FDS[2]	L-17-COMP-3-FDS[2]
Arsenate (As V) (mg/kg dw)	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Arsenite (As III) (mg/kg dw)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Dimethylarsinic acid (DMA)	0.0634	0.0871	0.0051	0.006	0.0053	0.005	0.005	0.005	0.005	0.005
Monomethylarsonic acid (MMA)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Arsenobetaine (AsB) (mg/kg dw)	0.034	0.0351	0.0678	0.0631	0.106	0.0731	0.0449	0.005	0.0058	0.0068
Arsenocholine (AsC) (mg/kg dw)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Total arsenic (mg/kg dw)	0.426	0.509	0.510	0.505	0.473	0.398	0.403	0.072	0.068	0.088
AsV + As III (%)	7.0	5.9	5.9	5.9	6.3	7.5	7.4	41.6	44.1	34.0
DMA and MMA (%)	16.1	18.1	2.0	2.2	2.2	2.5	2.4	13.9	14.7	11.3
AsB+AsC (%)	9.2	7.9	14.3	13.5	23.5	19.6	12.4	13.9	15.8	13.4
Total Hg (mg/kg ww)	0.0401	0.0530	0.0568	0.0617	0.0660	0.0579	0.0873	0.0518	0.0787	0.0908
MeHg (mg/kg ww)	0.0379	0.0464	0.0466	0.0509	0.0597	0.0577	0.0903	0.0523	0.0662	0.0382
Percent meHg (%)	94.5	87.5	82.0	82.5	90.5	99.7	103.4	101.0	84.1	42.1

Note:
Red font indicates non detect with upper of the detection limit (DL) used in assessment.
(1) Spottail Shiner.
(2) Finescale Dace.

Table A-18: Summary of Arsenic and Mercury Speciation for L-18 and L-19

Parameter	L-17-COMP-4-FDS[1]	L-17-COMP-5-FDS[1]	L-18-COMP-1-BSB[2]	L-18-COMP-2-BSB[2]	L-18-COMP-3-BSB[2]	L-18-COMP-4-BSB[2]	L-18-COMP-5-NRD[3]	L-19-COMP-1-FHM[4]	L-19-COMP-2-FHM[4]	L-19-COMP-3-FHM[4]	L-19-COMP-4-FHM[4]	L-19-COMP-5-FHM[4]
Arsenate (As V)	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Arsenite (As III)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Dimethylarsinic Acid (DMA, as As)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Monomethylarsonic Acid (MMA, as As)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Arsenobetaine (AsB, as As)	0.0055	0.0072	0.032	0.0245	0.0338	0.0324	0.0122	0.005	0.0052	0.005	0.005	0.0052
Arsenocholine (AsC, as As)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Total Arsenic	0.061	0.082	0.144	0.126	0.146	0.139	0.165	0.117	0.120	0.144	0.149	0.164
AsV + As III	49.2	36.6	20.8	23.8	20.6	21.6	18.2	25.6	25.0	20.8	20.1	18.3
DMA	16.4	12.2	6.9	7.9	6.9	7.2	6.1	8.5	8.3	6.9	6.7	6.1
AsB+AsC	17.2	14.9	25.7	23.4	26.6	26.9	10.4	8.5	8.5	6.9	6.7	6.2
total Hg	0.0682	0.0948	0.0465	0.0514	0.0542	0.0577	0.0599	0.0389	0.0290	0.0376	0.0302	0.0292
MeHg	0.0626	0.121	0.0528	0.0506	0.0582	0.0498	0.0723	0.0475	0.0312	0.0331	0.0352	0.0284
Percent meHg	91.8	127.6	113.5	98.4	107.4	86.3	120.7	122.1	107.6	88.0	116.6	97.3

Note:
Red font indicates non detect with upper of the detection limit (DL) used in assessment.
(1) Finescale Dace.
(2) Brook Stickleback.
(3) Northern Pearl Dace.
(4) Fathead Minnow.

1.5 Air Concentration and Deposition Rates

Numerous activities associated with the construction and operation of the Project will generate dust and other airborne emissions. Those airborne chemicals concentration and deposition rates were generated using AERMOD, as specified in Air Quality Assessment (Appendix G-2 of the EIS/EA). Table A-19 and A-20 present the ground level air concentrations, and deposition at the Maximum Point of Impingement (MPOI) and point of receptor locations and for all the COPCs, respectively.

Table A-19: Summary of Annual Ambient Air Concentration, Emissions Rates and Deposition

COPC	Air Concentration		Emission Rate	Deposition			
	Air conc AQT		Q	dep.AQT			
	mg/m^3		g/sec	g/m^2 - yr			
	Baseline	Project Alone	Project Alone	Soil Model[1]	Birch Lake[2]	Springpole Lake North Basin[3]	Springpole Lake Southeast Arm[4]
Aluminum	6.0E-05	9.4E-05	6.34E-01	3.89E-02	1.80E-02	1.44E-02	4.69E-03
Antimony	1.5E-06	1.2E-08	7.78E-05	4.77E-06	2.20E-06	1.76E-06	5.75E-07
Arsenic	1.1E-06	5.2E-07	3.47E-03	2.13E-04	9.90E-05	7.87E-05	2.56E-05
Barium	2.4E-06	5.6E-07	3.79E-03	2.32E-04	1.10E-04	8.59E-05	2.80E-05
Beryllium	6.0E-08	3.4E-09	2.28E-05	1.40E-06	6.50E-07	5.17E-07	1.69E-07
Bismuth	7.7E-07	2.2E-09	1.49E-05	9.15E-07	4.30E-07	3.38E-07	1.10E-07
Cadmium	1.7E-07	4.83E-09	3.24E-05	1.99E-06	9.30E-07	7.36E-07	2.40E-07
Chromium	1.2E-06	3.44E-07	2.31E-03	1.42E-04	6.60E-05	5.24E-05	1.71E-05
Cobalt	1.5E-07	1.24E-07	8.31E-04	5.10E-05	2.40E-05	1.89E-05	6.15E-06
Copper	8.2E-05	3.99E-07	2.68E-03	1.64E-04	7.91E-05	6.08E-05	1.98E-05
Iron	8.6E-05	2.30E-04	1.54E+00	9.48E-02	4.40E-02	3.51E-02	1.14E-02
Lead	6.9E-07	3.74E-07	2.51E-03	1.54E-04	7.20E-05	5.70E-05	1.86E-05
Magnesium	8.00E-05	9.00E-05	6.04E-01	3.71E-02	1.73E-02	1.37E-02	4.47E-03
Manganese	3.60E-06	5.73E-06	3.85E-02	2.36E-03	1.10E-03	8.73E-04	2.85E-04
Mercury	7.20E-09	9.57E-10	6.42E-06	3.94E-07	1.84E-07	1.46E-07	4.75E-08
Molybdenum	4.00E-06	2.54E-07	1.71E-03	1.05E-04	4.88E-05	3.87E-05	1.33E-05
Nickel	8.90E-07	2.67E-07	1.79E-03	1.10E-04	5.12E-05	4.06E-05	1.33E-05
Selenium	8.20E-07	1.14E-08	7.68E-05	4.72E-06	2.20E-06	1.74E-06	5.69E-07
Silver	2.60E-07	1.54E-08	1.03E-04	6.34E-06	2.95E-06	2.34E-06	7.64E-07
Strontium	1.00E-06	1.29E-06	8.67E-03	5.32E-04	2.48E-04	1.97E-04	6.42E-05
Thallium	4.90E-07	1.21E-08	8.14E-05	5.00E-06	2.33E-06	1.85E-06	6.03E-07
Tin	7.30E-07	1.21E-09	8.11E-06	4.98E-07	2.32E-07	1.84E-07	6.00E-08
Titanium	4.00E-06	5.77E-06	3.87E-02	2.38E-03	1.11E-03	8.78E-04	2.86E-04
Uranium	5.30E-09	2.04E-08	1.37E-04	8.42E-06	3.93E-06	3.11E-06	1.02E-06
Vanadium	1.60E-06	3.17E-07	2.13E-03	1.31E-04	6.09E-05	4.83E-05	1.58E-05
Zinc	1.00E-05	7.84E-07	5.26E-03	3.23E-04	1.51E-04	1.19E-04	3.90E-05
Benzo(a)anthracene [5]	7.49E-08	3.97E-09	1.79E-05	1.50E-07	1.50E-07	1.50E-07	1.50E-07
Benzo(a)pyrene	1.80E-08	9.55E-10	4.30E-06	3.59E-08	3.59E-08	3.59E-08	3.59E-08
Benzo(b)fluoranthene	2.89E-08	1.53E-09	6.90E-06	5.77E-08	5.77E-08	5.77E-08	5.77E-08

Table A-19: Summary of Annual Ambient Air Concentration, Emissions Rates and Deposition

COPC	Air Concentration		Emission Rate	Deposition			
	Air conc AQT		Q	dep.AQT			
	mg/m^3		g/sec	g/m^2 - yr			
	Baseline	Project Alone	Project Alone	Soil Model(1)	Birch Lake(2)	Springpole Lake North Basin(3)	Springpole Lake Southeast Arm(4)
Benzo(g,h,i)perylene	4.71E-08	2.50E-09	1.13E-05	9.41E-08	9.41E-08	9.41E-08	9.41E-08
Benzo(k)fluoranthene	2.19E-08	1.16E-09	5.22E-06	4.36E-08	4.36E-08	4.36E-08	4.36E-08
Chrysene	1.01E-07	5.36E-09	2.41E-05	2.02E-07	2.02E-07	2.02E-07	2.02E-07
Dibenzo(a,h)anthracene	1.09E-08	5.78E-10	2.60E-06	2.17E-08	2.17E-08	2.17E-08	2.17E-08
Indeno(1,2,3-cd)pyrene	1.81E-08	9.62E-10	4.33E-06	3.62E-08	3.62E-08	3.62E-08	3.62E-08

(1) Based on annual SPM deposition of 1.24 g/m^2
(2) Based on annual SPM deposition of 0.58 g/m^2, which is the 75th percentile for Birch Lake.
(3) Based on annual SPM deposition of 0.46 g/m^2
(4) Based on annual SPM deposition of 0.15 g/m^2
(5) SPM deposition was not adjusted for PAHs for surface water, which is conservative

Table A-20: Summary of Annual Concentration and Deposition Rates at Points of Reception for HHRA

Point of Reception	Mercury		Arsenic		Cobalt	
	Concentration (mg/m^3)	Deposition (g/m^2)	Concentration (mg/m^3)	Deposition (g/m^2)	Concentration (mg/m^3)	Deposition (g/m^2)
POR01	2.1E-10	5.0E-08	1.1E-07	2.7E-05	2.7E-08	6.4E-06
POR02	5.0E-10	1.4E-07	2.7E-07	7.3E-05	6.5E-08	1.8E-05
POR04	1.2E-10	6.4E-08	6.5E-08	3.4E-05	1.5E-08	8.3E-06
POR05	9.4E-10	3.3E-07	5.1E-07	1.8E-04	1.2E-07	4.2E-05
POR07	7.4E-11	2.7E-08	4.0E-08	1.5E-05	9.6E-09	3.5E-06
POR22	5.4E-11	2.4E-08	2.9E-08	1.3E-05	7.0E-09	3.1E-06
POR24	3.4E-11	1.2E-08	1.8E-08	6.3E-06	4.4E-09	1.5E-06
POR38	2.8E-11	9.7E-09	1.5E-08	5.3E-06	3.6E-09	1.3E-06
POR61	1.2E-10	3.2E-08	6.2E-08	1.7E-05	1.5E-08	4.1E-06

1.6 BCF and BAFs Used in the Modelling Effort

Bioconcentration Factors (BCF) and Bioaccumulation Factors (BAF) used in calculation of COPCs concentration in the tissue of soil and aquatic organisms are listed in the Table below (Table A-21).

The predominant form of mercury in fish is methylmercury; as such, the modelled methymercury concentration is set to be equal to mercury. Mercury is known to bioaccumulate in fish and the level of bioaccumulation is associated with the trophic level. Although HHRAP identified a BAF of 1000 L/kg for mercury, literature values can be much larger. A value of 10,000 was used for small fish (forage fish) that are eaten by smaller carnivores (i.e., Muskrat and Sandpiper) and 100,000 L/kg for large fish (carnivorous fish) that are eaten by larger carnivores (i.e., Black Bear and Bald Eagle). These values are estimated based on the 95th UCLM concentration in fish tissues and the surface water baseline concentration.

1.7 Biotransfer Factors

Biotransfer factors used in calculation of COPCs concentration in the tissue of mammals and birds and are listed in the Table below (Table A-22).

Biotransfer factors were predominantly selected from Sheppard 2010. Other resources were used where a value was not available from Sheppard or where a Sheppard value was not appropriate for application (e.g., limited detection, high standard deviation).

Table A-21: BCF and BAF Used in the Modelling Effort

COPCs	Soil to Plants	Soil to Invertebrates	Water to Plants	Water to Invertebrates	Water to Fish	Sediment to Invertebrates
	Regression[1]	Regression[1]	BCF (unitless)	BCF[3] (unitless)	BAF (unitless)	BAF[6] (unitless)
Arsenic	Cp=0.03752 x Cs	ln(Ci) = 0.706 x ln(Cs) – 1.421	293[2]	73	400[5] 50[11]	0.9[12]
Cadmium	ln(Cp)=0.546 x ln(Cs)+(-0.475)	ln(Ci) = 0.795 × ln(Cs) + 2.114	782[2]	3,461	200[5]	3.4
Chromium	Cp=0.041 x Cs	Ci = 0.306 × Cs	4,406[2]	3,000	200[5]	0.39
Cobalt	Cp=0.0075 x Cs	Ci = 0.122 × Cs	3120 [8]	4,066	300[5]	0.9[12]
Copper	ln(Cp)=0.394 x ln(Cs)+(0.668)	Ci = 0.515 × Cs	541[2]	3,718	200[5]	0.3
Lead	ln(Cp)=0.561 x ln(Cs)+(-1.328)	ln(Ci) = 0.807 × ln(Cs) - 0.218	1,706[2]	5,059	300[5]	0.63
Manganese	Cp=0.079 x Cs	ln(Ci) = 0.682 × ln(Cs) - 0.809	12220 [8]	4,066	500[5]	0.9[12]
Molybdenum[7]	Cp = 0.8 x Cs	Ci = 0.22 × Cs	130 [8]	164.3 [9]	10[5]	0.9[12]
Mercury	ln(Cp)=0.544 x ln(Cs)+(-0.996)	ln(Ci) = 0.118 × ln(Cs) - 0.684	24,762[2]	20,184	10,000 (Forage)[10] 100,000 (Carnivorous)[10]	0.068
Nickel	ln(Cp)=0.748 x ln(Cs)+(-2.223)	Ci = 1.89 × Cs	61[2]	28	100[5]	0.9[12]
Zinc	ln(Cp)=0.554 x ln(Cs)+(1.575)	ln(Ci) = 0.328 × ln(Cs) + 4.449	2,175[2]	4,578	2,060[4]	0.57
Mercury (methyl)	N/A	N/A	80,000[2]	55,000	NR	0.48

Notes:
BCF and BAF are unitless.
N/A Not Available
NR Not relevant as methylmercury concentration in fish set to mercury concentration.
1 US EPA Eco-SSL 2007.
2 US EPA Region VI 1999: Appendix C Table C4.
3 US EPA Region VI 1999: Appendix C Table C3.
4 US EPA HHRAP 2005.
5 NCRP, 1996.
6 US EPA Region VI 1999: Appendix C Table C6.
7 Soil to Plants equations from DOE 2003. Soil to Invertebrate equation from US EPA 1999.
8 Sheppard 2010. Values provided in dry weight are converted to wet weight.
9 Regoli, et al. 2012
10 Site-specific value.
11 US EPA 2003. Value used in HHRA and represents Trophic Level 3 fish.
12 Where a value was not identified, the arithmetic average of 6 recommended values for metals was applied.

Table A-22: Biotransfer Factors Used in the Modelling Effort

COPCs	Mammals	Source	Birds	Source
	day/kg			day/kg
Arsenic	0.016	Sheppard 2010	0.66	Sheppard, 2010
Cadmium	0.00833	Sheppard, 2010	1.62	Sheppard, 2010
Chromium	0.042	Sheppard, 2010	0.02	Sheppard, 2010
Cobalt	0.0034	Sheppard, 2010	0.04	Sheppard, 2010
Copper	0.31	Sheppard, 2010	1.49	Sheppard, 2010
Lead	0.0004	Staven, 2003	0.07	Sheppard, 2010
Manganese	0.00057	Sheppard, 2010	0.06	Sheppard, 2010
Molybdenum	0.0027	Sheppard, 2010	0.08	Sheppard, 2010
Mercury	0.25	Staven, 2003	0.03	Staven, 2003
Nickel	0.006	HHRAP, 2005	0.02	Sheppard, 2010
Zinc	0.1	Staven, 2003	7	Staven, 2003
Mercury (methyl)	0.00078	HHRAP, 2005	0.0358	HHRAP, 2005

2.0 MODELLED CONCENTRATIONS USED IN THE ASSESSMENT

Activities in all three assessment cases (Baseline, Project and Post-closure) have the potential to increase concentrations of metals and PAHs in soil and vegetation through deposition of particulate matter. Wildlife (e.g., moose and vole) that browse vegetation and incidentally ingest soil can then take up substances into tissues, which are then consumed by people or carnivorous wildlife. Therefore, concentrations of animal tissues and future concentrations of substances in soil and plants were estimated. The incremental concentrations predicted to be contributed from the Project activities to soil, plants and wild game in the region were calculated using the equations presented in the following sections, which include food chain modelling methods developed by the United States Environmental Protection Agency (US EPA 2005).

These methods provide a multi-pathway exposure assessment tool based on reasonable and protective assumptions about how substances emitted from combustion sources can be taken up into soil and plants and then by wildlife. A description of the methods used to predict concentrations in soil, plants and meat are presented below.

2.1. Soil

Calculation of Chemical of Potential Concern Concentration in Soil

Deposition onto soil was assumed to occur throughout the construction, operations and active closure phases of the Project (i.e., 18 years). The incremental increase in soil concentrations due to the Project was determined using equations presented below based on deposition at the MPOI.

Deposition rates per unit area of soil for the COPCs from the ambient air quality modelling were converted to deposition rates per unit mass of soil by using the following equation, which considers all of the COPC to be in particulate form:

$$Ds = \frac{100 \cdot \text{dep.AQT}}{\text{Zs} \cdot \text{BD}}$$

Where:

Parameter	Definition	Units	Value	Reference
Ds	Deposition Term	mg/kg-yr	7.6E-03	Calculated: Arsenic
dep.AQT	Deposition value from ambient air quality modelling (equals Q x Dytwp)	g/m^2-yr	2.1E-04	Air quality modelling
Zs	Soil mixing depth (default)	cm	2	US EPA 2005
BD	Soil bulk density for fine-grain soil	g/cm^3	1.4	MECP 2011
100	Conversion factor	(mg/cm^2)/(kg/cm^2)	100	n/a

Calculation of Chemical of Potential Concern Losses in Soil

Although COPCs may be deposited onto the soil from the ambient air, there remains the potential that they may be lost from the soil. Then, in order to calculate the concentration of COPC in soil, these losses have to be quantified. There are five mechanisms by which chemicals can be lost from soil:

- Biotic and abiotic degradation;
- Erosion;
- Surface runoff;
- Leaching; and
- Volatilization.

Each of these mechanisms needs to be addressed in the determination of the final predicted soil concentration.

Calculation of Chemical of Potential Concern Losses from Soil Due to Biotic and Abiotic Degradation

The COPC loss constant due to biotic and abiotic degradation (*ksg*) is COPC-specific. Values were obtained from US EPA (2005). For arsenic, ksg is:

$$ksg_{arsenic} = 0\ yr^{-1}$$

Calculation of Chemical of Potential Concern Losses from Soil Due to Erosion

The COPC loss constant due to erosion (*kse*) is typically COPC- and site-specific. However, US EPA (2005) recommends a default value of 0 for all COPCs based on the assumption that contaminated soil erodes equally both onto the site and away from the site. Therefore, there is no net loss or gain to the soil due to erosion. The kse for arsenic is:

$$kse_{arsenic} = 0\ yr^{-1}$$

Calculation of Chemical of Potential Concern Losses from Soil Due to Surface Runoff

After deposition onto the soil surface, COPC can be lost from the site due to surface runoff. To account for this, a loss constant is calculated. The COPC loss constant due to surface runoff (*ksr*) is typically COPC- and site-specific.

$$ksr = \frac{RO}{\theta_{sw} \cdot Z_s} \cdot \left(\frac{1}{1 + (Kds \cdot BD/\theta_{sw})}\right)$$

Where:

Parameter	Definition	Units	Value	Reference
ksr	COPC soil loss constant due to runoff	1/y	0.344	Calculated: Arsenic
RO	Average annual surface runoff from pervious areas	cm/y	28.01	Site Specific[1]
θ_{sw}	Soil volumetric water content	ml/cm^3	0.17	MECP 2011
Zs	Soil mixing depth (default)	cm	2	US EPA 2005
kds	Soil-water partition coefficient	ml/g	29	US EPA 2005
BD	Soil bulk density	g/cm^3	1.4	MECP 2011

1. Site specific value obtained from Hydrology Baseline Report, Appendix M-1 of the EIS/EA

Calculation of Chemical of Potential Concern Losses from Soil Due to Leaching

COPCs that are deposited to the soil surface can also be lost from the site through leaching processes. A leaching loss constant (i.e., *ksl* is calculated as follows):

$$ksl = \frac{P + I - RO - Ev}{\theta_{sw} \cdot Z_s \cdot [1.0 + (BD \cdot Kds/\theta_{sw})]}$$

Where:

Parameter	Definition	Units	Value	Reference
ksl	COPC soil loss constant due to leaching	1/y	0(2)	Calculated: Arsenic
P	Average annual precipitation (site-specific long-term (1981-2010) average value for Thunder Bay)	cm/y	68.6	Site Specific[1]
I	Average annual irrigation	cm/y	0	US EPA 2005
RO	Average annual surface runoff from pervious areas (default)	cm/y	28.01	Site Specific[1]
Ev	Average annual evapotranspiration	cm/y	46	Site Specific[1]
θ_{sw}	Soil volumetric water content	ml/cm^3	0.17	MECP 2011
Zs	Soil mixing depth (default)	cm	2	US EPA 2005
kds	Soil-water partition coefficient	ml/g	29	Chemical specific: Arsenic (US EPA 2005)
BD	Soil bulk density	g/cm^3	1.4	MECP 2011

Note:
1. Site specific value obtained from Hydrology Baseline Report, Appendix M-1 of the EIS/EA
2 Value set at 0 for conservatism.

Calculation of Chemical of Potential Concern Losses from Soil Due to Volatilization

Deposited COPCs can also be lost from the site through volatilization, particularly for chemicals with high vapour pressures. However for metals, non-volatile and semi-volatile COPCs, US EPA (2005) recommends setting all *ksv* values to be zero.

$$ksv_{arsenic} = 0\ yr^{-1}$$

Calculation of Chemical of Potential Concern Losses from Soil Due to All Processes

Therefore, the total loss constant for the site is the sum of all of the soil loss constants i.e.,

$$ks = ksg + kse + ksr + ksl + ksv$$

Where:

Parameter	Definition	Unit	Value	Reference
ks	COPC soil loss constant due to all processes	1/y	0.344	Calculated: Arsenic
ksg	COPC soil loss constant due to degradation	1/y	0	US EPA 2005
kse	COPC soil loss constant due to erosion	1/y	0	Calculated: Arsenic
ksr	COPC soil loss constant due to runoff	1/y	0.344	Calculated: Arsenic
ksl	COPC soil loss constant due to leaching	1/y	0	Calculated: Arsenic
ksv	COPC soil loss constant due to volatilization	1/y	0	Default value for metals

The values presented in the above table are for the worked example of arsenic.

Calculation of Chemical of Potential Concern Concentration in Soil

Following the calculation of the soil loss constants, the predicted COPC concentration can be determined. US EPA (2005) recommends using different equations for this calculation depending on whether or not the COPC being modelled is carcinogenic or non-carcinogenic.

Non-carcinogenic Chemical of Potential Concerns

$$Cs_{tD} = \frac{Ds \cdot [1 - exp(-ks \cdot tD)]}{ks}$$

Where:

Parameter	Description	Units	Value	Reference
Cs_{tD}	Incremental soil concentration at time *tD* for Project	mg/kg	0.0221	Calculated: Arsenic
Ds	Deposition term	mg/kg-yr	7.6E-03	Calculated: Arsenic
tD	Total time period over which deposition occurs	y	19	Assumption
ks	COPC soil loss constant due to all processes	1/yr	0.344	Calculated: Arsenic

For the initial screening (Section 3.4), the incremental concentration (0.0221 mg/kg) is added to the maximum soil concentration (i.e., 39.3 mg/kg).

$$Cs = 39.3\ mg/kg\ + 0.0221 = 39.3\ mg/kg$$

For the quantitative calculations, the incremental concentration (0.0221 mg/kg) is added to the EPC soil concentration (i.e., 12.0 mg/kg).

$$Cs = 12.0\ mg/kg\ + 0.0221 = 12.0\ mg/kg$$

2.1.2 Vegetation

Calculation of COPC Concentration in Terrestrial Plants

Vegetation has the capacity to accumulate some COPCs from the surrounding environment. The accumulation of the COPCs may be in different parts of the plant (e.g., berries, leaves, roots) and then have the potential to affect people who harvest and consume these plants. The amount of COPCs that is accumulated is dependent on a myriad of factors including the chemical itself, species of vegetation, and soil type. Therefore, in order to evaluate the health risks to people, it is necessary to predict the potential COPC concentration in the vegetation following emission, dispersion, and deposition.

There are no specific models available that predict the concentration of COPCs into specific constituents of the plant (e.g., berries). Therefore, for the purpose of this assessment, it was assumed that the assimilation of COPCs in plants would be distributed equally to all above ground produce. The human receptor would then consume the entire above ground produce.

The first step in this exposure modelling was to predict the COPC concentration in plants due to three specific pathways: deposition on the plant, absorption from the air, and uptake/translocation from the root. Absorption from the air is set to "0" as the being addressed are non-volatile.

Calculation of Chemical of Potential Concern Particle Deposition to Plant Surface

The plant concentration due to direct deposition onto the leaf surface is presented as follows:

$$Pd = \frac{1000 \cdot Q \cdot (1 - Fv) \cdot [Dydp + (Fw \cdot Dywp)] \cdot Rp \cdot [1.0 - exp(-kp \cdot Tp)]}{Yp \cdot kp}$$

Where:

Parameter	Definition	Units	Value	Reference
Pd	Plant concentration due to direct (wet/dry) deposition for Project only	mg/kg	1.75E-02	Calculated: Arsenic (MPOI)
1,000	Conversion factor from milligrams to grams	mg/g	1000	n/a
Q	COPC emission rate; COPC-specific from air quality modelling	g/sec	3.5E-03	Modelled; arsenic
Fv	Fraction of COPC air concentration in vapour phase	unitless	0	US EPA 2005
Dydp	Unitized yearly dry deposition from particle phase	sec/m^2-y	0.056	Modelled
Fw	Fraction of COPC wet deposition that adheres to plant surfaces (Default)	unitless	0.6	US EPA 2005
Dywp	Unitized yearly wet deposition from particle phase	sec/m^2-y	0.042	Modelled
Rp	Interception fraction of the edible portion of the plant: forage = 0.39 and berries = 0.053	unitless	0.39 (Forage)	US EPA 2005
kp	Plant surface loss coefficient (Default)	1/y	18	US EPA 2005
Tp	Length of plant exposure to deposition per harvest of the edible portion of plant (Default)	y	0.33	Assumed(1)
Yp	Yield or standing crop biomass of the edible portion of the plant (productivity) (Default)	kg/m^2	2.24	US EPA 2005

(1) Based on 4 month growing season

Calculation of Chemical of Potential Concern Root Uptake from Soil to Plant Tissue Above Ground

Typically, COPCs deposited on the soil surface may potentially enter into the vegetation through the root uptake process. In this process, the COPCs are dissolved in the soil pore water and then absorbed by the roots. Once absorbed by the roots, the COPCs are assumed to transport to the above ground tissues and sequester into the edible parts of the plant (e.g., leaves, berries). The process is modelled by the following:

$$Pr_{ag} = Br_{ag}\ x\ CF\ x\ Cs$$

Where:

Parameter	Definition	Units	Value	Reference
Pr_{ag}	Concentration of COPC in above-ground produce due to root uptake	mg/kg	1.79E-02	Calculated: Arsenic
CF	Conversion factor from dry weight to wet weight	unitless	47.5	Site-Specific
Br_{ag}	Plant-soil bioconcentration factor for above-ground produce	unitless	0.03752	US EPA Eco-SSL
Cs	Soil concentration	mg/kg	12	Calculated: Arsenic

The US EPA Eco-SSL equation provides value in dry weight. For the purpose of the human and wildlife plant consumption, the concentrations were provided on a wet-weight basis using the average water content specified in the analytical report (52.5%).

Calculation of Overall Chemical of Potential Concern Concentration in Plants

Therefore, the total contribution of COPCs to the surrogate plant's concentration from the airborne emissions of the Project would be the sum of the individual pathways that the chemicals may be absorbed by the plant.

$$Pi = (Pd + Pv + \mathrm{Pr})$$

Where:

Parameter	Definition	Units	Value	Reference
Pi	Concentration of COPC in plant	mg/kg	1.79E-02	Calculated: Arsenic (MPOI)
Pd	Concentration of COPC in plant due to direct (wet/dry) deposition	mg/kg	1.75E-02	Calculated: Arsenic
Pv	Concentration of COPC in plant due to air-to-plant transfer	mg/kg	0	Calculated: Arsenic
Pr	Concentration of COPC in above-ground produce due to root uptake	mg/kg	2.14E-02	Calculated: Arsenic

This value (*pi*) is then added to the baseline concentration of 3.92E-02 mg/kg, therefore, the overall plant concentration for the Project scenario is 5.71E-02 mg/kg.

2.2 Wild Game

After estimating the COPC concentration in the above ground tissue of forage plants, it was assumed that wild game will consume the plants and the COPCs will be assimilated and accumulate in the tissues of the animal. Similarly, the consumption of surface water by wild game would also introduce another source of exposures to the COPCs as deposited chemicals may transferred as runoff into surface waterbodies. The concentration in the wild game meat would then be predicted by the following equation:

$$A_{game} = \left((F_i \cdot Qp \cdot P) + (Qs \cdot Cs \cdot Bs) + (Q_W \cdot C_W \cdot B_W)\right) \cdot Ba \cdot MF \cdot AUF$$

Where:

Parameter	Definition	Units	Value	Reference
A_{game}	Concentration of COPC in game meat	mg/kg	0.113	Arsenic for Moose (MPOI, Project)
F_i	Fraction of forage grown on contaminated soil and ingested by the animal (recommended default)	unitless	1	US EPA 2005
Qp	Quantity of forage ingested by the animal per day	kg/d	15.68	FCSAP 2012 (Based on 90% of diet)
P	Concentration of COPC in forage ingested by the animal (wet weight)	mg/kg	0.057	Calculated for arsenic
Qp	Quantity of forage ingested by the animal per day	kg/d	3.92	FCSAP 2012 (Based on 10% of diet)

Parameter	Definition	Units	Value	Reference
P	Concentration of COPC in forage ingested by the animal (wet weight)	Mg/kg	1.07	Calculated for arsenic
Qs	Quantity of soil ingested by the animal	kg/d	0.16	FCSAP 2012
Bs	Soil bioavailability factor (recommended default)	unitless	1	US EPA 2005
Cs	Concentration of COPC in soil	mg/kg	12	Calculated for arsenic
Qw	Quantity of water ingested by the animal	L/d	20	FCSAP 2012
Cw	Average water concentration over exposure duration	mg/L	2.15E-03	Calculated for arsenic
Bw	Water bioavailability factor (recommended default)	unitless	1	US EPA 2005
Ba	Biotransfer factor for wild game	d/kg	0016	US EPA 2005
MF	Metabolism factor (recommended default)	unitless	1	US EPA 2005
AUF	Area Use Factor	unitless	1	Assumption

Plant ingestion rate of 19.6 kg wet weight/day is based on a dry food ingestion rate of 0.02 kg dry weight/kg bw /d and a body weight of 400 kg (8 kg dry weigh per day) adjusted for moisture content. Moisture content of 59.24% is based on a weighted average for forage (80% diet at 52.5% moisture) and aquatic plants (20% diet at 86.2% moisture). The moisture content assumption is likely to overestimate exposure.

2.3 Fish

After estimating the COPC concentration in surface waters, it was assumed that fish living in these waters will assimilate and accumulate COPCs in their tissues. The concentration in the fish tissue would then be predicted by the following equation:

$$A_{fish} = BCF_{fish} \cdot C_w$$

Where:

Parameter	Definition	Units	Value	Reference
A_{fish}	Concentration of COPC in fish tissue	mg/kg	3.48E-01	Calculated: Arsenic (MPOI, Project)
Cw	Dissolved phase water concentration	mg/L	2.15E-03	Modelled
BCF_{fish}	Bioconcentration factor for fish(1)	L/kg	50	US EPA 2003

2.4 Surface Water

The total COPC load to the Waterbody by all mechanisms above is calculated as follows (US EPA, 2005):

$$L_T = L_{DEP} + L_{dif} + L_{RI} + L_R + L_E + L_I$$

Parameter	Definition	Units	Value
L_T	Total COPC load to the waterbody (including deposition, runoff, and erosion	g/yr	Waterbody specific

Parameter	Definition	Units	Value
L_{DEP}	Total (wet and dry) particle phase and vapour phase COPC direct deposition load to waterbody	g/yr	See Section 2.4.1
L_{dif}	Vapour phase COPC diffusion load to waterbody	g/yr	0
L_{RI}	Runoff load from impervious surfaces	g/yr	0
L_R	Runoff load from pervious surfaces	g/yr	See Section 2.4.2
L_E	Erosion soil load	g/yr	See Section 2.4.3
L_I	Internal transfer	g/yr	0

The COPCs are all modelled as being present in the particulate phase. As such, the vapour phase COPC diffusion load is considered 0.

Impervious surfaces are areas impervious to rainfall such as roofs, driveways, streets and parking lots. For the surface waterbodies addressed (Birch Lake and Springpole Lake), the presence of impervious surfaces is minimal and would have a negligible impact. As such, runoff is set to 0.

Due to the limited data and uncertainty associated with the chemical or biological internal transfer, LI, of compounds into degradation products, US EPA (2005) generally recommends that a default value for this variable of zero be adopted. A value of zero has been adopted for this assessment.

Loading is calculated for each of the following surface waterbodies: Birch Lake, Springpole Lake north basin and Springpole Lake Southeast Arm. Inputs that are specific to a given waterbody are summarized below.

Parameter	Definition	Units	Value	Reference
A_L	Total watershed area receiving COPC deposition	m^2	7.58E+08 2.49E+07 1.36E+09	Birch Lake SL north basin SL Southeast Arm
A_w	Waterbody surface area (waterbody-specific)	m^2	1.14E+08 1.1E+07 1.3E+07	Birch Lake SL North Basin SL Southeast Arm
Vf_x	Average volumetric flow rate through waterbody; discussed below	m^3/yr	8.83E+07 3.78E+08 2.14E+08	Birch Lake SL north basin SL Southeast Arm
d_{wc}	Depth of water column (waterbody-specific)	m	7.4 6.3 6.3	Birch Lake SL north basin SL Southeast Arm
TSS	Total suspended solids concentration	mg/L	7.7 7.6 5.8	Birch Lake SL north basin SL Southeast Arm
a	Empirical intercept coefficient	unitless	0.6 1.4 0.6	Birch Lake SL north basin SL Southeast Arm

The subsequent calculations provide an example for arsenic in Birch Lake.

2.4.1 Total Particle and Vapour Phase Direct Deposition Load to Waterbody

The load from the direct deposition of wet and dry particles and vapours on the surface of the waterbody is as follows:

$$L_{DEP} = Q \cdot [\ F_v \cdot Dytwv + (1 - F_v) \cdot Dytwp\ ] \cdot A_W$$

Parameter	Definition	Units	Value	Reference
L_{DEP}	total (wet and dry) particle phase and vapour phase COPC direct deposition load to waterbody	g/yr	4.07E+04	Calculated
Q	COPC emission rate	g/s	3.5E-03	Modelled: Arsenic[1]
F_v	fraction of COPC air concentration in vapour phase	unitless	0	-
Dytwv	yearly (waterbody or watershed) average total (wet and dry) deposition from vapour phase	s/m^2-yr	0	-
Dytwp	yearly (waterbody or watershed) average total (wet and dry) deposition from particle phase	s/m^2-yr	5.48E-02	Modelled: Arsenic[1]
A_w	Waterbody surface area	m^2	7.58E+08	Birch Lake

SL – Springpole Lake
1. Based on Air Quality Assessment, Appendix G-2 of the EIS/EA

2.4.2 Runoff Load from Pervious Surfaces

Deposition in the watershed will occur onto pervious surfaces, such as grass and forest, and be washed off during rain events.

$$L_R = RO \cdot (A_L - A_I) \cdot \frac{Cs \cdot BD}{\theta_{sw} + Kd_s \cdot BD} \cdot 0.01$$

Parameter	Definition	Units	Value	Reference
L_R	Runoff load from pervious surfaces	g/yr	1.44E+05	Calculated: Arsenic
RO	Average annual surface runoff from pervious areas	cm/yr	28.01	Site specific[1]
A_L	Total watershed area receiving COPC deposition	m^2	7.58E+08	Birch Lake
A_I	Impervious watershed area receiving COPC deposition	m^2	0	-
Cs	Average soil concentration over exposure duration (in watershed soils)	mg COPC /kg soil	1.97E-02	Incremental arsenic soil concentration
BD	Soil bulk density	g soil/cm^3 soil	1.4	MECP 2011
Θsw	Soil volumetric water content	mL/ cm^3	0.12	MECP 2011
Kd_s	Soil-water partition coefficient	cm^3 water/g soil	29	Chemical specific: Arsenic (US EPA 2005)
0.01	Unit conversion factor	kg-cm^2/mg-m^2	0.01	US EPA 2005

1. Site specific value obtained from Hydrology Baseline Report, Appendix M-1

2.4.3 Soil Erosion Load

$$L_E = X_e \cdot (A_L - A_I) \cdot SD \cdot ER \cdot \frac{Cs \cdot Kd_s \cdot BD}{\theta_{sw} + Kd_s \cdot BD} \cdot 0.001$$

Parameter	Definition	Units	Value	Reference
L_E	Soil erosion load	g/yr	4.35E+02	Calculated: Arsenic
X_e	Unit soil loss	kg/m^2-yr	6.28E-01	Calculated
A_L	Total watershed area receiving COPC deposition	m^2	7.58E+08	Birch Lake
A_I	Impervious watershed area	m^2	0	-
SD	Sediment delivery ratio	unitless	4.66E-02	Calculated
ER	Soil enrichment ratio	unitless	1	US EPA 2005
Cs	Average soil concentration	mg COPC /kg soil	1.97E-02	Incremental arsenic soil concentration
BD	Soil bulk density	g/cm^3	1.4	MECP 2011
Θ_{sw}	Soil volumetric water content	mL/ cm^3	0.12	MECP 2011
Kd_s	Soil-water partition coefficient	mL water/g soil	29	Chemical specific: Arsenic (US EPA 2005)
0.001	Units conversion factor	k-cm^2/mg-m^2	0.001	US EPA 2005

2.4.4. Universal Soil Loss

$$X_e = RF \cdot K \cdot LS \cdot C \cdot PF \cdot \frac{907.18}{4047}$$

Parameter	Definition	Units	Value	Reference
X_e	Unit soil loss	kg/m^2-yr	6.28E-01	Calculated
RF	USLE rainfall (or erosivity) factor	yr^{-1}	47.9	Wall et al. 2002
K	USLE erodibility factor	ton/acre	0.39	US EPA 2005
LS	USLE length-slope factor	unitless	1.5	US EPA 2005
C	USLE cover management factor	unitless	0.1	US EPA 2005
PF	USLE supporting practice factor	unitless	1	US EPA 2005
907.18	Units conversion factor	kg/ton	907.18	US EPA 2005
4047	Units conversion factor	m^2/acre	4047	US EPA 2005

2.4.5. Sediment Delivery Ratio

The sediment delivery ratio is calculated on the basis of the watershed area.

$$SD = a \cdot (A_L)^{-b}$$

Parameter	Definition	Units	Value	Reference
SD	Sediment delivery ratio (watershed)	unitless	4.66E-02	Calculated
a	Empirical intercept coefficient	unitless	0.6	Birch Lake
b	Empirical intercept coefficient	unitless	0.125	US EPA 2005
A_L	Total watershed area (evaluated) receiving COPC deposition	m^2	7.58E+08	Birch Lake

2.4.6. Total Waterbody Concentration

The total waterbody concentration is calculated as follows:

$$C_{wtot} = \frac{L_T}{Vf_x \cdot f_{wc} + k_{wt} \cdot A_W \cdot (d_{wc} + d_{bs})}$$

Parameter	Definition	Units	Value	Reference
C_{wtot}	Total waterbody COPC concentration (including water column and bed sediment)	g COPC/m^3 waterbody	2.3E-05	Calculated: Arsenic
L_T	Total COPC load to the waterbody (including deposition, runoff, and erosion); presented previously	g/yr	1.85E-05	Calculated: Arsenic
Vf_x	Average volumetric flow rate through waterbody; discussed below	m^3/yr	8.83E+07	Birch Lake
f_{wc}	Fraction of total waterbody COPC concentration in the water column	unitless	8.93E-01	Calculated (see below)
k_{wt}	Overall total waterbody COPC dissipation rate constant	yr^{-1}	4.94	Calculated (see below)
A_w	Waterbody surface area (waterbody-specific)	m^2	1.14E+08	Birch Lake
d_{wc}	Depth of water column (waterbody-specific)	m	7.4	Birch Lake
d_{bs}	Depth of upper benthic sediment layer	m	0.03	US EPA 2005

The average volumetric flow rate through the waterbody (Vf_x) was calculated using the water balance model equation if data were available; otherwise, average volumetric flow rate was estimated for the lake based on the equation presented in US EPA (2005) [Watershed Area x (1/2) average annual RO].

The depth of the upper benthic layer (d_{bs}), which represents the portion of the bed that is in equilibrium with the water column, cannot be precisely specified; however, the US EPA (2005) recommends values from 0.01 to 0.05 and a default value of 0.03, which represents the midpoint of the specified range. This value has been adopted for use in this assessment.

US EPA (2005) recommends using the following equation to calculate f_{wc} (the fraction of total waterbody COPC concentration in the water column). In addition, the equation for f_{bs} is presented.

$$f_{wc} = \frac{(1 + Kd_{sw} \cdot TSS \cdot 1 \times 10^{-6}) \cdot d_{wc} / d_z}{(1 + Kd_{sw} \cdot TSS \cdot 1 \times 10^{-6}) \cdot d_{wc} / d_z + (\theta_{bs} + Kd_{bs} \cdot C_{BS}) \cdot d_{bs} / d_z}$$

$$f_{bs} = 1 - f_{wc}$$

Parameter	Definition	Units	Value	Reference
f_{wc}	Fraction of total waterbody COPC concentration in the water column	unitless	8.93E-01	Calculated: Arsenic
f_{bs}	Fraction of total waterbody COPC concentration in benthic sediment	unitless	1.07E-01	Calculated: Arsenic
Kd_{sw}	Suspended sediments/surface water partition coefficient; COPC-specific	L water/kg suspended sediment	29	Chemical specific: Arsenic (US EPA 2005)
TSS	Total suspended solids concentrations	mg/L	7.7	Birch Lake
1×10^{-6}	Units conversion factor	kg/mg	1×10^{-6}	US EPA 2005
d_z	Total waterbody depth ($d_{wc}+d_{bs}$)	m	7.43	Birch Lake
θ_{bs}	Bed sediment porosity	$L_{water}/L_{sediment}$	0.6	US EPA 2005
Kd_{bs}	Bed sediment/sediment pore water partition coefficient; COPC-specific	L water/kg bottom sediment	29	Chemical specific: Arsenic (US EPA 2005)
C_{BS}	Bed sediment concentration	g/cm^3 [equivalent to kg/L]	1	US EPA 2005
d_{wc}	Depth of water column (water-body specific)	m	7.4	Birch Lake
d_{bs}	Depth of upper benthic sediment layer; discussed previously	m	0.03	US EPA 2005

US EPA (2005) recommends the following equation to calculate the overall dissipation rate of COPCs in surface water, resulting from volatilization and benthic burial:

$$k_{wt} = f_{wc} \cdot k_v + f_{bs} \cdot k_b$$

Parameter	Definition	Units	Value	Reference
k_{wt}	Overall total waterbody COPC dissipation rate constant	yr^{-1}	4.94	Calculated: Arsenic
f_{wc}	Fraction of total waterbody COPC concentration in the water column	unitless	8.93E-01	Calculated: Arsenic
k_v	Water column volatilization rate constant	yr^{-1}	5.53	Calculated: Arsenic
f_{bs}	Fraction of total waterbody COPC concentration in benthic sediment	unitless	1.07E-01	Calculated: Arsenic
k_b	Benthic burial rate constant	yr^{-1}	3.19E-03	Calculated

The recommended equation (US EPA 2005) for benthic burial rate constant (k_b) is presented below:

$$k_b = \left(\frac{X_e \cdot A_L \cdot SD \cdot 1 \times 10^3 - Vf_x \cdot TSS}{A_W \cdot TSS} \right) \cdot \left(\frac{TSS \cdot 1 \times 10^{-6}}{C_{BS} \cdot d_{bs}} \right)$$

Parameter	Definition	Units	Value	Reference
k_b	Benthic burial rate constant	yr^{-1}	3.19E-03	Calculated
X_e	Unit soil loss	$kg/m^2\text{-}yr$	6.28E-01	Calculated
A_L	Total watershed area (evaluated) receiving deposition	m^2	7.58E+08	Birch Lake
SD	Sediment delivery ratio (watershed)	unitless	4.66E-02	Calculated
Vf_x	Average volumetric flow rate through waterbody	m^3/yr	8.83E+07	Birch Lake
TSS	Total suspended solids concentration	mg/L	7.7	Birch Lake
A_w	Waterbody surface area; waterbody-specific	m^2	1.14E+08	Birch Lake
C_{BS}	Bed sediment concentration	g/cm^3	1	US EPA 2005
d_{bs}	Depth of upper benthic sediment layer; discussed previously	m	0.03	US EPA 2005
1×10^{-6}	Units conversion factor	kg/mg	1×10^{-6}	US EPA 2005
1×10^{3}	Units conversion factor	g/kg	1×10^{3}	US EPA 2005

2.4.7. Concentration in Water Column (C_{wctot}) and Sorbed to Bed Sediment (C_{sb})

The concentration in water and in sediment is calculation as follows:

$$C_{wctot} = f_{wc} \cdot C_{wtot} \cdot \frac{d_{wc} + d_{bs}}{d_{wc}}$$

$$C_{sb} = f_{bs} \cdot C_{wtot} \cdot \left(\frac{Kd_{bs}}{\theta_{bs} + Kd_{bs} \cdot C_{BS}} \right) \cdot \left(\frac{d_{wc} + d_{bs}}{d_{bs}} \right)$$

Parameter	Definition	Units	Value	Reference
C_{wctot}	Total COPC concentration in water column	mg COPC /L water column	2.06E-05	Calculated: Arsenic
f_{wc}	Fraction of total waterbody COPC concentration in the water column	unitless	8.93E-01	Calculated: Arsenic
C_{wtot}	Total waterbody COPC concentration, including water column and bed sediment	mg COPC/L waterbody	2.30E-05	Calculated: Arsenic
d_{wc}	Depth of water column	m	7.4	Birch Lake
d_{bs}	Depth of upper benthic sediment layer	m	0.03	US EPA 2005
C_{sb}	Benthic burial rate constant	mg COPC/kg sediment	3.19E-03	Calculated
f_{bs}	Fraction of total waterbody COPC concentration in benthic sediment	unitless	1.07E-01	Calculated: Arsenic
Kd_{bs}	Bed sediment/sediment pore water partition coefficient; COPC-specific	L COPC/kg waterbody	29	Chemical specific: Arsenic (US EPA 2005)
θ_{bs}	Bed sediment porosity	$L_{pore\ water}$ /$L_{sediment}$	0.6	USEPA 2005
C_{BS}	Bed sediment concentration	g/cm^3	1	USEPA 2005

2.6 References

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Attachment B
Human Health Risk Assessment Model

Non-Carcinogenic Model

Attachment B-1: Non-Carcinogenic Exposure Point Concentrations

Attachment B-2a: Non-Carcinogenic Dose Calculation Results – Heavy Consumer

Attachment B-2b: Non-Carcinogenic Dose Calculation Results – Average Consumer

Attachment B-3a: Non-Carcinogenic Human Health Risk – Heavy Consumer

Attachment B-3b: Non-Carcinogenic Human Health Risk – Average Consumer

Carcinogenic Model

Attachment B-4: Carcinogenic Exposure Point Concentrations

Attachment B-5a: Carcinogenic Dose Calculation Results – Heavy Consumer

Attachment B-5b: Carcinogenic Dose Calculation Results – Average Consumer

Attachment B-6a: Carcinogenic Human Health Risk – Heavy Consumer

Attachment B-6b: Carcinogenic Human Health Risk – Average Consumer

Example Calculation

Attachment B-7: Non-Carcinogenic and Carcinogenic Human Health Risk Example Calculations

Attachment B-1: Non-Carcinogenic Exposure Point Concentrations

Table B-1-1 Baseline and Predicted Arsenic EPC Concentrations in Soil, Sediment, Surface Water and Country Foods

Point of Reception	Soil Concentration at time tD for Non-Carcinogens			Sediment Concentration			Surface Water Concentration (Aquatic Plants, Game and Fish)			Total Concentration in Plants (1) (Leafy Plants)				Total Concentration in Plants (2) (Berries)				Total Concentration in Aquatic Plants		
Units	mg/kg			mg/kg			mg/L			mg/kg				mg/kg				mg/kg		
	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure	Project Alone	Baseline	Project	Post-Closure	Project Alone	Baseline	Project	Post-Closure
POR01	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	1.02E-03	2.15E-03	2.15E-03	3.92E-02	4.15E-02	3.93E-02	2.30E-03	2.22E-02	2.25E-02	2.23E-02	3.31E-04	1.04E+00	1.08E+00	1.08E+00
POR02	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	5.39E-04	5.86E-04	1.15E-03	3.92E-02	4.55E-02	3.94E-02	6.27E-03	2.22E-02	2.31E-02	2.23E-02	9.02E-04	1.04E+00	1.04E+00	1.06E+00
POR04	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	1.02E-03	1.47E-03	1.47E-03	3.92E-02	4.22E-02	3.93E-02	2.95E-03	2.22E-02	2.26E-02	2.23E-02	4.25E-04	1.04E+00	1.05E+00	1.05E+00
POR05	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	1.02E-03	2.15E-03	2.15E-03	3.92E-02	5.43E-02	3.96E-02	1.51E-02	2.22E-02	2.44E-02	2.25E-02	2.17E-03	1.04E+00	1.08E+00	1.08E+00
POR07	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	6.74E-04	1.27E-03	8.82E-04	3.92E-02	4.05E-02	3.92E-02	1.26E-03	2.22E-02	2.24E-02	2.22E-02	1.82E-04	1.04E+00	1.06E+00	1.04E+00
POR22	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	6.25E-04	1.30E-03	8.63E-04	3.92E-02	4.03E-02	3.92E-02	1.10E-03	2.22E-02	2.24E-02	2.22E-02	1.58E-04	1.04E+00	1.06E+00	1.04E+00
POR24	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	9.36E-04	9.67E-04	9.67E-04	3.92E-02	3.97E-02	3.92E-02	5.42E-04	2.22E-02	2.23E-02	2.22E-02	7.80E-05	1.04E+00	1.04E+00	1.04E+00
POR38	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	7.70E-04	1.26E-03	8.54E-04	3.92E-02	3.96E-02	3.92E-02	4.50E-04	2.22E-02	2.23E-02	2.22E-02	6.47E-05	1.04E+00	1.05E+00	1.04E+00
POR61	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	9.36E-04	9.67E-04	9.67E-04	3.92E-02	4.07E-02	3.92E-02	1.48E-03	2.22E-02	2.24E-02	2.22E-02	2.13E-04	1.04E+00	1.04E+00	1.04E+00
MPOI	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	1.02E-03	2.15E-03	2.15E-03	3.92E-02	5.72E-02	3.92E-02	1.80E-02	2.22E-02	2.48E-02	2.22E-02	2.59E-03	1.04E+00	1.08E+00	1.08E+00

Table B-1-1 Baseline and Predicted Arsenic EPC Concentrations in Soil, Sediment, Surface Water and Country Foods

Point of Reception	Concentration of COPC in Meat Tissue (1) (Moose)			Concentration of COPC in Meat Tissue (2) (Hare)			Concentration of COPC in Meat Tissue (3) (Grouse)			Concentration of COPC in Fish Tissue 1 (Lake Whitfish)			Concentration of COPC in Fish Tissue 2 (Walleye)			Concentration of COPC in Invertebrates Tissue		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure
POR01	1.06E-01	1.09E-01	1.09E-01	7.92E-02	7.92E-02	7.92E-02	6.33E-02	6.34E-02	6.34E-02	2.92E-01	3.48E-01	3.48E-01	6.59E-02	1.22E-01	1.22E-01	1.39E+00	1.39E+00	1.39E+00
POR02	1.06E-01	1.07E-01	1.07E-01	7.92E-02	7.93E-02	7.92E-02	6.33E-02	6.35E-02	6.34E-02	2.92E-01	2.94E-01	3.22E-01	6.59E-02	6.82E-02	9.62E-02	1.39E+00	1.39E+00	1.39E+00
POR04	1.06E-01	1.08E-01	1.07E-01	7.92E-02	7.92E-02	7.92E-02	6.33E-02	6.34E-02	6.34E-02	2.92E-01	3.14E-01	3.14E-01	6.59E-02	8.81E-02	8.81E-02	1.39E+00	1.39E+00	1.39E+00
POR05	1.06E-01	1.13E-01	1.09E-01	7.92E-02	7.93E-02	7.92E-02	6.33E-02	6.39E-02	6.35E-02	2.92E-01	3.48E-01	3.48E-01	6.59E-02	1.22E-01	1.22E-01	1.39E+00	1.40E+00	1.40E+00
POR07	1.06E-01	1.08E-01	1.06E-01	7.92E-02	7.92E-02	7.92E-02	6.33E-02	6.34E-02	6.33E-02	2.92E-01	3.22E-01	3.02E-01	6.59E-02	9.56E-02	7.63E-02	1.39E+00	1.39E+00	1.39E+00
POR22	1.06E-01	1.08E-01	1.06E-01	7.92E-02	7.92E-02	7.92E-02	6.33E-02	6.34E-02	6.33E-02	2.92E-01	3.26E-01	3.04E-01	6.59E-02	9.95E-02	7.78E-02	1.39E+00	1.39E+00	1.39E+00
POR24	1.06E-01	1.06E-01	1.06E-01	7.92E-02	7.92E-02	7.92E-02	6.33E-02	6.33E-02	6.33E-02	2.92E-01	2.94E-01	2.94E-01	6.59E-02	6.74E-02	6.74E-02	1.39E+00	1.39E+00	1.39E+00
POR38	1.06E-01	1.07E-01	1.06E-01	7.92E-02	7.92E-02	7.92E-02	6.33E-02	6.33E-02	6.33E-02	2.92E-01	3.17E-01	2.96E-01	6.59E-02	9.05E-02	7.01E-02	1.39E+00	1.39E+00	1.39E+00
POR61	1.06E-01	1.06E-01	1.06E-01	7.92E-02	7.92E-02	7.92E-02	6.33E-02	6.34E-02	6.33E-02	2.92E-01	2.94E-01	2.94E-01	6.59E-02	6.74E-02	6.74E-02	1.39E+00	1.39E+00	1.39E+00
MPOI	1.06E-01	1.13E-01	1.09E-01	7.92E-02	7.94E-02	7.92E-02	6.33E-02	6.40E-02	6.34E-02	2.92E-01	3.48E-01	3.48E-01	6.59E-02	1.22E-01	1.22E-01	1.39E+00	1.40E+00	1.39E+00

Table B-1-1 Baseline and Predicted Arsenic EPC Concentrations in Soil, Sediment, Surface Water and Country Foods

Point of Reception	Concentration of COPC in Meat Tissue (4) (Deer)			Surface Water Concentration for Ingestion and Dermal Contact		
Units	mg/kg			mg/L		
	Baseline	Project	Post-Closure	Baseline	Project	Post-Closure
POR01	1.02E-03	1.02E-03	1.02E-03	1.02E-03	1.04E-03	1.04E-03
POR02	9.15E-03	1.05E-02	1.18E-02	NR	NR	NR
POR04	9.19E-03	9.87E-03	1.18E-02	NR	NR	NR
POR05	9.19E-03	1.26E-02	1.20E-02	NR	NR	NR
POR07	9.16E-03	9.48E-03	1.18E-02	NR	NR	NR
POR22	6.25E-04	6.25E-04	6.25E-04	6.25E-04	2.40E-08	2.40E-08
POR24	9.18E-03	9.30E-03	1.18E-02	NR	NR	NR
POR38	9.17E-03	9.30E-03	1.18E-02	NR	NR	NR
POR61	9.18E-03	9.51E-03	1.18E-02	NR	NR	NR
MPOI	9.19E-03	1.32E-02	1.19E-02	NR	NR	NR

Attachment B-2a: Dose Calculation Results – Heavy Consumer

Table B-2a-1 Dose Calculation Results for Arsenic - Heavy Consumer

Point of Reception Location	Assessment Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1 (Moose)	Large Mammal 2 (Deer)	Small Mammal (Hare)	Game Bird (Grouse)	Fish 1 (Lake Whitefish)	Fish 2 (Walleye)
		(mg/kg-day)			mg/kg-day		mg/m3	mg/kg-day		mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	7.9E-06	4.5E-06	8.5E-06	3.5E-08	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR02	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.0E-05	2.0E-07	7.9E-06	4.5E-06	8.5E-06	3.6E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR04	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	7.9E-06	4.5E-06	8.5E-06	3.4E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR05	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	7.9E-06	4.5E-06	8.5E-06	4.3E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR07	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.5E-05	2.5E-07	7.9E-06	4.5E-06	8.5E-06	3.2E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR22	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.3E-05	2.3E-07	7.9E-06	4.5E-06	8.5E-06	2.1E-08	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR24	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.4E-05	3.5E-07	7.9E-06	4.5E-06	8.5E-06	3.2E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR38	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.8E-05	2.9E-07	7.9E-06	4.5E-06	8.5E-06	3.2E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR61	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.4E-05	3.5E-07	7.9E-06	4.5E-06	8.5E-06	3.2E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
MPOI	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	7.9E-06	4.5E-06	8.5E-06	4.5E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR01	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.1E-06	3.8E-05	3.9E-07	8.3E-06	4.5E-06	8.8E-06	3.5E-08	8.6E-07	2.6E-06	9.5E-05	3.3E-05
POR02	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.3E-06	2.1E-05	2.2E-07	9.1E-06	4.6E-06	8.6E-06	4.0E-07	8.6E-07	2.6E-06	8.0E-05	1.9E-05
POR04	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.1E-06	5.3E-05	5.4E-07	8.5E-06	4.5E-06	8.7E-06	4.0E-07	8.6E-07	2.6E-06	8.6E-05	2.4E-05
POR05	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.5E-06	7.8E-05	8.0E-07	1.1E-05	4.9E-06	9.1E-06	4.1E-07	8.6E-07	2.6E-06	9.5E-05	3.3E-05
POR07	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	4.6E-05	4.7E-07	8.1E-06	4.5E-06	8.7E-06	4.0E-07	8.6E-07	2.6E-06	8.8E-05	2.6E-05
POR22	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	8.7E-10	8.9E-12	8.1E-06	4.5E-06	8.7E-06	2.1E-08	8.6E-07	2.6E-06	8.9E-05	2.7E-05
POR24	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.5E-05	3.6E-07	8.0E-06	4.5E-06	8.5E-06	4.0E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR38	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	4.6E-05	4.7E-07	8.0E-06	4.5E-06	8.6E-06	4.0E-07	8.6E-07	2.6E-06	8.6E-05	2.5E-05
POR61	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.1E-06	3.5E-05	3.6E-07	8.2E-06	4.5E-06	8.6E-06	4.0E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
MPOI	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.5E-06	7.8E-05	8.0E-07	1.1E-05	5.0E-06	9.1E-06	4.0E-07	8.6E-07	2.6E-06	9.5E-05	3.3E-05
POR01	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.8E-05	3.9E-07	7.9E-06	4.5E-06	8.8E-06	3.5E-08	8.6E-07	2.6E-06	9.5E-05	3.3E-05
POR02	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	4.2E-05	4.3E-07	7.9E-06	4.5E-06	8.6E-06	4.0E-07	8.6E-07	2.6E-06	8.8E-05	2.6E-05
POR04	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	5.3E-05	5.4E-07	7.9E-06	4.5E-06	8.6E-06	4.0E-07	8.6E-07	2.6E-06	8.6E-05	2.4E-05
POR05	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	7.8E-05	8.0E-07	8.0E-06	4.5E-06	8.8E-06	4.1E-07	8.6E-07	2.6E-06	9.5E-05	3.3E-05
POR07	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.2E-05	3.3E-07	7.9E-06	4.5E-06	8.6E-06	4.0E-07	8.6E-07	2.6E-06	8.2E-05	2.1E-05
POR22	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	8.7E-10	8.9E-12	7.9E-06	4.5E-06	8.6E-06	2.1E-08	8.6E-07	2.6E-06	8.3E-05	2.1E-05
POR24	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.5E-05	3.6E-07	7.9E-06	4.5E-06	8.5E-06	4.0E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
POR38	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.1E-05	3.2E-07	7.9E-06	4.5E-06	8.5E-06	4.0E-07	8.6E-07	2.6E-06	8.1E-05	1.9E-05
POR61	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.5E-05	3.6E-07	7.9E-06	4.5E-06	8.5E-06	4.0E-07	8.6E-07	2.6E-06	8.0E-05	1.8E-05
MPOI	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	7.8E-05	8.0E-07	7.9E-06	4.5E-06	8.8E-06	4.0E-07	8.6E-07	2.6E-06	9.5E-05	3.3E-05

Table B-2a-2 Dose Calculation Results for Cobalt - Heavy Consumer

Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1 (Moose)	Large Mammal 2 (Deer)	Small Mammal (Hare)	Game Bird (Grouse)	Fish 1 (Lake Whitefish)	Fish 2 (Walleye)
		(mg/kg-day)			mg/kg-day		mg/m3	mg/kg-day		mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	3.4E-08	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR02	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.1E-06	8.5E-09	1.0E-05	1.3E-05	1.5E-05	9.8E-07	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR04	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	9.5E-07	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR05	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	1.1E-06	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR07	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	9.4E-07	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR22	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	3.4E-08	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR24	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	9.3E-07	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR38	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	9.3E-07	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR61	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	9.4E-07	1.6E-05	2.5E-06	1.3E-05	2.1E-05
MPOI	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	1.0E-05	1.3E-05	1.5E-05	1.1E-06	1.6E-05	2.5E-06	1.3E-05	2.1E-05
POR01	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	2.1E-07	4.9E-06	2.0E-08	1.0E-05	1.3E-05	2.0E-04	3.4E-08	1.6E-05	2.5E-06	3.1E-04	3.2E-04
POR02	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	2.5E-07	5.9E-06	2.4E-08	1.1E-05	1.4E-05	6.9E-05	1.2E-06	1.6E-05	2.5E-06	9.8E-05	1.1E-04
POR04	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	2.0E-07	1.8E-05	7.3E-08	1.1E-05	1.3E-05	2.4E-04	1.2E-06	1.6E-05	2.5E-06	3.7E-04	3.8E-04
POR05	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	3.0E-07	1.5E-05	6.2E-08	1.2E-05	1.4E-05	2.0E-04	1.2E-06	1.6E-05	2.5E-06	3.1E-04	3.2E-04
POR07	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.9E-07	5.0E-06	2.0E-08	1.0E-05	1.3E-05	6.0E-05	1.2E-06	1.6E-05	2.5E-06	8.4E-05	9.2E-05
POR22	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.9E-07	2.6E-06	1.1E-08	1.0E-05	1.3E-05	6.2E-05	3.4E-08	1.6E-05	2.5E-06	8.8E-05	9.6E-05
POR24	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	5.2E-06	2.1E-08	1.0E-05	1.3E-05	6.3E-05	1.2E-06	1.6E-05	2.5E-06	8.9E-05	9.7E-05
POR38	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	5.0E-06	2.0E-08	1.0E-05	1.3E-05	6.0E-05	1.2E-06	1.6E-05	2.5E-06	8.4E-05	9.2E-05
POR61	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.9E-07	5.2E-06	2.1E-08	1.0E-05	1.3E-05	6.3E-05	1.2E-06	1.6E-05	2.5E-06	8.9E-05	9.7E-05
MPOI	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	3.0E-07	1.5E-05	6.2E-08	1.2E-05	1.5E-05	2.0E-04	1.2E-06	1.6E-05	2.5E-06	3.1E-04	3.2E-04
POR01	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	4.9E-06	2.0E-08	1.0E-05	1.3E-05	9.4E-05	3.4E-08	1.8E-05	2.5E-06	1.4E-04	1.5E-04
POR02	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	8.9E-06	3.6E-08	1.0E-05	1.3E-05	1.1E-04	1.2E-06	1.8E-05	2.5E-06	1.7E-04	1.7E-04
POR04	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	5.8E-06	2.4E-08	1.0E-05	1.3E-05	7.2E-05	1.2E-06	1.8E-05	2.5E-06	1.0E-04	1.1E-04
POR05	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	7.4E-06	3.0E-08	1.0E-05	1.3E-05	9.4E-05	1.2E-06	1.8E-05	2.5E-06	1.4E-04	1.5E-04
POR07	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.8E-06	1.1E-08	1.0E-05	1.3E-05	2.8E-05	1.2E-06	1.8E-05	2.5E-06	3.4E-05	4.2E-05
POR22	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.6E-06	1.1E-08	1.0E-05	1.3E-05	2.8E-05	3.4E-08	1.8E-05	2.5E-06	3.3E-05	4.1E-05
POR24	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	4.9E-06	2.0E-08	1.0E-05	1.3E-05	5.9E-05	1.2E-06	1.8E-05	2.5E-06	8.3E-05	9.0E-05
POR38	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.7E-06	1.1E-08	1.0E-05	1.3E-05	2.8E-05	1.2E-06	1.8E-05	2.5E-06	3.4E-05	4.2E-05
POR61	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	4.9E-06	2.0E-08	1.0E-05	1.3E-05	5.9E-05	1.2E-06	1.8E-05	2.5E-06	8.3E-05	9.0E-05
MPOI	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	7.4E-06	3.0E-08	1.0E-05	1.3E-05	9.4E-05	1.2E-06	1.8E-05	2.5E-06	1.4E-04	1.5E-04

Table B-2a-3 Dose Calculation Results for Mercury - Heavy Consumer

Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1 (Moose)	Large Mammal 2 (Deer)	Small Mammal (Hare)	Game Bird (Grouse)	Fish 1 (Lake Whitefish)	Fish 2 (Walleye)
		(mg/kg-day)			mg/kg-day		mg/m3	mg/kg-day		mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	1.7E-09	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR02	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR04	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR05	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR07	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	1.8E-07	1.9E-09	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR22	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	1.7E-09	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR24	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR38	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	1.8E-07	1.9E-09	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR61	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
MPOI	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	3.8E-07	1.1E-05	1.9E-08	1.4E-06	9.6E-06
POR01	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	1.7E-09	1.1E-05	1.9E-08	6.9E-06	6.9E-06
POR02	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.3E-08	9.9E-08	1.0E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	6.0E-06	6.0E-06
POR04	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	1.2E-07	1.2E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	7.3E-06	7.3E-06
POR05	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.3E-08	1.2E-07	1.2E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	6.9E-06	6.9E-06
POR07	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	1.8E-07	1.9E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	1.1E-05	1.1E-05
POR22	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	1.7E-09	1.1E-05	1.9E-08	1.1E-05	1.1E-05
POR24	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.2E-08	9.4E-10	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	5.5E-06	5.5E-06
POR38	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	1.9E-07	2.0E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	1.2E-05	1.2E-05
POR61	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.5E-08	9.7E-10	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	5.7E-06	5.7E-06
MPOI	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.3E-08	1.2E-07	1.2E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	6.9E-06	6.9E-06
POR01	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	1.7E-09	1.1E-05	1.9E-08	1.6E-05	1.6E-05
POR02	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	5.5E-06	5.5E-06
POR04	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	1.6E-07	1.6E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	9.6E-06	9.6E-06
POR05	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	2.7E-07	2.8E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	1.6E-05	1.6E-05
POR07	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.4E-08	9.7E-10	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	5.7E-06	5.7E-06
POR22	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	1.7E-09	1.1E-05	1.9E-08	5.7E-06	5.7E-06
POR24	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.3E-08	9.5E-10	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	5.6E-06	5.6E-06
POR38	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.4E-08	9.6E-10	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	5.7E-06	5.7E-06
POR61	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	5.5E-06	5.5E-06
MPOI	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	2.7E-07	2.8E-09	1.5E-06	1.6E-06	1.4E-06	4.9E-07	1.1E-05	1.9E-08	1.6E-05	1.6E-05

Table B-2a-4 Dose Calculation Results for Methyl Mercury - Heavy Consumer (mg/kg-day)

Receptor Location	Scenario	Surface Water		Fish 1 (Lake Whitefish)	Fish 2 (Walleye)
		Ingestion	Dermal	Ingestion	Ingestion
POR01	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR02	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR04	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR05	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR07	Baseline	1.8E-08	8.5E-08	3.3E-04	1.9E-03
POR22	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR24	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR38	Baseline	8.4E-09	4.0E-08	3.3E-04	1.9E-03
POR61	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
MPOI	Baseline	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR01	Project	4.2E-09	2.0E-08	3.4E-04	1.9E-03
POR02	Project	4.6E-09	2.2E-08	3.3E-04	1.9E-03
POR04	Project	5.6E-09	2.7E-08	3.4E-04	1.9E-03
POR05	Project	5.3E-09	2.5E-08	3.4E-04	1.9E-03
POR07	Project	8.4E-09	4.0E-08	2.6E-04	1.8E-03
POR22	Project	4.2E-09	2.0E-08	3.6E-04	1.9E-03
POR24	Project	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR38	Project	8.9E-09	4.3E-08	3.3E-04	1.9E-03
POR61	Project	4.2E-09	2.0E-08	3.3E-04	1.9E-03
MPOI	Project	5.3E-09	2.5E-08	3.4E-04	1.9E-03
POR01	Post-Closure	4.2E-09	2.0E-08	3.9E-04	1.9E-03
POR02	Post-Closure	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR04	Post-Closure	7.4E-09	3.5E-08	3.5E-04	1.9E-03
POR05	Post-Closure	1.2E-08	5.9E-08	3.9E-04	1.9E-03
POR07	Post-Closure	4.3E-09	2.1E-08	2.3E-04	1.8E-03
POR22	Post-Closure	4.2E-09	2.0E-08	3.3E-04	1.9E-03
POR24	Post-Closure	4.3E-09	2.0E-08	3.3E-04	1.9E-03
POR38	Post-Closure	4.3E-09	2.1E-08	3.0E-04	1.9E-03
POR61	Post-Closure	4.3E-09	2.0E-08	3.3E-04	1.9E-03
MPOI	Post-Closure	1.2E-08	5.9E-08	3.9E-04	1.9E-03

Attachment B-2b: Dose Calculation Results – Average Consumer

Table B-2a-1 Dose Calculation Results for Arsenic - Average Consumer

Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	1.8E-06	1.0E-06	1.7E-05	1.0E-07	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR02	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.0E-05	2.0E-07	1.8E-06	1.0E-06	1.7E-05	1.0E-06	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR04	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	1.8E-06	1.0E-06	1.7E-05	9.8E-07	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR05	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	1.8E-06	1.0E-06	1.7E-05	1.3E-06	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR07	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.5E-05	2.5E-07	1.8E-06	1.0E-06	1.7E-05	9.4E-07	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR22	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.3E-05	2.3E-07	1.8E-06	1.0E-06	1.7E-05	6.2E-08	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR24	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.4E-05	3.5E-07	1.8E-06	1.0E-06	1.7E-05	9.3E-07	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR38	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	2.8E-05	2.9E-07	1.8E-06	1.0E-06	1.7E-05	9.3E-07	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR61	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.4E-05	3.5E-07	1.8E-06	1.0E-06	1.7E-05	9.5E-07	1.7E-06	8.1E-06	1.7E-05	3.7E-06
MPOI	Baseline	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.7E-05	3.8E-07	1.8E-06	1.0E-06	1.7E-05	1.3E-06	1.7E-06	8.1E-06	1.7E-05	3.7E-06
POR01	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.1E-06	3.8E-05	3.9E-07	1.9E-06	1.0E-06	1.7E-05	1.0E-07	1.7E-06	8.1E-06	2.0E-05	6.9E-06
POR02	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.3E-06	2.1E-05	2.2E-07	2.1E-06	1.1E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.7E-05	3.9E-06
POR04	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.1E-06	5.3E-05	5.4E-07	2.0E-06	1.1E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.8E-05	5.0E-06
POR05	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.5E-06	7.8E-05	8.0E-07	2.5E-06	1.1E-06	1.8E-05	1.2E-06	1.7E-06	8.2E-06	2.0E-05	6.9E-06
POR07	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	4.6E-05	4.7E-07	1.9E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.8E-05	5.4E-06
POR22	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	8.7E-10	8.9E-12	1.9E-06	1.0E-06	1.7E-05	6.2E-08	1.7E-06	8.1E-06	1.9E-05	5.7E-06
POR24	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.5E-05	3.6E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.7E-05	3.8E-06
POR38	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	4.6E-05	4.7E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.8E-05	5.1E-06
POR61	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.1E-06	3.5E-05	3.6E-07	1.9E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.7E-05	3.8E-06
MPOI	Project	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.5E-06	7.8E-05	8.0E-07	2.7E-06	1.2E-06	1.8E-05	1.2E-06	1.7E-06	8.2E-06	2.0E-05	6.9E-06
POR01	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.8E-05	3.9E-07	1.8E-06	1.0E-06	1.7E-05	1.0E-07	1.7E-06	8.1E-06	2.0E-05	6.9E-06
POR02	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	4.2E-05	4.3E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.8E-05	5.5E-06
POR04	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	5.3E-05	5.4E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.8E-05	5.0E-06
POR05	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	7.8E-05	8.0E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	2.0E-05	6.9E-06
POR07	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.2E-05	3.3E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.7E-05	4.3E-06
POR22	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	8.7E-10	8.9E-12	1.8E-06	1.0E-06	1.7E-05	6.2E-08	1.7E-06	8.1E-06	1.7E-05	4.4E-06
POR24	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.5E-05	3.6E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.7E-05	3.8E-06
POR38	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.1E-05	3.2E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.7E-05	4.0E-06
POR61	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	3.5E-05	3.6E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	1.7E-05	3.8E-06
MPOI	Post-Closure	2.9E-05	1.5E-06	4.6E-06	1.8E-06	1.1E-04	1.0E-06	7.8E-05	8.0E-07	1.8E-06	1.0E-06	1.7E-05	1.2E-06	1.7E-06	8.1E-06	2.0E-05	6.9E-06

Table B-2b-2 Dose Calculation Results for Cobalt - Average Consumer

Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	1.0E-08	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR02	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.1E-06	8.5E-09	2.4E-06	3.0E-06	2.9E-06	2.9E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR04	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	2.8E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR05	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	3.1E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR07	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	2.7E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR22	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	1.0E-08	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR24	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	2.7E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR38	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	2.7E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR61	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	2.7E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
MPOI	Baseline	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	1.8E-06	7.4E-09	2.4E-06	3.0E-06	2.9E-06	3.1E-07	3.0E-06	7.8E-07	2.6E-06	4.1E-06
POR01	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	2.1E-07	4.9E-06	2.0E-08	2.4E-06	3.1E-06	4.0E-05	1.0E-08	3.0E-06	7.8E-07	6.1E-05	6.2E-05
POR02	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	2.5E-07	5.9E-06	2.4E-08	2.5E-06	3.1E-06	1.3E-05	3.4E-07	3.0E-06	7.8E-07	1.9E-05	2.0E-05
POR04	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	2.0E-07	1.8E-05	7.3E-08	2.4E-06	3.1E-06	4.7E-05	3.4E-07	3.0E-06	7.8E-07	7.2E-05	7.4E-05
POR05	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	3.0E-07	1.5E-05	6.2E-08	2.7E-06	3.3E-06	4.0E-05	3.4E-07	3.0E-06	7.8E-07	6.1E-05	6.2E-05
POR07	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.9E-07	5.0E-06	2.0E-08	2.4E-06	3.0E-06	1.2E-05	3.4E-07	3.0E-06	7.8E-07	1.6E-05	1.8E-05
POR22	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.9E-07	2.6E-06	1.1E-08	2.4E-06	3.0E-06	1.2E-05	1.0E-08	3.0E-06	7.8E-07	1.7E-05	1.9E-05
POR24	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	5.2E-06	2.1E-08	2.4E-06	3.0E-06	1.2E-05	3.4E-07	3.0E-06	7.8E-07	1.7E-05	1.9E-05
POR38	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	5.0E-06	2.0E-08	2.4E-06	3.0E-06	1.2E-05	3.4E-07	3.0E-06	7.8E-07	1.6E-05	1.8E-05
POR61	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.9E-07	5.2E-06	2.1E-08	2.4E-06	3.0E-06	1.2E-05	3.4E-07	3.0E-06	7.8E-07	1.7E-05	1.9E-05
MPOI	Project	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	3.0E-07	1.5E-05	6.2E-08	2.8E-06	3.4E-06	4.0E-05	3.4E-07	3.0E-06	7.8E-07	6.1E-05	6.2E-05
POR01	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	4.9E-06	2.0E-08	2.4E-06	3.0E-06	1.8E-05	1.0E-08	3.4E-06	7.8E-07	2.7E-05	2.8E-05
POR02	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	8.9E-06	3.6E-08	2.4E-06	3.0E-06	2.2E-05	3.4E-07	3.4E-06	7.8E-07	3.2E-05	3.4E-05
POR04	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	5.8E-06	2.4E-08	2.4E-06	3.0E-06	1.4E-05	3.4E-07	3.4E-06	7.8E-07	2.0E-05	2.2E-05
POR05	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	7.4E-06	3.0E-08	2.4E-06	3.0E-06	1.8E-05	3.4E-07	3.4E-06	7.8E-07	2.7E-05	2.8E-05
POR07	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.8E-06	1.1E-08	2.4E-06	3.0E-06	5.5E-06	3.4E-07	3.4E-06	7.8E-07	6.7E-06	8.2E-06
POR22	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.6E-06	1.1E-08	2.4E-06	3.0E-06	5.4E-06	1.0E-08	3.4E-06	7.8E-07	6.4E-06	7.9E-06
POR24	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	4.9E-06	2.0E-08	2.4E-06	3.0E-06	1.1E-05	3.4E-07	3.4E-06	7.8E-07	1.6E-05	1.8E-05
POR38	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	2.7E-06	1.1E-08	2.4E-06	3.0E-06	5.5E-06	3.4E-07	3.4E-06	7.8E-07	6.6E-06	8.1E-06
POR61	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	4.9E-06	2.0E-08	2.4E-06	3.0E-06	1.1E-05	3.4E-07	3.4E-06	7.8E-07	1.6E-05	1.8E-05
MPOI	Post-Closure	4.6E-05	3.9E-07	3.6E-06	3.1E-06	3.3E-05	1.8E-07	7.4E-06	3.0E-08	2.4E-06	3.0E-06	1.8E-05	3.4E-07	3.4E-06	7.8E-07	2.7E-05	2.8E-05

Table B-2b-3 Dose Calculation Results for Mercury - Average Consumer

Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	5.0E-10	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR02	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR04	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR05	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR07	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	1.8E-07	1.9E-09	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR22	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	5.0E-10	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR24	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR38	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	1.8E-07	1.9E-09	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR61	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
MPOI	Baseline	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.1E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR01	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	5.0E-10	2.1E-06	6.1E-09	6.9E-06	2.7E-05
POR02	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.3E-08	9.9E-08	1.0E-09	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	4.6E-06	2.5E-05
POR04	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	1.2E-07	1.2E-09	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	7.9E-06	2.8E-05
POR05	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.3E-08	1.2E-07	1.2E-09	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	6.9E-06	2.7E-05
POR07	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	1.8E-07	1.9E-09	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR22	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	5.0E-10	2.1E-06	6.1E-09	1.6E-05	3.6E-05
POR24	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.2E-08	9.4E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	3.5E-06	2.3E-05
POR38	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	1.9E-07	2.0E-09	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	5.1E-06	2.5E-05
POR61	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.5E-08	9.7E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	4.0E-06	2.4E-05
MPOI	Project	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.3E-08	9.2E-08	9.4E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	3.5E-06	2.3E-05
POR01	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	5.0E-10	2.1E-06	6.1E-09	2.9E-05	4.9E-05
POR02	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
POR04	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	1.6E-07	1.6E-09	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	1.3E-05	3.3E-05
POR05	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	2.7E-07	2.8E-09	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	2.9E-05	4.9E-05
POR07	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.4E-08	9.7E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	-9.3E-06	1.1E-05
POR22	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	5.0E-10	2.1E-06	6.1E-09	3.9E-06	2.4E-05
POR24	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.3E-08	9.5E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	3.7E-06	2.4E-05
POR38	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.4E-08	9.6E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	-9.4E-06	1.1E-05
POR61	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.4E-06	1.2E-08	9.1E-08	9.3E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	3.4E-06	2.3E-05
MPOI	Post-Closure	3.5E-07	3.0E-08	2.8E-08	3.3E-08	3.5E-06	1.2E-08	9.3E-08	9.5E-10	3.5E-07	3.7E-07	2.8E-07	1.4E-07	2.1E-06	6.1E-09	3.7E-06	2.4E-05

Table B-2b-4 Dose Calculation Results for Methyl Mercury - Average Consumer

Receptor Location	Scenario	Surface Water		Fish 1	Fish 2
		Ingestion	Dermal	Ingestion	Ingestion
POR01	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR02	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR04	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR05	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR07	Baseline	1.8E-08	8.5E-08	6.3E-05	3.7E-04
POR22	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR24	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR38	Baseline	8.4E-09	4.0E-08	6.3E-05	3.7E-04
POR61	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
MPOI	Baseline	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR01	Project	4.2E-09	2.0E-08	6.5E-05	3.7E-04
POR02	Project	4.6E-09	2.2E-08	6.4E-05	3.7E-04
POR04	Project	5.6E-09	2.7E-08	6.5E-05	3.7E-04
POR05	Project	5.3E-09	2.5E-08	6.5E-05	3.7E-04
POR07	Project	8.4E-09	4.0E-08	5.0E-05	3.5E-04
POR22	Project	4.2E-09	2.0E-08	6.9E-05	3.7E-04
POR24	Project	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR38	Project	8.9E-09	4.3E-08	6.4E-05	3.7E-04
POR61	Project	4.2E-09	2.0E-08	6.3E-05	3.7E-04
MPOI	Project	5.3E-09	2.5E-08	6.5E-05	3.7E-04
POR01	Post-Closure	4.2E-09	2.0E-08	7.5E-05	3.8E-04
POR02	Post-Closure	4.2E-09	2.0E-08	6.3E-05	3.7E-04
POR04	Post-Closure	7.4E-09	3.5E-08	6.8E-05	3.7E-04
POR05	Post-Closure	1.2E-08	5.9E-08	7.5E-05	3.8E-04
POR07	Post-Closure	4.3E-09	2.1E-08	4.4E-05	3.5E-04
POR22	Post-Closure	4.2E-09	2.0E-08	6.4E-05	3.7E-04
POR24	Post-Closure	4.3E-09	2.0E-08	6.4E-05	3.7E-04
POR38	Post-Closure	4.3E-09	2.1E-08	5.8E-05	3.6E-04
POR61	Post-Closure	4.3E-09	2.0E-08	6.4E-05	3.7E-04
MPOI	Post-Closure	1.2E-08	5.9E-08	7.5E-05	3.8E-04

Attachment B-3a: Non-Carcinogenic Human Health Risk – Heavy Consumer

Table B-3a-1 Non-Carcinogenic Risks Based on Heavy Country Food Consumption Rates for Arsenic

Scenario's	Area	Surface Water Node	Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.026	0.015	0.028	0.000	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00106	0.126	0.0013	0.028	0.015	0.029	0.000	0.003	0.009	0.32	0.11	**1.1**	0.11
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.126	0.0013	0.026	0.015	0.029	0.000	0.003	0.009	0.32	0.11	**1.1**	0.11
	West of Birch Lake	8	POR24 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.113	0.0012	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00097	0.117	0.0012	0.027	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.117	0.0012	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
	South of Springpole Lake	DL	POR22 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.076	0.0008	0.026	0.015	0.028	0.000	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00098	0.000	0.0000	0.027	0.015	0.029	0.000	0.003	0.009	0.30	0.09	1.0	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.000	0.0000	0.026	0.015	0.029	0.000	0.003	0.009	0.28	0.07	0.9	
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.082	0.0008	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00099	0.154	0.0016	0.027	0.015	0.029	0.001	0.003	0.009	0.29	0.09	**1.1**	0.13
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.107	0.0011	0.026	0.015	0.029	0.001	0.003	0.009	0.27	0.07	1.0	
	Gull Lake	10	POR38 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.093	0.0010	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00097	0.153	0.0016	0.027	0.015	0.029	0.001	0.003	0.009	0.29	0.08	**1.1**	0.11
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.103	0.0011	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	0.02
TLRU	North of Birch Lake	6	POR05	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00144	0.260	0.0027	0.036	0.016	0.030	0.001	0.003	0.009	0.32	0.11	**1.3**	0.25
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.260	0.0027	0.027	0.015	0.029	0.001	0.003	0.009	0.32	0.11	**1.3**	0.24
	West of Mine	7	POR04	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00101	0.178	0.0018	0.028	0.015	0.029	0.001	0.003	0.009	0.29	0.08	**1.1**	0.10
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.178	0.0018	0.026	0.015	0.029	0.001	0.003	0.009	0.29	0.08	**1.1**	0.10
	South of Mine	11	POR02	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.065	0.0007	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00121	0.071	0.0007	0.030	0.015	0.029	0.001	0.003	0.009	0.27	0.06	1.0	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.139	0.0014	0.026	0.015	0.029	0.001	0.003	0.009	0.29	0.09	**1.1**	0.13
	Further South of Mine	8	POR61	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.113	0.0012	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00101	0.117	0.0012	0.027	0.015	0.029	0.001	0.003	0.009	0.27	0.06	1.0	0.008
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.117	0.0012	0.026	0.015	0.028	0.001	0.003	0.009	0.27	0.06	1.0	
MPOI	North of Mine	6	NA	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.026	0.015	0.028	0.002	0.003	0.009	0.27	0.06	1.0	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00145	0.260	0.0027	0.038	0.017	0.030	0.001	0.003	0.009	0.32	0.11	**1.3**	0.26
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.260	0.0027	0.026	0.015	0.029	0.001	0.003	0.009	0.32	0.11	**1.3**	0.24

Table B-3a-2 Non-Carcinogenic Risks Based on Heavy Country Food Consumption Rates for Cobalt

Scenario's	Area	Surface Water Node	Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.000	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00041	0.005	0.00002	0.010	0.013	0.204	0.000	0.016	0.002	0.31	0.32	1.0	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.005	0.00002	0.010	0.013	0.094	0.000	0.018	0.002	0.14	0.15	0.5	
	West of Birch Lake	8	POR24 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00037	0.005	0.00002	0.010	0.013	0.063	0.001	0.016	0.002	0.09	0.10	0.4	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.005	0.00002	0.010	0.013	0.059	0.001	0.018	0.002	0.08	0.09	0.4	
	South of Springpole Lake	DL	POR22 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.000	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00037	0.003	0.00001	0.010	0.013	0.062	0.000	0.016	0.002	0.09	0.10	0.4	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.003	0.00001	0.010	0.013	0.028	0.000	0.018	0.002	0.03	0.04	0.2	
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00038	0.005	0.00002	0.010	0.013	0.060	0.001	0.016	0.002	0.08	0.09	0.4	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.003	0.00001	0.010	0.013	0.028	0.001	0.018	0.002	0.03	0.04	0.2	
	Gull Lake	10	POR38 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00037	0.005	0.00002	0.010	0.013	0.060	0.001	0.016	0.002	0.08	0.09	0.4	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.003	0.00001	0.010	0.013	0.028	0.001	0.018	0.002	0.03	0.04	0.2	
TLRU	North of Birch Lake	6	POR05	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00060	0.015	0.00006	0.012	0.014	0.204	0.001	0.016	0.002	0.31	0.32	1.0	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.007	0.00003	0.010	0.013	0.094	0.001	0.018	0.002	0.14	0.15	0.5	
	West of Mine	7	POR04	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00039	0.018	0.00007	0.011	0.013	0.242	0.001	0.016	0.002	0.37	0.38	**1.1**	**1.0**
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.006	0.00002	0.010	0.013	0.072	0.001	0.018	0.002	0.10	0.11	0.4	
	South of Mine	11	POR02	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00049	0.006	0.00002	0.011	0.014	0.069	0.001	0.016	0.002	0.10	0.11	0.4	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.009	0.00004	0.010	0.013	0.112	0.001	0.018	0.002	0.17	0.17	0.6	
	Further South of Mine	8	POR61	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00039	0.005	0.00002	0.010	0.013	0.063	0.001	0.016	0.002	0.09	0.10	0.4	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.015	0.00006	0.010	0.013	0.059	0.001	0.018	0.002	0.08	0.09	0.4	
MPOI	North of Mine	6	NA	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.010	0.013	0.015	0.001	0.016	0.002	0.01	0.02	0.2	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00060	0.015	0.00006	0.012	0.015	0.205	0.001	0.016	0.002	0.31	0.32	1.0	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.007	0.00003	0.010	0.013	0.094	0.001	0.018	0.002	0.14	0.15	0.5	

Table B-3a-3 Non-Carcinogenic Risks Based on Heavy Country Food Consumption Rates for Mercury

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0000	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0003	0.000003	0.005	0.005	0.005	0.0000	0.036	0.0001	0.02	0.02	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0000	0.036	0.0001	0.05	0.05	0.2	
	West of Birch Lake	8	POR24 Cabin	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
	South of Springpole Lake	DL	POR22 Cabin	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0000	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0000	0.036	0.0001	0.04	0.04	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0000	0.036	0.0001	0.02	0.02	0.1	
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000006	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000006	0.005	0.005	0.005	0.0016	0.036	0.0001	0.00	0.03	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.00	0.03	0.1	
	Gull Lake	10	POR38 Cabin	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000006	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000007	0.005	0.005	0.005	0.0016	0.036	0.0001	0.04	0.04	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.00	0.02	0.1	
TLRU	North of Birch Lake	6	POR05	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0004	0.000004	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0009	0.000009	0.005	0.005	0.005	0.0016	0.036	0.0001	0.05	0.05	0.2	
	West of Mine	7	POR04	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0004	0.000004	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0005	0.000005	0.005	0.005	0.005	0.0016	0.036	0.0001	0.03	0.03	0.1	
	South of Mine	11	POR02	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
	Further South of Mine	8	POR61	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
MPOI	North of Mine	6	NA	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.005	0.005	0.005	0.0013	0.036	0.0001	0.00	0.03	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0004	0.000004	0.005	0.005	0.005	0.0016	0.036	0.0001	0.02	0.02	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0009	0.000009	0.005	0.005	0.005	0.0016	0.036	0.0001	0.05	0.05	0.2	

Table B-3a-4 Non-Carcinogenic Risks Based on Heavy Country Food Consumption Rates for Methyl Mercury (Sensitive Receptor)

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Surface Water		Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.10E-05	1.00E-04	1.68	9.48	11.2	0.1
				Post-Closure	2.10E-05	1.00E-04	1.94	9.75	11.7	0.6
	West of Birch Lake	8	POR24 Cabin	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.10E-05	1.00E-04	1.64	9.44	11.1	
				Post-Closure	2.10E-05	1.00E-04	1.64	9.44	11.1	
	South of Springpole Lake	DL	POR22 Cabin	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.10E-05	1.00E-04	1.79	9.59	11.4	0.3
				Post-Closure	2.10E-05	1.00E-04	1.64	9.45	11.1	
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	8.90E-05	4.30E-04	1.63	9.44	11.1	
				Project	4.20E-05	2.00E-04	1.28	9.08	10.4	
				Post-Closure	2.20E-05	1.00E-04	1.13	8.93	10.1	
	Gull Lake	10	POR38 Cabin	Baseline	4.20E-05	2.00E-04	1.63	9.44	11.1	
				Project	4.50E-05	2.10E-04	1.66	9.46	11.1	
				Post-Closure	2.20E-05	1.00E-04	1.48	9.29	10.8	
TLRU	North of Birch Lake	6	POR05	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.70E-05	1.30E-04	1.68	9.48	11.2	0.1
				Post-Closure	6.20E-05	3.00E-04	1.94	9.75	11.7	0.6
	West of Mine	7	POR04	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.80E-05	1.30E-04	1.69	9.49	11.2	0.1
				Post-Closure	3.70E-05	1.80E-04	1.75	9.56	11.3	0.2
	South of Mine	11	POR02	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.30E-05	1.10E-04	1.65	9.46	11.1	
				Post-Closure	2.10E-05	1.00E-04	1.63	9.44	11.1	
	Further South of Mine	8	POR61	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.10E-05	1.00E-04	1.64	9.44	11.1	
				Post-Closure	2.10E-05	1.00E-04	1.64	9.44	11.1	
MPOI	North of Mine	6	NA	Baseline	2.10E-05	1.00E-04	1.63	9.44	11.1	
				Project	2.70E-05	1.30E-04	1.68	9.48	11.2	0.1
				Post-Closure	6.20E-05	3.00E-04	1.94	9.75	11.7	0.6

Table B-3a-5 Non-Carcinogenic Risks Based on Heavy Country Food Consumption Rates for Methyl Mercury (General Populaton)

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Surface Water		Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
			Cabin	Project	2.10E-05	1.00E-04	0.33	1.88	2.2	0
				Post-Closure	2.10E-05	1.00E-04	0.39	1.94	2.3	0.1
	West of Birch Lake	8	POR24	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
			Cabin	Project	2.10E-05	1.00E-04	0.32	1.88	2.2	
				Post-Closure	2.10E-05	1.00E-04	0.33	1.88	2.2	
	South of Springpole Lake	DL	POR22	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
			Cabin	Project	2.10E-05	1.00E-04	0.35	1.91	2.3	0.1
				Post-Closure	2.10E-05	1.00E-04	0.33	1.88	2.2	
	Springpole Lake Southeast Arm	9	POR07	Baseline	8.90E-05	4.30E-04	0.32	1.87	2.2	
			Cabin	Project	4.20E-05	2.00E-04	0.25	1.8	2.1	
				Post-Closure	2.20E-05	1.00E-04	0.22	1.77	2	
	Gull Lake	10	POR38	Baseline	4.20E-05	2.00E-04	0.32	1.87	2.2	
			Cabin	Project	4.50E-05	2.10E-04	0.33	1.88	2.2	
				Post-Closure	2.20E-05	1.00E-04	0.29	1.85	2.1	
TLRU	North of Birch Lake	6	POR05	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
				Project	2.70E-05	1.30E-04	0.33	1.88	2.2	0
				Post-Closure	6.20E-05	3.00E-04	0.39	1.94	2.3	0.1
	West of Mine	7	POR04	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
				Project	2.80E-05	1.30E-04	0.34	1.89	2.2	0
				Post-Closure	3.70E-05	1.80E-04	0.35	1.9	2.2	0
	South of Mine	11	POR02	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
				Project	2.30E-05	1.10E-04	0.33	1.88	2.2	
				Post-Closure	2.10E-05	1.00E-04	0.32	1.88	2.2	
	Further South of Mine	8	POR61	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
				Project	2.10E-05	1.00E-04	0.32	1.88	2.2	
				Post-Closure	2.10E-05	1.00E-04	0.33	1.88	2.2	
MPOI	North of Mine	6	NA	Baseline	2.10E-05	1.00E-04	0.32	1.87	2.2	
				Project	2.70E-05	1.30E-04	0.33	1.88	2.2	0
				Post-Closure	6.20E-05	3.00E-04	0.39	1.94	2.3	0.1

Attachment B-3b: Non-Carcinogenic Human Health Risk – Average Consumer

Table B-3b-1 Non-Carcinogenic Risks Based on Average Country Food Consumption Rates for Arsenic

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00106	0.126	0.0013	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.7	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.126	0.0013	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.7	
	West of Birch Lake	8	POR24 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.113	0.0012	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00097	0.117	0.0012	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.117	0.0012	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
	South of Springpole Lake	DL	POR22 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.076	0.0008	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00098	0.000	0.0000	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.6	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.000	0.0000	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.6	
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.082	0.0008	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00099	0.154	0.0016	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.8	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.107	0.0011	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
	Gull Lake	10	POR38 Cabin	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.093	0.0010	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00097	0.153	0.0016	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.7	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.103	0.0011	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
TLRU	North of Birch Lake	6	POR05	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00144	0.260	0.0027	0.008	0.004	0.006	0.000	0.001	0.003	0.06	0.02	0.9	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.260	0.0027	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.9	
	West of Mine	7	POR04	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00101	0.178	0.0018	0.007	0.004	0.006	0.000	0.001	0.003	0.06	0.02	0.8	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.178	0.0018	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.8	
	South of Mine	11	POR02	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.065	0.0007	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00121	0.071	0.0007	0.007	0.004	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.139	0.0014	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.7	
	Further South of Mine	8	POR61	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.113	0.0012	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00101	0.117	0.0012	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.117	0.0012	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
MPOI	North of Mine	6	NA	Baseline	0.10	0.0050	0.015	0.006	0.38	0.00095	0.124	0.0013	0.006	0.003	0.006	0.000	0.001	0.003	0.05	0.01	0.7	
				Project	0.10	0.0050	0.015	0.006	0.38	0.00145	0.260	0.0027	0.009	0.004	0.006	0.000	0.001	0.003	0.06	0.02	0.9	
				Post-Closure	0.10	0.0050	0.015	0.006	0.38	0.00095	0.260	0.0027	0.006	0.003	0.006	0.000	0.001	0.003	0.06	0.02	0.9	

Table B-3b-2 Non-Carcinogenic Risks Based on Average Country Food Consumption Rates for Cobalt

Scenario's	Area	Surface Water Node	Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00041	0.005	0.00002	0.002	0.003	0.040	0.000	0.003	0.001	0.06	0.06	0.3	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.005	0.00002	0.002	0.003	0.018	0.000	0.003	0.001	0.03	0.03	0.2	
	West of Birch Lake	8	POR24 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00037	0.005	0.00002	0.002	0.003	0.012	0.000	0.003	0.001	0.02	0.02	0.1	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.005	0.00002	0.002	0.003	0.011	0.000	0.003	0.001	0.02	0.02	0.1	
	South of Springpole Lake	DL	POR22 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00037	0.003	0.00001	0.002	0.003	0.012	0.000	0.003	0.001	0.02	0.02	0.1	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.003	0.00001	0.002	0.003	0.005	0.000	0.003	0.001	0.01	0.01	0.1	
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00038	0.005	0.00002	0.002	0.003	0.012	0.000	0.003	0.001	0.02	0.02	0.1	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.003	0.00001	0.002	0.003	0.006	0.000	0.003	0.001	0.01	0.01	0.1	
	Gull Lake	10	POR38 Cabin	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00037	0.005	0.00002	0.002	0.003	0.012	0.000	0.003	0.001	0.02	0.02	0.1	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.003	0.00001	0.002	0.003	0.005	0.000	0.003	0.001	0.01	0.01	0.1	
TLRU	North of Birch Lake	6	POR05	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00060	0.015	0.00006	0.003	0.003	0.040	0.000	0.003	0.001	0.06	0.06	0.3	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.007	0.00003	0.002	0.003	0.018	0.000	0.003	0.001	0.03	0.03	0.2	
	West of Mine	7	POR04	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00039	0.018	0.00007	0.002	0.003	0.047	0.000	0.003	0.001	0.07	0.07	0.3	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.006	0.00002	0.002	0.003	0.014	0.000	0.003	0.001	0.02	0.02	0.2	
	South of Mine	11	POR02	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00049	0.006	0.00002	0.003	0.003	0.013	0.000	0.003	0.001	0.02	0.02	0.2	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.009	0.00004	0.002	0.003	0.022	0.000	0.003	0.001	0.03	0.03	0.2	
	Further South of Mine	8	POR61	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00039	0.005	0.00002	0.002	0.003	0.012	0.000	0.003	0.001	0.02	0.02	0.1	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.015	0.00006	0.002	0.003	0.011	0.000	0.003	0.001	0.02	0.02	0.2	
MPOI	North of Mine	6	NA	Baseline	0.05	0.0004	0.004	0.003	0.03	0.00036	0.002	0.00001	0.002	0.003	0.003	0.000	0.003	0.001	0.00	0.00	0.1	
				Project	0.05	0.0004	0.004	0.003	0.03	0.00060	0.015	0.00006	0.003	0.003	0.040	0.000	0.003	0.001	0.06	0.06	0.3	
				Post-Closure	0.05	0.0004	0.004	0.003	0.03	0.00036	0.007	0.00003	0.002	0.003	0.018	0.000	0.003	0.001	0.03	0.03	0.2	

Table B-3b-3 Non-Carcinogenic Risks Based on Average Country Food Consumption Rates for Mercury

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0000	0.007	0.0000	0.01	0.08	0.1	
			Cabin	Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0003	0.000003	0.001	0.001	0.001	0.0000	0.007	0.0000	0.02	0.09	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0000	0.007	0.0000	0.10	0.16	0.3	
	West of Birch Lake	8	POR24	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
			Cabin	Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
	South of Springpole Lake	DL	POR22	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0000	0.007	0.0000	0.01	0.08	0.1	
			Cabin	Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0000	0.007	0.0000	0.05	0.12	0.2	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0000	0.007	0.0000	0.01	0.08	0.1	
	Springpole Lake Southeast Arm	9	POR07	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000006	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
			Cabin	Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000006	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
	Gull Lake	10	POR38	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000006	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
			Cabin	Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0006	0.000007	0.001	0.001	0.001	0.0005	0.007	0.0000	0.02	0.08	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.04	0.1	
TLRU	North of Birch Lake	6	POR05	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0004	0.000004	0.001	0.001	0.001	0.0005	0.007	0.0000	0.02	0.09	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0009	0.000009	0.001	0.001	0.001	0.0005	0.007	0.0000	0.10	0.16	0.3	
	West of Mine	7	POR04	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0004	0.000004	0.001	0.001	0.001	0.0005	0.007	0.0000	0.03	0.09	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0005	0.000005	0.001	0.001	0.001	0.0005	0.007	0.0000	0.04	0.11	0.2	
	South of Mine	11	POR02	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.02	0.08	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
	Further South of Mine	8	POR61	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
MPOI	North of Mine	6	NA	Baseline	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0004	0.007	0.0000	0.01	0.08	0.1	
				Project	0.001	0.0001	0.0001	0.0001	0.01	0.00014	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	
				Post-Closure	0.001	0.0001	0.0001	0.0001	0.01	0.00013	0.0003	0.000003	0.001	0.001	0.001	0.0005	0.007	0.0000	0.01	0.08	0.1	

Table B-3b-4 Non-Carcinogenic Risks Based on Average Country Food Consumption Rates for Methyl Mercury

Scenario's	Area	Surface Water Node	Receptor Location	Scenario	Surface Water		Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01 Cabin	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.1E-05	1.0E-04	0.33	1.84	**2.2**	0.016
				Post-Closure	2.1E-05	1.0E-04	0.38	1.89	**2.3**	0.12
	West of Birch Lake	8	POR24 Cabin	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Post-Closure	2.1E-05	1.0E-04	0.32	1.83	2.1	
	South of Springpole Lake	DL	POR22 Cabin	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.1E-05	1.0E-04	0.35	1.86	**2.2**	0.059
				Post-Closure	2.1E-05	1.0E-04	0.32	1.83	2.1	
	Springpole Lake Southeast Arm	9	POR07 Cabin	Baseline	8.9E-05	4.3E-04	0.32	1.83	2.1	
				Project	4.2E-05	2.0E-04	0.25	1.76	2.0	
				Post-Closure	2.2E-05	1.0E-04	0.22	1.73	2.0	
	Gull Lake	10	POR38 Cabin	Baseline	4.2E-05	2.0E-04	0.32	1.83	2.1	
				Project	4.5E-05	2.1E-04	0.32	1.83	2.2	
				Post-Closure	2.2E-05	1.0E-04	0.29	1.80	2.1	
TLRU	North of Birch Lake	6	POR05	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.7E-05	1.3E-04	0.33	1.84	**2.2**	0.017
				Post-Closure	6.2E-05	3.0E-04	0.38	1.89	**2.3**	0.12
	West of Mine	7	POR04	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.8E-05	1.3E-04	0.33	1.84	2.2	0.021
				Post-Closure	3.7E-05	1.8E-04	0.34	1.85	2.2	0.046
	South of Mine	11	POR02	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.3E-05	1.1E-04	0.32	1.83	**2.2**	
				Post-Closure	2.1E-05	1.0E-04	0.32	1.83	2.1	
	Further South of Mine	8	POR61	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Post-Closure	2.1E-05	1.0E-04	0.32	1.83	2.1	
MPOI	North of Mine	6	NA	Baseline	2.1E-05	1.0E-04	0.32	1.83	2.1	
				Project	2.7E-05	1.3E-04	0.33	1.84	**2.2**	0.017
				Post-Closure	6.2E-05	3.0E-04	0.38	1.89	**2.3**	0.12

Table B-3b-5 Non-Carcinogenic Risks Based on Average Country Food Consumption Rates for Methyl Mercury (General Population)

Scenarios	Area	Surface Water Node	Receptor Location	Scenario	Surface Water		Fish 1	Fish 2	Total HQ	Incremental HQ
					Ingestion	Dermal	Ingestion	Ingestion		
Cabin	North of Birch Lake	6	POR01	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
			Cabin	Project	2.10E-05	1.00E-04	0.06	0.37	0.4	
				Post-Closure	2.10E-05	1.00E-04	0.07	0.38	0.5	0.02
	West of Birch Lake	8	POR24	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
			Cabin	Project	2.10E-05	1.00E-04	0.06	0.36	0.4	
				Post-Closure	2.10E-05	1.00E-04	0.06	0.36	0.4	
	South of Springpole Lake	DL	POR22	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
			Cabin	Project	2.10E-05	1.00E-04	0.07	0.37	0.4	
				Post-Closure	2.10E-05	1.00E-04	0.06	0.36	0.4	
	Springpole Lake Southeast Arm	9	POR07	Baseline	8.90E-05	4.30E-04	0.06	0.36	0.4	
			Cabin	Project	4.20E-05	2.00E-04	0.05	0.35	0.4	
				Post-Closure	2.20E-05	1.00E-04	0.04	0.34	0.4	
	Gull Lake	10	POR38	Baseline	4.20E-05	2.00E-04	0.06	0.36	0.4	
			Cabin	Project	4.50E-05	2.10E-04	0.06	0.36	0.4	
				Post-Closure	2.20E-05	1.00E-04	0.06	0.36	0.4	
TLRU	North of Birch Lake	6	POR05	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
				Project	2.70E-05	1.30E-04	0.06	0.37	0.4	
				Post-Closure	6.20E-05	3.00E-04	0.07	0.38	0.5	0.02
	West of Mine	7	POR04	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
				Project	2.80E-05	1.30E-04	0.07	0.37	0.4	
				Post-Closure	3.70E-05	1.80E-04	0.07	0.37	0.4	
	South of Mine	11	POR02	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
				Project	2.30E-05	1.10E-04	0.06	0.36	0.4	
				Post-Closure	2.10E-05	1.00E-04	0.06	0.36	0.4	
	Further South of Mine	8	POR61	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
				Project	2.10E-05	1.00E-04	0.06	0.36	0.4	
				Post-Closure	2.10E-05	1.00E-04	0.06	0.36	0.4	
MPOI	North of Mine	6	NA	Baseline	2.10E-05	1.00E-04	0.06	0.36	0.4	
				Project	2.70E-05	1.30E-04	0.06	0.37	0.4	
				Post-Closure	6.20E-05	3.00E-04	0.07	0.38	0.5	0.02

Attachment B-4: Carcinogenic Exposure Point Concentrations

Table B-4-1 Baseline and Predicted Arsenic EPC Concentrations in Soil, Sediment, Surface WaterPlants and Invertebrates - Project Alone (mg/kg)

Point of Reception	Soil Concentration	Sediment Concentration	Total Concentration in Forage	Total Concentration in Berries	Total Concentration in Aquatic Plants	Concentration of COPC in Invertebrates Tissue
POR01	3.43E-03	1.54E-05	2.30E-03	3.31E-04	4.04E-02	4.40E-03
POR02	2.21E-02	5.97E-04	6.50E-03	1.09E-03	1.86E-02	1.64E-02
POR04	4.40E-03	1.54E-05	2.95E-03	4.25E-04	1.60E-02	5.24E-03
POR05	2.25E-02	1.54E-05	1.51E-02	2.17E-03	4.04E-02	1.66E-02
POR07	1.88E-03	1.54E-05	1.26E-03	1.82E-04	1.86E-02	2.88E-03
POR16	9.81E-05	1.54E-05	6.57E-05	9.46E-06	0.00E+00	3.57E-04
POR22	1.64E-03	1.54E-05	1.10E-03	1.58E-04	1.86E-02	2.61E-03
POR24	8.09E-04	1.54E-05	5.42E-04	7.80E-05	1.11E-03	1.58E-03
POR38	6.72E-04	1.54E-05	4.50E-04	6.47E-05	1.86E-02	1.39E-03
POR61	2.21E-03	1.54E-05	1.48E-03	2.13E-04	1.86E-02	3.22E-03
MPOI	2.68E-02	1.54E-05	1.80E-02	2.59E-03	4.04E-02	1.88E-02

Table B-4-2 Predicted Incremental Increase in Arsenic EPCs in Surface Water at Modelling Nodes (mg/L)

Birch Lake					Springpole Lake - Southeast Arm					Springpole Lake - North Basin				
Node	Project Phase	Surface Water	Deposition	Concentration	Node	Project Phase	Surface Water	Deposition	Concentration	Node	Project Phase	Surface Water	Deposition	Concentration
Node 6	Construction	0.00E+00	1.54E-05	1.54E-05	Discharge	Construction	1.83E-04	3.84E-05	2.22E-04	Node 11	Construction	4.31E-05	3.65E-06	4.68E-05
	Operations	0.00E+00	1.54E-05	1.54E-05	Location	Operations	3.50E-04	3.84E-05	3.88E-04		Operations	5.38E-07	3.65E-06	4.19E-06
	Active Closure	0.00E+00	1.54E-05	1.54E-05		Active Closure	6.33E-04	3.84E-05	6.72E-04		Active Closure	5.99E-07	3.65E-06	4.25E-06
	Post-closure	1.11E-03	0.00E+00	1.11E-03		Post-closure	2.00E-04	0.00E+00	2.00E-04		Post-closure	6.03E-04	0.00E+00	6.03E-04
Node 7	Construction	0.00E+00	1.54E-05	1.54E-05	Node 9	Construction	1.64E-04	3.84E-05	2.02E-04	Node 5	Construction	4.28E-05	3.65E-06	4.64E-05
	Operations	0.00E+00	1.54E-05	1.54E-05		Operations	3.39E-04	3.84E-05	3.77E-04		Operations	2.78E-07	3.65E-06	3.93E-06
	Active Closure	0.00E+00	1.54E-05	1.54E-05		Active Closure	6.16E-04	3.84E-05	6.54E-04		Active Closure	3.09E-07	3.65E-06	3.96E-06
	Post-closure	4.29E-04	0.00E+00	4.29E-04		Post-closure	1.96E-04	0.00E+00	1.96E-04		Post-closure	3.85E-04	0.00E+00	3.85E-04
Node 8	Construction	1.43E-06	1.54E-05	1.68E-05	Node 10	Construction	1.95E-05	3.84E-05	5.79E-05					
	Operations	1.74E-06	1.54E-05	1.71E-05		Operations	1.88E-04	3.84E-05	2.26E-04					
	Active Closure	1.32E-06	1.54E-05	1.67E-05		Active Closure	4.54E-04	3.84E-05	4.92E-04					
	Post-closure	1.54E-05	0.00E+00	1.54E-05		Post-closure	4.52E-05	0.00E+00	4.52E-05					
					SE Arm	Construction	1.19E-04	3.84E-05	1.57E-04					
						Operations	2.98E-04	3.84E-05	3.37E-04					
						Active Closure	5.56E-04	3.84E-05	5.94E-04					
						Post-closure	1.69E-04	0.00E+00	1.69E-04					

Note - There is assumed to be no air deposition from Project during post closure

Table B-4-3 Predicted Incremental Increase in Arsenic EPCs in Surface Water used in ILCR Calculations (mg/L)

Project Phase	Node 6 & Background	Node 7 & 8	Node 8	Node 11 & 5	Node 5 & DL	SE Arm	Node 10
Construction	-	-	1.68E-05	-	1.34E-04	1.57E-04	5.79E-05
Operations	-	-	1.71E-05	-	1.96E-04	3.37E-04	2.26E-04
Active Closure	-	-	1.67E-05	-	3.38E-04	5.94E-04	4.92E-04
Post Closure	5.54E-04	2.22E-04	1.54E-05	4.94E-04	2.93E-04	1.69E-04	4.52E-05

- Value not used. Post-closure concentration used to represent lifetime exposure as it had the greatest concentration over the Project

Attachment B-5a: Carcinogenic Dose Calculation Results – Heavy Consumer

Table B-5a Arsenic Incremental Dose for Heavy Consumer

Receptor Location	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	6.3E-10	1.7E-10	2.2E-10	1.2E-11	2.8E-11	3.6E-09	2.4E-07	2.9E-09	2.5E-07	3.7E-08	3.5E-07	1.5E-07	2.3E-11	3.3E-09	4.0E-06	4.0E-06
POR02	5.3E-09	1.4E-09	1.8E-09	2.9E-11	8.3E-10	1.2E-08	2.2E-06	2.6E-08	7.2E-07	1.2E-07	2.5E-07	1.1E-07	2.3E-11	2.6E-09	2.9E-06	2.9E-06
POR04	2.9E-10	9.3E-11	1.1E-10	2.4E-11	2.9E-11	7.1E-10	9.8E-07	1.2E-08	3.3E-07	4.7E-08	1.5E-06	0.0E+00	1.7E-10	3.1E-08	1.6E-06	1.6E-06
POR05	1.4E-09	3.8E-10	4.9E-10	2.4E-11	2.9E-11	5.4E-09	2.4E-06	2.9E-08	1.7E-06	2.4E-07	3.5E-07	1.5E-07	2.3E-11	3.3E-09	4.0E-06	4.0E-06
POR07	3.5E-10	1.0E-10	1.3E-10	1.2E-11	2.8E-11	1.3E-09	1.9E-06	2.3E-08	1.4E-07	2.0E-08	2.4E-07	0.0E+00	1.7E-11	3.0E-09	1.7E-06	1.7E-06
POR22	3.1E-10	8.9E-11	1.1E-10	1.2E-11	2.8E-11	9.5E-10	5.8E-08	6.9E-10	1.2E-07	1.7E-08	1.7E-07	7.3E-08	1.8E-11	3.1E-09	1.9E-06	1.9E-06
POR24	1.2E-10	4.3E-11	5.1E-11	1.8E-11	2.8E-11	4.1E-10	1.4E-07	2.5E-09	6.0E-08	8.6E-09	2.5E-08	1.0E-08	1.4E-11	2.9E-09	1.2E-07	1.2E-07
POR38	9.9E-11	3.9E-11	4.6E-11	1.8E-11	2.8E-11	3.4E-10	8.2E-07	1.1E-08	5.0E-08	7.2E-09	1.7E-07	7.4E-08	1.5E-11	3.0E-09	8.0E-07	8.0E-07
POR61	1.6E-10	5.8E-11	6.9E-11	2.4E-11	2.9E-11	6.9E-10	7.0E-08	8.4E-10	1.6E-07	2.4E-08	2.5E-08	1.0E-08	1.4E-11	2.9E-09	1.2E-07	1.2E-07

Attachment B-5b: Carcinogenic Dose Calculation Results – Average Consumer

Table B-5b Arsenic Incremental Dose for Average Consumer

Receptor Location	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
POR01	4.3E-10	1.3E-10	1.6E-10	1.8E-11	2.8E-11	2.4E-09	2.4E-07	2.9E-09	5.9E-08	8.5E-09	6.9E-08	4.4E-08	4.4E-12	1.0E-09	7.8E-07	7.8E-07
POR02	1.4E-09	3.7E-10	4.8E-10	2.9E-11	2.3E-10	2.9E-09	2.2E-06	2.6E-08	1.7E-07	2.8E-08	6.1E-08	3.9E-08	4.2E-12	1.0E-09	7.0E-07	7.0E-07
POR04	2.9E-10	9.3E-11	1.1E-10	2.4E-11	2.9E-11	7.1E-10	9.8E-07	1.2E-08	7.5E-08	1.1E-08	2.9E-08	1.9E-08	3.4E-12	9.6E-10	3.1E-07	3.1E-07
POR05	1.4E-09	3.8E-10	4.9E-10	2.4E-11	2.9E-11	5.4E-09	2.4E-06	2.9E-08	3.8E-07	5.5E-08	6.9E-08	4.4E-08	4.4E-12	1.0E-09	7.8E-07	7.8E-07
POR07	2.4E-10	7.7E-11	9.6E-11	1.8E-11	2.8E-11	8.7E-10	1.9E-06	2.3E-08	3.2E-08	4.6E-09	4.7E-08	0.0E+00	3.3E-12	9.6E-10	3.2E-07	3.2E-07
POR22	2.2E-10	6.9E-11	8.6E-11	1.8E-11	2.8E-11	6.4E-10	5.8E-08	6.9E-10	2.8E-08	4.0E-09	3.3E-08	2.1E-08	3.5E-12	9.7E-10	3.8E-07	3.8E-07
POR24	1.2E-10	4.3E-11	5.1E-11	1.8E-11	2.8E-11	4.1E-10	1.4E-07	1.7E-09	1.4E-08	2.0E-09	4.9E-09	2.9E-09	2.7E-12	9.1E-10	2.2E-08	2.2E-08
POR38	9.9E-11	3.9E-11	4.6E-11	1.8E-11	2.8E-11	3.4E-10	8.2E-07	1.1E-08	1.2E-08	1.7E-09	3.4E-08	2.1E-08	3.0E-12	9.3E-10	1.5E-07	1.5E-07
POR61	1.6E-10	5.8E-11	6.9E-11	2.4E-11	2.9E-11	6.9E-10	7.0E-08	8.4E-10	3.8E-08	5.5E-09	4.9E-09	2.9E-09	2.7E-12	9.1E-10	2.2E-08	2.2E-08

Attachment B-6a: Carcinogenic Human Health Risk – Heavy Consumer

Table B-6a Heavy Consumer Arsenic Incremental Lifetime Cancer Risk

Receptor Location	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total ILCR
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	
POR01	1.1E-09	3.1E-10	6.1E-09	2.2E-11	5.0E-11	9.8E-08	4.4E-07	5.3E-09	4.6E-07	6.6E-08	6.4E-07	2.7E-07	4.1E-11	5.9E-09	7.3E-06	7.3E-06	1.6E-05
POR02	9.6E-09	2.5E-09	5.0E-08	5.2E-11	1.5E-09	3.1E-07	3.9E-06	4.7E-08	1.3E-06	2.2E-07	4.6E-07	1.9E-07	4.2E-11	4.7E-09	5.2E-06	5.2E-06	1.7E-05
POR04	5.2E-10	1.7E-10	3.1E-09	4.3E-11	5.2E-11	1.9E-08	1.8E-06	2.1E-08	5.9E-07	8.4E-08	2.7E-06	0.0E+00	3.1E-10	5.5E-08	2.9E-06	2.9E-06	1.1E-05
POR05	2.5E-09	6.8E-10	1.3E-08	4.3E-11	5.2E-11	1.5E-07	4.4E-06	5.3E-08	3.0E-06	4.3E-07	6.4E-07	2.7E-07	4.1E-11	5.9E-09	7.3E-06	7.3E-06	2.3E-05
POR07	6.3E-10	1.8E-10	3.5E-09	2.2E-11	5.0E-11	3.5E-08	3.4E-06	4.2E-08	2.5E-07	3.6E-08	4.3E-07	0.0E+00	3.1E-11	5.5E-09	3.0E-06	3.0E-06	1.0E-05
POR22	5.5E-10	1.6E-10	3.1E-09	2.2E-11	5.0E-11	2.6E-08	1.0E-07	1.2E-09	2.2E-07	3.1E-08	3.1E-07	1.3E-07	3.3E-11	5.6E-09	3.5E-06	3.5E-06	7.8E-06
POR24	2.1E-10	7.8E-11	1.4E-09	3.2E-11	5.1E-11	1.1E-08	2.5E-07	4.5E-09	1.1E-07	1.6E-08	4.6E-08	1.8E-08	2.5E-11	5.2E-09	2.1E-07	2.1E-07	8.8E-07
POR38	1.8E-10	7.0E-11	1.2E-09	3.2E-11	5.1E-11	9.2E-09	1.5E-06	1.9E-08	8.9E-08	1.3E-08	3.1E-07	1.3E-07	2.7E-11	5.3E-09	1.4E-06	1.4E-06	4.9E-06
POR61	2.8E-10	1.1E-10	1.9E-09	4.3E-11	5.2E-11	1.9E-08	1.3E-07	1.5E-09	2.9E-07	4.2E-08	4.6E-08	1.8E-08	2.5E-11	5.2E-09	2.1E-07	2.1E-07	9.7E-07

Attachment B-6b: Carcinogenic Human Health Risk – Average Consumer

Table B-6b Average Consumer Arsenic Incremental Lifetime Cancer Risk

Receptor Location	Soil			Sediment		Air	Surface Water		Leafy Plants	Berries	Large Mammal 1	Large Mammal 2	Small Mammal	Game Bird	Fish 1	Fish 2	Total ILCR
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	
POR01	7.8E-10	2.3E-10	4.3E-09	3.2E-11	5.1E-11	6.6E-08	4.4E-07	5.3E-09	1.1E-07	1.5E-08	1.2E-07	7.9E-08	8.0E-12	1.9E-09	1.4E-06	1.4E-06	3.7E-06
POR02	2.4E-09	6.7E-10	1.3E-08	5.3E-11	4.1E-10	7.9E-08	3.9E-06	4.7E-08	3.0E-07	5.0E-08	1.1E-07	7.0E-08	7.6E-12	1.8E-09	1.3E-06	1.3E-06	7.1E-06
POR04	5.2E-10	1.7E-10	3.1E-09	4.3E-11	5.2E-11	1.9E-08	1.8E-06	2.1E-08	1.4E-07	2.0E-08	5.2E-08	3.3E-08	6.1E-12	1.7E-09	5.6E-07	5.6E-07	3.2E-06
POR05	2.5E-09	6.8E-10	1.3E-08	4.3E-11	5.2E-11	1.5E-07	4.4E-06	5.3E-08	6.9E-07	1.0E-07	1.2E-07	7.9E-08	8.0E-12	1.9E-09	1.4E-06	1.4E-06	8.4E-06
POR07	4.4E-10	1.4E-10	2.6E-09	3.2E-11	5.1E-11	2.4E-08	3.4E-06	4.2E-08	5.8E-08	8.4E-09	8.4E-08	0.0E+00	6.0E-12	1.7E-09	5.8E-07	5.8E-07	4.7E-06
POR22	3.9E-10	1.2E-10	2.3E-09	3.2E-11	5.1E-11	1.7E-08	1.0E-07	1.2E-09	5.1E-08	7.3E-09	6.0E-08	3.8E-08	6.4E-12	1.7E-09	6.8E-07	6.8E-07	1.6E-06
POR24	2.1E-10	7.8E-11	1.4E-09	3.2E-11	5.1E-11	1.1E-08	2.5E-07	3.0E-09	2.5E-08	3.6E-09	8.9E-09	5.3E-09	4.9E-12	1.6E-09	4.0E-08	4.0E-08	3.9E-07
POR38	1.8E-10	7.0E-11	1.2E-09	3.2E-11	5.1E-11	9.2E-09	1.5E-06	1.9E-08	2.1E-08	3.0E-09	6.1E-08	3.9E-08	5.3E-12	1.7E-09	2.8E-07	2.8E-07	2.2E-06
POR61	2.8E-10	1.1E-10	1.9E-09	4.3E-11	5.2E-11	1.9E-08	1.3E-07	1.5E-09	6.8E-08	9.8E-09	8.9E-09	5.3E-09	4.9E-12	1.6E-09	4.0E-08	4.0E-08	3.2E-07

Attachment B-7: Human Health Risk Example Calculations

HUMAN HEALTH RISK ASSESSMENT EXAMPLE CALCULATIONS

Using the COPC concentrations predicted in each relevant environmental medium, equations provided by Health Canada (2024) and additional inputs, as identified in the following sections, the daily intake of chemicals from the following exposure pathways was calculated:

- Ingestion of soil;
- Dermal contact with soil;
- Inhalation of soil particulates;
- Ingestion of sediment;
- Dermal contact with sediment;
- Ingestion of surface water
- Dermal contact with water
- Inhalation of particulates in air from emissions
- Ingestion of native vegetation;
- Ingestion of wildlife game; and
- Ingestion of fish.

Average daily doses were calculated for each COPC for the Baseline, Project and, Post-Closure scenarios at each receptor location. Average daily doses were calculated for toddlers (receptor for non-carcinogenic risks) using receptor-specific parameters provided by Health Canada (2024) as shown in Table B.

The non-carcinogenic l example calculations below are for arsenic in the Baseline Assessment Scenario at the POR07 and the country food calculations are for the heavy consumer.

The carcinogenic example calculations below are for arsenic in the at POR07 (Springpole Lake Southeast Arm) and for the country food calculations are for the heavy consumer.

Table B-7-1 Characteristics of Human Receptors

Receptor Characteristic	Receptors					Reference
	Infant	Toddler	Child	Teen	Adult	
Age	0 - 6 mo.	7 mo. - 4 y	5 - 11 y	12 - 19 y	≥20 y	Health Canada 2024
Lifestage Length (y)	0.5	4.5	7	8	60	Health Canada 2024
Age Dependent Adjustment Factor	10	5	3	2	1	Health Canada 2013
Body weight (kg)	8.2	16.5	32.9	59.7	70.7	Health Canada 2024
Soil ingestion rate (kg/d)	2.00×10^{-5}	8.00×10^{-5}	2.00×10^{-5}	2.00×10^{-5}	2.00×10^{-5}	Health Canada 2024
Inhalation rate (m^3/d)	2.2	8.3	14.5	15.6	16.6	Health Canada 2024
Water ingestion rate (L/d)	0.3	0.6	0.8	1	1.5	Health Canada 2024
Skin surface area (cm^2)						
- hands	320	430	590	800	890	Health Canada 2024
- arms	550	890	1,480	2,230	2,500	Health Canada 2024
- legs	910	1,690	3,070	4,970	5,720	Health Canada 2024
- exposed area, not hands	1,460	2,580	4,550	7,200	8,220	Calculated
- feet	250	430	720	1080	1190	Health Canada 2024
- total	3,620	6,130	10,140	15,470	17,640	Health Canada 2024
Soil loading to exposed skin (g/cm^2 per event)						
- hands	1.0×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	Health Canada 2021a
- surfaces other than hands	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	Health Canada 2021a
Heavy Consumer Food ingestion (kg/d):						
Total Plants Consumption Rate	0.01436	0.01326	0.01961	0.02431	0.0276	Chan et al. 2014
– consumption of berries	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption
– consumption of medicinal plants (Labrador Tea)	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption
Consumption rate of higher tropic level fish	0	0.08991	0.14834	0.17981	0.17891	Chan et al. 2014
Consumption rate of Game Meat (1)	0	0.4073	0.6044	0.8409	0.13139	Chan et al. 2014
- consumption rate of Moose	0	0.0266	0.0390	0.0546	0.0843	Chan et al. 2014
- consumption rate of Deer	0	0.0113	0.0165	0.0232	0.03573	Chan et al. 2014
- consumption rate of Snowshoe Hare	0	0.0036	0.0052	0.0073	0.0113	Chan et al. 2014
Consumption rate of Grouse	0	0.0132	0.0196	0.0273	0.0426	Chan et al. 2014
Average Consumer Food ingestion (kg/d):						
Total Plants Consumption	0.00332	0.00307	0.00454	0.00562	0.00639	Chan et al. 2014
– consumption of berries	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption
– consumption of medicinal plants (Labrador Tea)	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	1/2 of total plants consumption	Assumption

Table B-7-1 Characteristics of Human Receptors

Receptor Characteristic	Receptors					Reference
	Infant	Toddler	Child	Teen	Adult	
Consumption rate of higher tropic level fish	0	0.01743	0.02876	0.03486	0.03486	Chan et al. 2014
Consumption rate of Game Meat (2)	0	0.00914	0.0134	0.0188	0.029	Chan et al. 2014
- consumption rate of Moose	0	0.0052	0.0076	0.0106	0.01638	Chan et al. 2014
- consumption rate of Deer	0	0.0033	0.0048	0.0068	0.01043	Chan et al. 2014
- consumption rate of Snowshoe Hare	0	0.0007	0.0010	0.0014	0.0022	Chan et al. 2014
Consumption rate of Grouse	0	0.0042	0.0062	0.0087	0.0134	Chan et al. 2014

(1) Consumption rates used in calculation are 64% moose (meat and organs), 9% hare and 27% deer (which includes deer meat and caribou liver) for heavy consumer.
(2) Consumption rates used in calculation are 56% moose (meat and organs), 8% hare and 36% deer (which includes deer meat and caribou liver) for average consumer.

Calculation of Chemical of Potential Concern Intakes Due to Ingestion of Soil

The average daily dose due to the incidental ingestion of soil was calculated as follows:

$$ADD_{Soil-Ing} = \frac{Conc_{soil} \cdot IngR_{soil} \cdot F \cdot RAF \cdot D2 \cdot D3}{BW}$$

$$LADD_{\square} = \frac{Conc_{soil} \cdot IngR_{soil} \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

Where:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	2.9E-05	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	5.67E-10	Calculated for arsenic
$Conc_{soil}$	COPC concentration in soil	mg/kg	12	Chemical Specific
$Conc_{soil}$	Incremental COPC concentration in soil	mg/kg	1.88E-03	Chemical Specific
$IngR_{soil}$	Ingestion rate for soil	mg/d	Table B-7-1	HC 2024
F	Fraction from site	unitless	1	Assumption
RAF	Relative absorption factor for COPC	unitless	0.5	Chemical Specific, MECP 2011
D2	Days per week exposed / 7 days	unitless	1	HC 2024
D3	Weeks per year exposed / 52 weeks	unitless	1	HC 2024
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

Calculation of Chemical of Potential Concern Intakes Due to Dermal Contact with Soil

The average daily dose due to the direct dermal contact with the soil was calculated as follows:

$$ADD_{Toddler} = \frac{(Conc_{soil} \cdot SA_H \cdot SL_H) + (Conc_{soil} \cdot SA_O \cdot SL_O) \cdot F \cdot RAF \cdot D2 \cdot D3}{BW}$$

$$LADD_{\square} = \frac{(Conc_{soil} \cdot SA_H \cdot SL_H) + (Conc_{soil} \cdot SA_O \cdot SL_O) \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

Where:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	1.5E-06	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	1.48E-10	Calculated for arsenic
$Conc_{soil}$	COPC concentration in soil (Toddler)	mg/kg	12	Calculated for arsenic
	Incremental COPC concentration in soil for ILCR	mg/kg	1.88E-03	Calculated for arsenic
SA_H	Hands skin surface area	cm^2	Table B-7-1	HC 2024
SA_O	Other than hands skin surface area	cm^2	Table B-7-1	HC 2024
F	Fraction from site	unitless	1	Assumption

Parameter	Definition	Units	Value	Reference
SL_H	Soil Loading for hands	kg/cm^2/event	$1x10^{-7}$	HC 2024
SL_O	Soil Loading for body parts other than hands	kg/cm^2/event	$1x10^{-8}$	HC 2024
RAF	Relative absorption factor for COPC	unitless	0.03	Chemical Specific, HC 2021
D2	Days per week exposed / 7 days	unitless	1	Assumption
D3	Weeks per year exposed / 52 weeks	unitless	50	Assumption
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

Calculation of Chemical of Potential Concern Intakes Due to Inhalation of Soil

The average daily dose due to the inhalation of resuspended soil particulates was calculated as follows:

$$ADD_{Toddler} = \frac{Conc_{soil} \cdot 0.00076 \cdot InhR \cdot F \cdot RAF \cdot D1 \cdot D2 \cdot D3}{BW}$$

$$LAD = \frac{Conc_{soil} \cdot 0.00076 \cdot InhR \cdot F \cdot RAF \cdot D1 \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

Where:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	4.58E-06	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	1.95E-10	Calculated for arsenic
$Conc_{soil}$	COPC concentration in soil (Toddler)	mg/kg	12	Calculated for arsenic
	Incremental COPC concentration in soil for ILCR	mg/kg	1.88E-03	Calculated for arsenic
0.00076	Concentration of respirable particulate matter in ambient air	mg/m^3	0.00076	HC 2024
InhR	Inhalation rate	m^3/d	Table B-7-1	HC 2024
F	Fraction from site	unitless	1	Assumption
RAF	Relative absorption factor for COPC	unitless	1	HC 2024
D1	Hours per day exposed / 24 hours	unitless	1	HC 2024
D2	Days per week exposed / 7 days	unitless	1	HC 2024
D3	Weeks per year exposed / 52 weeks	unitless	1	HC 2024
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

Calculation of Chemical of Potential Concern Intakes Due to Ingestion of Vegetation

The average daily dose due to the ingestion of leafy vegetation such as Labrador tea was calculated as follows:

$$ADD_{Toddler} = \frac{Conc_{veg} \cdot IngR_{veg} \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot}{BW}$$

$$LADD = \frac{Conc_{veg} \cdot IngR_{veg} \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

where:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	7.88E-06	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	1.39E-07	Calculated for arsenic
$Conc_{veg}$	COPC concentration in native vegetation (wet-weight) for the Operations case (Toddler)	mg/kg	3.92E-02	Calculated for arsenic
	Incremental COPC concentration in native vegetation (wet-weight)	mg/kg	1.26E-03	Calculated for arsenic
$IngR_{veg}$	Ingestion rate for leafy plants	g/d	Table B-7-1	Chan et al. 2014
F	Fraction from site	unitless	1	Assumption
RAF	Relative absorption factor for COPC	unitless	1	Assumption
D2	Days per week exposed / 7 days	unitless	1	Assumption
D3	Weeks per year exposed / 52 weeks	unitless	1	Assumption
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

The average daily dose due to the ingestion of native berries such as blueberries is calculated the same as above. The values for these berries are as follows:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	1.49E-02	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	2.01E-08	Calculated for arsenic
$Conc_{veg}$	COPC concentration in berries (wet-weight) (Toddler)	mg/kg	2.22E-02	Calculated for arsenic
	Incremental COPC concentration in berries (wet-weight)	mg/kg	1.82E-04	Calculated for arsenic
$IngR_{veg}$	Ingestion rate for berries (Toddler)	g/d	6.63	Chan et al. 2014
	Ingestion rate for berries	g/d	Table B-7-1	Chan et al. 2014
F	Fraction from site	unitless	1	Assumption

Calculation of Chemical of Potential Concern Intakes Due to Ingestion of Wildlife Game

The average daily dose due to the ingestion of wild game such as moose was calculated as follows:

$$ADD_{Toddler} = \frac{Conc_{game} \cdot IngR_{game} \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot}{BW}$$

$$AD = \frac{Conc_{game} \cdot IngR_{game} \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

where:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	8.51E-05	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	2.39E-06	Calculated for arsenic
$Conc_{game}$	COPC concentration in mammal (wet-weight) (Toddler)	mg/kg	1.06E-01	Calculated for arsenic
	Incremental COPC concentration in mammal (wet-weight)			
	Construction	mg/kg	4.61E-04	Calculated for arsenic
	Operations	mg/kg	9.25E-04	Calculated for arsenic
	Active Closure	mg/kg	1.59E-03	Calculated for arsenic
	Post-Closure	mg/kg	4.92E-04	Calculated for arsenic
$IngR_{game}$	Ingestion rate for wild game	g/d	Table B-7-1	Chan et al. 2014
F	Fraction from site	unitless	1	Assumption
RAF	Relative absorption factor for COPC	unitless	1	US EPA 2005a
D2	Days per week exposed / 7 days	unitless	1	Assumption
D3	Weeks per year exposed / 52 weeks	unitless	1	Assumption
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

Values provided above are for the Moose. The same calculation is used for Deer, Hare and Game Birds. The values for these food items are as follows

Parameter	Definition	Units	Value	Reference
Deer				
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	3.13E-06	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	1.01E-06	Calculated for arsenic
$Conc_{game}$	COPC concentration in mammal (wet-weight) (Toddler)	mg/kg	9.16E-03	Calculated for arsenic
	Incremental COPC concentration in mammal (wet-weight)			
	Construction	mg/kg	4.61E-04	Calculated for arsenic
	Operations	mg/kg	9.25E-04	Calculated for arsenic
	Active Closure	mg/kg	1.59E-03	Calculated for arsenic
	Post-Closure	mg/kg	4.92E-04	Calculated for arsenic

Parameter	Definition	Units	Value	Reference
Hare				
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	8.56E-06	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	1.73E-10	Calculated for arsenic
$Conc_{game}$	COPC concentration in mammal (wet-weight) (Toddler)	mg/kg	7.92E-02	Calculated for arsenic
	Incremental COPC concentration in mammal (wet-weight)			
	Construction	mg/kg	2.06E-06	Calculated for arsenic
	Operations	mg/kg	2.44E-06	Calculated for arsenic
	Active Closure	mg/kg	2.97E-06	Calculated for arsenic
	Post-Closure	mg/kg	2.09E-06	Calculated for arsenic
Game Bird				
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	2.58E-05	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	3.04E-08	Calculated for arsenic
$Conc_{game}$	COPC concentration in bird (wet-weight) (Toddler)	mg/kg	6.33E-02	Calculated for arsenic
	Incremental COPC concentration in mammal (wet-weight)			
	Construction	mg/kg	1.01E-04	Calculated for arsenic
	Operations	mg/kg	1.05E-04	Calculated for arsenic
	Active Closure	mg/kg	1.12E-04	Calculated for arsenic
	Post-Closure	mg/kg	1.01E-04	Calculated for arsenic

Calculation of Chemical of Potential Concern Intakes Due to Ingestion of Fish

The average daily dose due to the ingestion of sport fish was calculated as follows:

$$ADD_{Toddler} = \frac{Conc_{fish} \cdot IngR_{fish} \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot}{BW}$$

$$LAD = \frac{Conc_{fish} \cdot IngR_{fish} \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

Where:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	7.96E-05	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	1.66E-06	Calculated for arsenic
$Conc_{fish}$	COPC concentration in fish (wet-weight) for the Operations case (Toddler)	mg/kg	2.92E-01	Calculated for arsenic
	COPC concentration in fish (wet-weight) for the Project Alone (Adult)			
	Construction	mg/kg	7.85E-03	Calculated for arsenic
	Operations	mg/kg	1.68E-02	Calculated for arsenic
	Active Closure	mg/kg	2.97E-02	Calculated for arsenic
	Post-Closure	mg/kg	8.45E-03	Calculated for arsenic
$IngR_{fish}$	Ingestion rate for fish	g/d	Table B-7-1	Chan et al. 2014

Parameter	Definition	Units	Value	Reference
F	Fraction from site	unitless	1	Assumption
RAF	Relative absorption factor for COPC	unitless	1	US EPA 2005
D2	Days per week exposed / 7 days	unitless	1	Assumption
D3	Weeks per year exposed / 52 weeks	unitless	1	Assumption
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

The average daily dose due to the ingestion of the second species of fish is calculated the same as above. The values for this fish species are as follows:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	1.80E-05	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	1.66E-06	Calculated for arsenic
$Conc_{fish}$	COPC concentration in fish (wet-weight) for the Operations case (Toddler)	mg/kg	6.59E-02	Calculated for arsenic
	COPC concentration in fish (wet-weight) for the Project Alone (Adult)			
	Construction	mg/kg	7.85E-03	Calculated for arsenic
	Operations	mg/kg	1.68E-02	Calculated for arsenic
	Active Closure	mg/kg	2.97E-02	Calculated for arsenic
	Post-Closure	mg/kg	8.45E-03	Calculated for arsenic

Calculation of COPC Intakes Due to Ingestion of Water from the Rivers and Lakes

The average daily dose due to the ingestion of surface water was calculated as follows:

$$ADD_{Toddler} = \frac{C_w \cdot IngR_w \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot}{BW}$$

$$LADD = \frac{C_w \cdot IngR_w \cdot F \cdot RAF \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

where:

Parameter	Definition	Units	Value	Reference
(L)ADD	Average Daily Dose (Toddler)	mg/kg-d	2.45E-05	Calculated for arsenic
	Lifetime Average Daily Dose (Amortized)	mg/kg-d	4.67E-06	Calculated for arsenic
C_w	COPC concentration in surface water for the Operations case (Toddler)	mg/L	6.73E-07	Calculated for arsenic
	Incremental COPC concentration in surface water for the Project Alone	mg/L		
	Construction	mg/L	1.57E-04	Calculated for arsenic
	Operations	mg/L	3.37E-04	Calculated for arsenic
	Active Closure	mg/L	5.94E-04	Calculated for arsenic
	Post-Closure	mg/L	1.69E-04	Calculated for arsenic
$IngR_w$	Ingestion rate for water	L/d	Table B-7-1	HC 2024

Parameter	Definition	Units	Value	Reference
F	Fraction from site	unitless	1	Assumption
RAF	Relative absorption factor for COPC	unitless	1	US EPA 2005
D2	Days per week exposed / 7 days	unitless	1	Assumption
D3	Weeks per year exposed / 52 weeks	unitless	1	Assumption
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

Calculation of Chemical of Potential Concern Intakes Due to Dermal Exposure to Surface Water

The average daily dose due to the dermal exposure to surface water was calculated as follows:

Calculation of Permeability Coefficient

The first step is to calculate a chemical-specific steady-state permeability coefficient from water into the stratum corneum. For inorganic chemicals (i.e., arsenic) the coefficient is taken from the US EPA (US EPA 2007a) document for dermal exposure assessment.

Where:

Parameter	Definition	Units	Value	Reference
K_p	Permeability coefficient in water	cm/hr	0.001	US EPA 2004

Calculation of the Lag Time and Effective Diffusion Through the Stratum Corneum

Then the lag time (LT) per event needs to be evaluated, but in order to do it, the effective diffusion coefficient through the stratum corneum (D_{sc}) has to be determined first.

$$\frac{D_{sc}}{l_{sc}} = 10^{(-2.80-0.0056\times MW)}$$

Where:

Parameter	Definition	Units	Value	Reference
D_{sc}	Effective diffusion coefficient through the stratum corneum	cm^2/hr	5.8E-07	Calculated for arsenic
L_{sc}	Apparent thickness of the stratum corneum (default value)	cm	0.001	US EPA 2005
MW	Molecular Weight	g/mol	78	US EPA 2005

Lag time calculation equation:

$$LT = \frac{{l_{sc}}^2}{6 \times D_{sc}}$$

Where:

Parameter	Definition	Units	Value	Reference
LT	Lag Time	hr	0.287	Calculated for arsenic
D_{sc}	Effective diffusion coefficient through the stratum corneum	cm^2/hr	$5.80x10^{-7}$	Calculated for arsenic
L_{sc}	Apparent thickness of the stratum corneum (default value)	cm	0.001	US EPA 2005

Calculation of Time to Reach Steady State

Then the time to reach steady state has to be evaluated as follow:

$$If\ B \leq 0.6,\ then\ T = 2.4 \times LT$$

and

$$If\ B \succ 0.6, then\ T = 6 \times LT \times \left[b - (b^2 - c^2)\right]$$

Where:

Parameter	Definition	Units	Value	Reference
T	Time to reach Steady State	hr	0.69	Calculated for arsenic
LT	Lag Time	hr	0.287	Calculated for arsenic
B	Ratio of the permeability coefficient through the stratum corneum relative to its permeability coefficient across the viable epidermis	unitless	$3.40x10^{-3}$	Calculated for arsenic

The ratio of the permeability coefficient through the stratum corneum relative to its permeability coefficient across the viable epidermis is calculated by:

$$B = \frac{K_p \times (MW)^{0.5}}{2.6}$$

Where:

Parameter	Definition	Units	Value	Reference
B	Ratio of the permeability coefficient through the stratum corneum relative to its permeability coefficient across the viable epidermis	unitless	$3.40x10^{-3}$	Calculated for arsenic
MW	Molecular Weight	g/mol	78	US EPA 2005
K_p	Permeability coefficient in water	cm/hr	0.001	US EPA 2005

Calculation of Dermal Dose per Event

All those variables were calculated in order to evaluate the dermal absorbed dose per event (DA_{event}). Once again the equation to calculate DA_{event}, is conditional for organic compounds:

$$If\ t_{event} \leq T,\ then\ DA_{event} = 2 \times FA \times K_p \times C_w \times \sqrt{\frac{6LT \times t_{event}}{\pi}}$$

or

$$If\ t_{event} \succ T,\ then: DA_{event} = FA \times K_p \times C_w \times \left[\frac{t_{event}}{1+B} + 2LT\left(\frac{1+3B+3B^2}{1+B^2}\right)\right]$$

But for inorganic compounds it is simply expressed as:

$$DA_{event} = K_p \times \frac{C_w}{1000} \times t_{event}$$

Where:

Parameter	Definition	Units	Value	Reference
t_{event}	Event duration	hr	1	assumption
DA_{event}	Dermal absorbed dose per event	mg/cm^2-event	6.74E-10	Calculated for arsenic
DA_{event}	Incremental dermal absorbed dose per event			
		mg/cm^2-event	1.57E-10	Calculated for arsenic
		mg/cm^2-event	3.37E-10	Calculated for arsenic
		mg/cm^2-event	5.94E-10	Calculated for arsenic
		mg/cm^2-event	1.69E-10	Calculated for arsenic
FA	Fraction absorbed in water	unitless	1	US EPA 2005
K_p	Permeability coefficient in water	cm/hr	0.001	US EPA 2005
C_w	COPC concentration in surface water	mg/L	6.7E-04	Calculated for arsenic
1000	Conversion factor from mg/L to mg/cm^3	unitless	1000	n/a
LT	Lag Time	hr	0.287	Calculated for arsenic
B	Ratio of the permeability coefficient through the stratum corneum relative to its permeability coefficient across the viable epidermis	unitless	3.40E-03	US EPA 2005

The DA_{event} will then be incorporated in the equation to calculate the daily absorbed dose per kilograms of body weight.

$$DAD_{Toddler} = \frac{DA_{event} \cdot F \cdot SA \cdot EV \cdot D2 \cdot D3 \cdot}{BW}$$

$$LDAD_{\square} = \frac{DA_{event} \cdot F \cdot SA \cdot EV \cdot D2 \cdot D3 \cdot D4}{LE \cdot BW}$$

Where:

Parameter	Definition	Units	Value	Reference
DAD	Estimated dermal absorbed dose (Toddler)	mg/kg-d		Calculated for arsenic
	Lifetime dermal absorbed dose (Amortized)	mg/kg-d	5.78E-08	Calculated for arsenic
DA_{event}	Dermal absorbed dose per event	mg/cm^2-event	See table above	Calculated for arsenic
	Incremental dermal absorbed dose per event	mg/cm^2-event		Calculated for arsenic
EV	Event frequency	event/d	1	Assumption
SA	Skin surface area for swimming	cm^2	Table B-7-1	HC 2024
D2	Days per week exposed / 7 days	unitless	1	Assumption
D3	Weeks per year exposed / 52 weeks	unitless	1	Assumption
D4	Total years Exposed	yr	Table B-7-1	HC 2024
LE	Life Expectancy	yr	80	HC 2024
BW	Body weight	kg	Table B-7-1	HC 2024

ESTIMATES OF HEALTH RISKS

After estimated daily intakes for each COPC were calculated for each relevant exposure pathway, non-cancer and cancer risks were determined using equations and assumptions provided by Health Canada (2024).

Noncarcinogenic risks were evaluated by the calculation of a Hazard Quotient (HQ) which integrated the estimated daily intakes that were determined for toddlers with toxicological reference values for each COPC. Carcinogenic risks were assessed by the Incremental Lifetime Cancer Risks (ILCR) based on the lifetime average daily dose and applying the TRV (i.e., inhalation unit risk for inhalation exposure and oral slope factor for ingestion exposure.

HQ were calculated for Baseline, Operations (Project) and Post-closure Assessment Scenarios at each POR. ILCR were calculated for the Project Alone Assessment Scenario at each POR.

Systemic Toxicants and Calculation of the Hazard Quotient

$$Hazard\ Quotient = \frac{Estimated\ Daily\ Intake}{Toxicological\ Reference\ Value}$$

The calculation for HQ for toddlers from soil ingestion, dermal contact and inhalation of particulates is:

$$Hazard\ Quotient = \frac{2.90E-05 + 1.50E-06 + 4.55E-06\ mg/kg/day}{3.0 \times 10^{-4}\ mg/kg/day} = 1.17E-01$$

Carcinogens and Calculation of the Incremental Lifetime Cancer Risk

$$Incremental\ Lifetime\ Cancer\ Risk = Estimated\ Daily\ Intake \times Unit\ Risk$$

The calculation of ILCRs for adult from soil ingestion:

Incremental Lifetime Cancer Risk = (LADD for Ingestion + LADD for Dermal Contact) x Oral Slope Factor + LADD for Soil Particulate Inhalation x IUR

= (5.67E-10 + 1.48E-10) x 1.8 (mg/kg/day)$^{-1}$ + 1.95E-10 x 27 (mg/kg/day)$^{-1}$

= 6.55E-09

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Attachment C
Ecological Receptors Model

ECOLOGICAL RECEPTORS MODEL

Details concerning the inputs and outputs for the Ecological Health risk modelling effort for Springpole Gold Project are addressed below.

CALCULATION OF MEDIA CONCENTRATIONS

Quantifying the potential risks to ecological health requires estimating the concentration of each chemical of potential concern (COPC) in the relevant environmental media. Concentrations in soil, sediment and surface water are summarized below. Concentrations in food items are provided in Section 5.4.4.

The input concentrations for most media are discussed in other sections of the report as noted in the table below.

Media	Basis of EPC	Location of Information
Soil	95th UCLM of the baseline data plus deposition for project and post-closure	Soil data provided in Attachment A, Section 1. Calculation of deposition described in Attachment A, Section 2. Summary of concentrations provided below.
Sediment	95th UCLM of the baseline data plus deposition for project and post-closure	Sediment data provided in Attachment A, Section 1. Calculation of deposition described in Attachment A, Section 2. Summary of concentrations provided below.
Surface Water	Maximum of Modelled 75th percentile data (1). Project and post-closure scenario's include deposition.	Surface water modelling addressed in Appendix N-1 and N-2 in the EIS/EA. Calculation of deposition described in Attachment A, Section 2. Summary of concentrations provided below.
Terrestrial Plants	95th UCLM of the baseline data. Uptake from soil using baseline soil concentrations. Addition of incremental soil concentrations from deposition for project and post-closure.	Plant data provided in Attachment A, Section 1. Calculation of deposition described in Attachment A, Section 2. Uptake values provided in Attachment A, Section 1.6..
Aquatic Plants	95th UCLM of the baseline data. Uptake from surface water for project and post-closure.	Plant data provided in Attachment A, Section 1. Uptake values provided in Attachment A, Section 1.6.
Small Mammal	Ingestion of soil, water and food items and transfer of COPC into tissues.	Transfer into tissues using transfer factor provided in Attachment A, Section 1.6. Example calculation provided in Attachment A for a mammal.
Bird	Ingestion of soil, water and food items and transfer of COPC into tissues.	Transfer into tissues using transfer factor provided in Attachment A, Section 1.6.
Fish	95th UCLM of the baseline data. Uptake from surface water for project and post-closure.	Plant data provided in Attachment A, Section 1. Uptake values provided in Table Attachment A, Section 1.6.
Soil Invertebrates	Uptake from soil using baseline soil concentrations. Addition of incremental soil concentrations from deposition for project and post-closure.	Uptake values provided in Attachment A, Section 1.6.
Aquatic Invertebrates	Uptake from surface water.	Uptake values provided in Attachment A, Section 1.6.
Benthic Invertebrates	Uptake from sediment.	Uptake values provided in Attachment A, Section 1.6.

(1) Appendix O-1, O-2 and O-3 in the EIS/EA

Examples of uptake into terrestrial plants and fish are provided in Attachment A. Example calculations for the other media are provided below.

Concentration of Soil, Sediment and Surface Water Used in Ecological Model

The soil, sediment and surface water concentrations used in the ecological model are provided below. Methylmercury was not measured in sediment. The baseline sediment concentration was set at 10% of the mercury concentration (CCME, 1999). Methylmercury was not modelled within the surface water data. The concentration was set to 4.6% mercury based on the ratio of methylmercury to mercury identified in surface water samples.

Table C-1 Soil, Sediment and Surface Water Concentrations Used in Ecological Model

COPC	Soil Concentration			Sediment Concentration			Water Concentration		
	mg/kg			mg/kg			mg/L		
	Baseline	Project	Post-closure	Baseline	Project	Post-closure	Baseline	Project	Post-closure
Arsenic	1.20E+01	1.20E+01	1.20E+01	1.12E+01	1.12E+01	1.12E+01	1.20E-03	1.74E-03	2.44E-03
Cadmium	1.92E-01	1.92E-01	1.92E-01	6.04E-01	6.04E-01	6.04E-01	2.62E-05	2.53E-05	2.84E-05
Chromium	2.89E+01	2.89E+01	2.89E+01	3.35E+01	3.35E+01	3.35E+01	2.50E-04	2.24E-03	1.06E-03
Cobalt	9.40E+00	9.41E+00	9.41E+00	9.67E+00	9.67E+00	9.67E+00	8.00E-05	5.87E-04	3.13E-04
Copper	1.81E+01	1.81E+01	1.81E+01	3.40E+01	3.40E+01	3.40E+01	1.00E-03	1.88E-03	1.19E-03
Lead	8.72E+00	8.81E+00	8.81E+00	1.98E+01	1.98E+01	1.98E+01	3.00E-05	2.02E-03	1.48E-04
Manganese	7.41E+02	7.42E+02	7.42E+02	8.03E+02	8.03E+02	8.03E+02	9.42E-03	9.82E-03	9.82E-03
Mercury	7.22E-02	7.24E-02	7.24E-02	1.02E-01	1.02E-01	1.02E-01	5.00E-06	7.91E-06	8.44E-06
Nickel	1.83E+01	1.83E+01	1.83E+01	2.46E+01	2.46E+01	2.46E+01	7.62E-03	6.19E-03	4.18E-03
Zinc	5.25E+01	5.26E+01	5.26E+01	7.46E+01	7.46E+01	7.46E+01	2.00E-03	6.46E-03	2.60E-03
Mercury (methyl)	NV	NV	NV	1.02E-02	1.02E-02	1.02E-02	2.30E-07	3.64E-07	3.88E-07
Molybdenum	3.22E+00	3.22E+00	3.22E+00	1.24E+00	1.28E+00	1.28E+00	2.50E-04	1.73E-02	8.89E-04

Calculation of COPC in Terrestrial Invertebrates Tissue

Terrestrial invertebrates are exposed to COPCs through direct contact in the soil. Below is a worked example for arsenic. The equation is taken from US EPA Eco-SSl Arsenic (2005).

$$C_{\text{inv}} = e^{(0.706*(ln\,Cs))-1.4121}$$

Where:

Cinv = Concentration of COPC in invertebrate tissue (mg/kg)
Cs = Soil concentration (12.0 mg/kg; for arsenic)

$$C_{\text{inv}} = e^{(0.706*(ln\,7.7mg/kg))-1.4121}$$
$$C_{\text{inv}} = 1.55mg/kg$$

Calculation of COPC in Aquatic Invertebrates Tissue

Aquatic invertebrates are exposed to COPCs through direct contact in the surface water. Below is a worked example for arsenic at the Project Assessment Scenario. The equation is taken from US EPA 1999.

$$C_{\text{aqu-inv}} = BCF\ x\ Csw$$
$$C_{\text{aqu-inv}} = 73\ x\ 1.74E-03$$
$$C_{\text{aqu-inv}} = 1.27E-01$$

Where:

$C_{\text{aqu-inv}}$ = Concentration of COPC in aquatic invertebrate tissue (mg/kg)
Csw = Surface water concentration (1.74E-03 mg/kg; for arsenic)

Calculation of COPC in Benthic Invertebrates Tissue

Sediment invertebrates are exposed to COPCs through direct contact in the surface water. Below is a worked example for arsenic at the Project Assessment Scenario.. The equation is taken from US EPA 1999.

$$C_{\text{ben-inv}} = BCF\ x\ Csed$$
$$C_{\text{ben-inv}} = 0.9\ x\ 1.12 + 01$$
$$C_{\text{ben-inv}} = 1.01E + 01$$

Where:

$C_{\text{aqu-inv}}$ = Concentration of COPC in benthic invertebrate tissue (mg/kg)
Csw = Sediment concentration (11.2 mg/kg; for arsenic)

Calculation of Average Daily Doses for Wild Game

After estimating the COPC concentration in the above ground tissue of forage plants, it was assumed that wild game will consume the plants and the COPCs will be assimilated and accumulate in the tissues of the animal. Similarly, the consumption of surface water by wild game would also introduce another source of exposures to the COPCs as deposited chemicals may run off into surface waterbodies. The ADD for the wild game would then be predicted by the following equation:

$$ADD_{game} = \left(\left(\sum(F_i \cdot Qp_i \cdot P_i) \div B_{w_2}\right) + \left((Qs \cdot Cs) \div B_w\right) + \left((Q_W \cdot C_W) \div B_W\right)\right) \cdot MF \cdot AUF$$

Where:

Parameter	Definition	Units	Value	Reference
ADD_{game}	Average Daily Dose of COPC for Hare	mg/kg/day	6.36E-02	Calculated for arsenic at MPOI for Project
F_i	Fraction of food item foraged on impacted area and ingested by the animal (recommended default)	unitless	1	US EPA 2005
Qp_1	Quantity of plant type 1 ingested by the animal per day(1)	kg/d	3.92E-02	FCSAP 2012 (Based on 90% food ingestion)
P_1	Concentration of COPC in plant type 1 ingested by the animal (wet weight)	mg/kg	5.71E-02	Calculated for arsenic

Parameter	Definition	Units	Value	Reference
Qp_2	Quantity of plant type 2 ingested by the animal per day(1)	kg/d	2.49E-02	FCSAP 2012 (Based on 10% food ingestion)
P_2	Concentration of COPC in plant type 2 ingested by the animal (wet weight)	mg/kg	1.06	Calculated for arsenic
Qs	Quantity of soil ingested by the animal	kg/d	4.91E-03	FCSAP 2012
Cs	Concentration of COPC in soil	mg/kg	12	Measured for arsenic
Qw	Quantity of water ingested by the animal	L/d	0.13	FCSAP 2012
Cw	Average water concentration over exposure duration	mg/L	1.74E-03	Measured for arsenic
Bw	Body Weight	kg	1.3	FCSAP 2012
MF	Metabolism factor (recommended default)	unitless	1	US EPA 2005
AUF	Area Use Factor	unitless	1	Assumption

Food ingestion rate for the Hare is 0.06 kg dry weight/kg BW/day. Adjusting by body weight provides a food ingestion rate of 0.078 kg dry weight/day. The ingestion rate is adjusted by the default water content of 85% (US EPA 2007) to provide an ingestion rate of 0.52 kg wet weight/day.

A similar equation was used to predict the ADD for all ecological receptors based on their specific diet.

When calculating the concentration with a small mammal or bird, the same equation is used as presented above. An additional step is taken where the concentration of the COPC within the tissue of the game (mg/kg) then calculated using a biotransfer factor.

$$C_{prey} = Biotransfer\ factor\ x\ ADDprey \text{ x BW}$$
$$C_{prey} = 7.8E-04\ x\ 5.96E-02\ x\ 1.3$$
$$C_{prey} = 1.24E-03$$

$$C_{\text{ben-inv}} = 1.01E+01$$

where:

C_{prey}	=	Concentration of COPC in mammal or bird tissue (mg/kg)
Biotransfer factor	=	Ba_{beef} used for mammals and Ba_{poult} used for birds (day/kg)
ADDprey	=	Average daily dose in prey (mg/kg/day)
BW	=	Body weight (kg)

ECOLOGICAL RISK CHARACTERIZATION

After the average daily doses for each COPC were estimated for each relevant exposure pathway, risks were evaluated by calculating exposure ratios (ER). Risks were evaluated by the calculation of an ER using the average daily doses (ADD) that were determined for ecological receptors, along with toxicological reference values (TRV) for each COPC.

$$ER = \frac{ADD}{TRV}$$

ERs provide a quantitative estimate of overall risk. The ER is a unitless value, defined as the ratio of the magnitude of exposure to magnitude of a standard effect.

Therefore, the calculation for Exposure Ratio for the Hare from ingestion was:

$$Exposure\ Ratio \quad = \quad \frac{0.0662 mg/kg/day}{1.04\ mg/kg/day} \quad = \quad 0.0636$$

ERs for all of the remaining ecological receptors were calculated using the equation shown above.

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Attachment D-1A
Human Health Toxicological Profiles

HUMAN HEALTH TOXICOLOGICAL PROFILES

Arsenic

Chemical Properties

Parameter		Units	Value	Source
Molecular Weight	MW	g/mol	77.95	US EPA 2005
L_{og} Octanol Water Partition Co-efficient	L_{og} K_{ow}	unitless	0.68	US EPA 2005
Diffusivity in Air	Da	cm^2/sec	0.0772	US EPA 2005
Diffusivity in Water	Dw	unitless	$9.57x10^{-6}$	US EPA 2005
Soil Water Partition Coefficient	K_{ds}	cm^3/g	29	US EPA 2005
Relative Absorption Factor – Ingestion of Soil and Sediment	RAF_{ing}	unitless	0.5	MECP, 2011
Relative Absorption Factor – Ingestion of Plants	RAF_{ing}	unitless	0.5	Koch et al., 2013
Relative Absorption Factor – Ingestion of Water	RAF_{ing}	unitless	1	HC 2024
Relative Absorption Factor - Dermal	RAF_{derm}	unitless	0.03	HC 2024
Relative Absorption Factor - Inhalation	RAF_{inh}	unitless	1	HC 2024
Percent Inorganic Arsenic – Game Meat		%	5.03	Schoof et al., 1999
Percent Inorganic Arsenic – Fish		%	10	Section 1.4.3.2 of Attachment A
Percent Inorganic Arsenic – Plants		%	100	Assumed

Arsenic is classified as a metalloid; having both metal and non-metal properties (Agency for Toxic Substances and Disease Registry; ATSDR 2007). Toxicity is dependent on its valence state, physical and chemical properties. Arsenic may appear in its trivalent ($^{+}3$ or $^{-}3$) or pentavalent ($^{+}5$) form and may be bound with a myriad of compounds. Therefore, arsenic exposures may result in many different potential effects and toxicological endpoints.

Source

Arsenic is a naturally occurring element that is widely distributed in the earth's crust (ATSDR 2007). It may be released to the environment through anthropogenic activities such as mining and smelting of lead and copper ores, coal-fired power plants, and incinerators. It is also used as a major constituent of some wood preservatives. Soils and dusts may also be a source of arsenic exposure. It is found naturally in plants, animals, erosion of rock, forest fires, water and soil.

Exposure

Acute

Sensory loss of the peripheral nervous system is one of the most common effects of acute exposure to arsenic. Inorganic arsine gas (AsH_3), one of the most toxic inorganic arsenic compounds, causes acute effects like nausea, vomiting, shortness of breath, and hemolytic reactions. It should be noted that laboratory animals are generally less sensitive than humans to the toxic effects of inorganic arsenic. In addition, the critical effects appear to be immunosuppression and hepato-renal dysfunction in rodents whereas in humans, the skin, vascular system, and peripheral nervous system are the primary target organs (Amdur et al. 1991). Ingestion of large doses (i.e., 70 to 180 milligrams; mg) of inorganic arsenic can be fatal. Symptoms of acute oral intoxication include fever, anorexia, hepatomegaly, melanosis, and cardiac arrhythmia. The acute lethal dose has been estimated to be about 0.6 milligrams per kilogram per day (mg/kg-d; ATSDR 1989).

Chronic Exposure

With inorganic arsenic in drinking water, liver injury, which manifests as jaundice and may progress to cirrhosis and liver cancer, is more characteristic of chronic exposure. In adults, the principal health effects from chronic exposure to arsenic include skin effects and disease such as hyperpigmentation and keratosis; vascular disease; respiratory effects and bladder, lung and liver cancer. There are many documented cases of skin cancer related to the consumption of arsenic in drinking water (Amdur et al. 1991). In children, health effects due to oral chronic exposure to arsenic include skin lesions, neurodevelopmental effects, lung disease, and reproductive effects including decreased birth weight, spontaneous abortion and neonatal death (Cal EPA 2008).

Lung absorption is dependent on particle size and water solubility. Small particles in the range of 0.1 to 1 micrometres (µm) are deposited deeper into the lung than larger particles, thereby increasing their potential for absorption. For larger particles (usually 5 µm or more), 80% of the inhaled arsenic will be absorbed even if they are not directly absorbed through the lungs with the mucocillary mechanism (Lagerkvist et al. 1986).

Carcinogenicity

There is a causal association between inhalation exposure to arsenic and skin and lung cancer. Additional studies indicate that arsenic causes cancer of internal organs from oral ingestion (Casarett and Doull 2003). Arsenic is classified as a Group 1 carcinogen (Carcinogenic to Humans) by the International Agency on Cancer Research (IARC 2012). EPA also has classified inorganic arsenic as a known human carcinogen. Health Canada provides TRVs for carcinogenic effects associated with arsenic exposure; however, arsenic is assessed for both cancer and non-cancer endpoints here.

Toxicological Reference Values

Health Canada has not selected a non-cancer TRV for arsenic, however it is of the understanding of the risk assessment community that the interpretation of the toxicological endpoint of arsenic is currently under review. The non-cancer oral TRV of 3×10^{-4} mg/mg/day for arsenic was selected by the MECP (2017) and is based on the US EPA Integrated Risk Information System (1991) and ATSDR (2007). This is derived from a LOAEL of 0.009 mg/L (converted to 0.008 mg/kg/day) and a LOAEL of 0.17 mg/L (converted to 0.014 mg/kg/day) from two studies of human chronic oral exposure by Tseng (1977), and Tseng et al. (1968). The critical effect in the studies was hyperpigmentation, keratosis and possible vascular complications. An uncertainty factor of 3 was applied to account for both the lack of data to preclude reproductive toxicity as a critical effect and to account for some uncertainty in whether the NOAEL of the critical study accounts for all sensitive individuals.

The MECP no longer recommends the California EPA inhalation TRV in their MECP TRV list due to low confidence. The MECP indicates a route-to-route extrapolation can be completed using an oral TRV. Using the oral TRV of $3x10^{-4}$ mg/kg/day an inhalation TRV of $1.05x10^{-3}$ mg/m^3 is calculated based on a body weight of 70 kg and an inhalation rate of 20 m^3/day, as is standard practice.

The arsenic TRVs for carcinogenic effects provided by Health Canada (2021) is an oral slope factor of 1.80 (mg/kg/day)$^{-1}$. The oral slope factor is based on a human study by Morales et al. (2000) and a critical endpoint of bladder, liver and lung cancer.

The carcinogenic unit risk of 6.4 (mg/m^3)$^{-1}$ was selected from Health Canada (HC 2021) based on an epidemiological study involving an occupationally exposed cohort where a high incidence of lung cancer was observed (Higgins et al. 1986).

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Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)

Chemical Properties

Parameter		Units	Value[(1)]	Source
Relative Absorption Factor - Inhalation	RAF_{inh}	unitless	1	HC 2024

Note:
[(1)] Values are provided for Benzo(a)pyrene.

Source

Polycyclic Aromatic Hydrocarbons (PAHs) are a class of hundreds of different chemicals that commonly occur as mixtures in the environment. They typically result from combustion, especially of diesel fuel, coke, and natural gas sources. They are composed of multiple aromatic carbon rings.

Because they often occur in the environment as mixtures, there is limited toxicological data on PAH mixtures. Therefore, individual PAHs were typically evaluated as separate chemicals in the past for risk characterization without consideration of their potential for interactive effects.

Exposure

Carcinogenicity

Several epidemiologic studies have shown increased mortality due to lung cancer in humans exposed to coke oven emissions, roofing-tar emissions, and cigarette smoke. Each of these chemical mixtures contains PAHs such as benzo[a]pyrene, chrysene, benz[a]anthracene, benzo[b]fluoranthene, and dibenz[a,h]anthracene as well as other potentially carcinogenic PAHs and other carcinogenic and potentially carcinogenic chemicals, tumor promoters, initiators, and co-carcinogens such as nitrosamines, coal tar pitch, and creosote (ATSDR 1995). Multiple studies have shown that exposure to individual or a mixture of carcinogenic PAHs may induce tumors in laboratory animals by oral, inhalation and dermal pathways.

Carcinogenic PAHs has been evaluated by taking into account potency equivalency factors. This method first estimates the carcinogenic potency of benzo(a)pyrene (B(a)P) and then evaluates the remaining carcinogenic PAHs relative to the carcinogenic potency of B(a)P i.e., 'B[a]P total potency equivalents (TPE)'. The risks associated with the PAH mixture is then determined by multiplying the total number of B(a)P equivalents with the potency for B(a)P. The result is equivalent to summing up carcinogenic risks attributable to each individual PAH in the mixture.

The Canadian Council of Ministers of the Environment (CCME 2010) has referred to the toxic equivalency factors for PAHs as B(a)P Potency Equivalence Factors:

CCME Potency Equivalence Factors for Carcinogenic Polycyclic Aromatic Hydrocarbons

Carcinogenic PAH Compound	Potency Equivalence Factor
Benzo(b+j)fluoranthene	0.1
Benzo[ghi]perylene	0.01
Chrysene	0.01
Indeno[1,2,3-c,d]pyrene	0.1
Benz[a]anthracene	0.1
Benzo[k]fluoranthene	0.1
Benzo[a]pyrene	1
Dibenz[a,h]anthracene	1

Toxicological Reference Values

The Whole Mixture Model assumes that the carcinogenic potency of the PAH mixture is directly proportional to the concentration of B(a)P in the mixture. The risk is determined by multiplying the concentration of B(a)P of the mixture and the carcinogenic potency of the B(a)P surrogate. In other words, B(a)P acts as a surrogate for all other PAHs present in the mixture and assumes the potency of the entire PAH fraction. International Agency for Research on Cancer (IARC 2012) classifies PAHs as a group 1 carcinogen (carcinogenic to humans).

The California Office of Environmental Health Hazard Assessment (OEHHA 2009) provides an inhalation unit risk of 1.1 $(mg/m^3)^{-1}$. Health Canada (HC 2021) has a value of 0.6 $(mg/m^3)^{-1}$ based on tumors of the upper gastrointestinal tract.

References

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Diesel Particulate Matter

Chemical Properties

Parameter		Units	Value[(1)]	Source
Relative Absorption Factor - Inhalation	RAF_{inh}	unitless	1	HC 2024

Note:
[(1)] Values for Benzo(a)pyrene were adopted and used for Diesel Exhaust Particulate.

Source

Diesel particulate matter is emitted from diesel vehicles mainly via combustion (i.e., exhaust), of diesel fuel (HC 2016). Diesel exhaust contain many gaseous and particulate compounds, including carbon monoxide, nitrogen oxide (NO_X), $PM_{2.5}$, ultrafine particulates (UFP), polycyclic aromatic hydrocarbons (PAHs) and many semi-volatile and volatile organic compounds (HC 2016).

Exposure

Carcinogenicity

Several epidemiologic studies have shown that exposure to diesel exhaust particulates plays a role in the development of lung cancer. Consistent elevated lung cancer risks in association with occupational exposure to diesel exhaust have been reported by many research groups, for many occupations, using multiple study designs and exposure metrics (HC 2016).

Toxicological Reference Values

Health Canada has selected a chronic non-cancer inhalation TRV of 5 x 10^{-3} mg/m^3 for diesel particulate matter. The NOAEL of 0.46 mg/m^3 from the study by Ishinishi et al. (1986, 1988) was selected as the point of departure for the development of a chronic inhalation TRV. In this multi-dose study, rats were chronically exposed to diesel particulate matter with dose-dependent effects observed in the respiratory tract including inflammation, histopathological changes and/or functional changes. A human equivalent concentration of 0.12 mg/m^3, based on this point of departure (i.e., NOAEL) from Ishinishi et al. (1986, 1988), was calculated by Health Canada to develop a chronic TRV. A total uncertainty factor of 25 was applied to the health equivalent concentration to derive a chronic inhalation TRV of 5 x 10^{-3} mg/m^3 for diesel particulate matter.

OEHHA derived an inhalation unit risk of 0.3 (mg/m3)-1 from human epidemiological studies of occupationally exposed populations to diesel particulate matter. The estimated range of lung cancer risk (upper 95% confidence interval) based on human epidemiological data is 1.3E-10^{-4} to 2.4E-10^{-3} (µg/$m^{3)-1}$ (ARB 1998, 2016).

References

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Cobalt

Chemical Properties

Parameter		Units	Value	Source
Molecular Weight	MW	g/mol	59	US EPA 2005a
L_{og} Octanol Water Partition Co-efficient	L_{og} K_{ow}	unitless	0.23	US EPA 2005a
Diffusivity in Air	Da	cm^2/sec	0.0772	US EPA 2005a
Diffusivity in Water	Dw	unitless	$9.57x10^{-6}$	US EPA 2005a
Soil Water Partition Coefficient	K_{ds}	cm^3/g	126	US EPA 2005b
Relative Absorption Factor - Ingestion	RAF_{ing}	unitless	1	HC 2024
Relative Absorption Factor - Dermal	RAF_{derm}	unitless	0.001	MECP 2011
Relative Absorption Factor - Inhalation	RAF_{inh}	unitless	1	HC 2024

Source

Cobalt is a naturally-occurring element. Small amounts of cobalt are naturally found in most rocks, soil, water, plants, and animals, typically in small amounts. Cobalt is also found in meteorites. Elemental cobalt is a hard, silvery grey metal. However, cobalt is usually found in the environment combined with other elements such as oxygen, sulphur, and arsenic. Small amounts of these chemical compounds can be found in rocks, soil, plants, and animals. A biochemically important cobalt compound is vitamin B12 or cyanocobalamin. Vitamin B12 is essential for good health in animals and humans.

Cobalt is usually mixed with other metals to form alloys, which are harder or more resistant to wear and corrosion. These alloys are used for artificial hip and knee joints. Cobalt compounds are used as colorants in glass, ceramics, and paints, as catalysts, and as paint driers. Cobalt colorants have a characteristic blue color; however, not all cobalt compounds are blue. Cobalt compounds are also used as trace element additives in agriculture and medicine (ATSDR 2004).

Exposure

Acute

Short-term occupational exposure to cobalt dust or fumes can cause eye and respiratory tract irritation, headaches, vertigo, drowsiness, and a condition known as "metal fume fever." This 24- to 48-hour illness was characterized by an influenza-like symptoms with chills, fever, aching muscles, and dryness in the mouth and throat (ATSDR 2004).

Chronic Exposure

There are few toxicological problem related to cobalt oral-intake. Cardiomyopathy has been observed on heavy beer drinker, probably because of the addition of 1 part per million (ppm) of cobalt used to enhance its foaming qualities (Amdur et al. 1991). On the other hand, inhalation-related effects are well-known, especially among people who work with hard metal, which is an alloy of tungsten carbide and cobalt. These effects include respiratory irritation, diminished pulmonary function, wheezing, asthma, pneumonia, and fibrosis and occurred at exposure levels ranging from 0.007 to 0.893 mg cobalt/m^3 (ATSDR 2004).

No reproductive or ocular effects are known to be associated with cobalt exposure. In a few studies on occupational exposure, some neurological effects, like memory loss and nerve deafness, were observed on workers.

Carcinogenicity

There is no evidence to date that indicate cobalt can cause cancer in humans. The US EPA does not classify cobalt as a human carcinogen (Group D) because there were no adequate human or animal cancer studies that demonstrate a causal relationship (Baars et al. 2001).

Toxicological Reference Values

Health Canada does not provide a human health oral and inhalation TRV for cobalt.

The ATSDR adopted a minimal risk levels (MRL) of 1×10^{-2} mg/kg-d for intermediate duration oral exposure, based on a LOAEL of 1 mg/kg-d for polycythemia in human volunteers (Davis and Fields 1958). The MECP adopted the oral ATSDR TRVs with an additional order of magnitude of uncertainty applied. The TRV of 1×10^{-3} mg/kg-d used for the HHRA of cobalt was provided by the MECP.

RVIM derived a tolerable concentration in air (TCA) of 5×10^{-4} mg/m^3 for chronic inhalation exposure based on a LOAEL of 0.05 mg/m^3 for interstitial lung disease in humans. The MECP adopted this inhalation TRV of 5×10^{-4} mg/m^3 and this inhalation TRV was used for the HHRA of cobalt.

References

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Mercury

Chemical Properties

Parameter		Units	Value	Source
Molecular Weight	MW	g/mol	200.59	US EPA 2005
L_{og} Octanol Water Partition Co-efficient	L_{og} K_{ow}	unitless	0.62	US EPA 2005
Diffusivity in Air	Da	cm^2/sec	0.0109	US EPA 2005
Diffusivity in Water	Dw	unitless	$3.01x10^{-5}$	US EPA 2005
Soil Water Partition Coefficient	K_{ds}	cm^3/g	1000	US EPA 2005
Relative Absorption Factor - Ingestion	RAF_{ing}	unitless	1 (Water, Food) 0.5 (Soil, Sediment)	MECP 2011
Relative Absorption Factor - Dermal	RAF_{derm}	unitless	0.1	MECP 2011
Relative Absorption Factor - Inhalation	RAF_{inh}	unitless	1	HC 2024

Source

Mercury occurs naturally in the environment and exists in several forms. These forms can be organized under three headings: metallic mercury (also known as elemental mercury), inorganic mercury, and organic mercury. The general population can be exposed to all forms of mercury; however, the general population is primarily exposed to organic mercury via dietary exposure in the form of methylmercury and elemental mercury (ATSDR 2022).

Exposure

Acute

Short-term exposure (hours) to high levels of metallic mercury vapor in the air can cause chills, fevers, dyspnea, headaches, gastrointestinal disturbances, disturbances of hearing and vision and pulmonary edema (ATSDR 2022).

Chronic Exposure

Animal studies indicate that long-term oral exposure to inorganic mercury salts causes kidney damage, effects on blood pressure and heart rate, and effects on the stomach. Study results also suggest that reactions involving the immune system may occur in sensitive populations after swallowing inorganic mercury salts (ATSDR 2022).

Carcinogenicity

In the current assessment, mercury was not assessed as a carcinogen as Health Canada and the MECP have not classified it as such. The International Agency for Research on Cancer (IARC 1993) have not classified mercury as to its carcinogenicity to humans. This is based on inadequate evidence in humans for the carcinogenicity of mercury and mercury compounds; inadequate evidence in experimental animals for the carcinogenicity of metallic mercury; and limited evidence in experimental animals for the carcinogenicity of mercuric chloride (IARC 1993).

Toxicological Reference Values

An oral reference dose of 3×10^{-4} mg/kg/day was selected as the oral TRV to assess mercury in the current assessment. This value was selected by Health Canada (2021) and is based on three studies: Druet et al. (1978), Bernaudin et al. (1981) and Andres (1984) where the critical effect is nephrotoxicity. In the Druet study, rats were exposed via sub-cutaneous injection for a period ranging between 1 to 8 weeks with the following doses: 0, 5, 10, 25, 50, 100 and 200 µg/100 g-body weight and 1, 2 or 3 injections per week (various groups). The studies by Bernaudin and Andres exposed rats via gavage for a period of 2 months to 2.22 mg mercury/kg/body weight/week. Lowest observed adverse effects levels ranged between 0.226 mg/kg/day and 0.633 mg/kg/day. The oral RfD was derived using an uncertainty factor of 1000 (10x use of subchronic studies, 10x interspecies variability; 10x use of a LOAEL) to the LOAEL of 0.3 mg/kg/day.

An inhalation reference concentration of 9×10^{-5} mg/m^3 was selected as the inhalation TRV to assess mercury in the current assessment. This TRV was selected by the MECP (2024) and was derived by the California Office of Environmental Health Hazard Assessment (OEHHA) in 2000.

References

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Methylmercury

Chemical Properties

Parameter		Units	Value	Source
Molecular Weight	MW	g/mol	216	US EPA 2005
L_{og} Octanol Water Partition Co-efficient	L_{og} K_{ow}	unitless	0.08	US EPA 2005
Diffusivity in Air	Da	cm^2/sec	0.0528	US EPA 2005
Diffusivity in Water	Dw	unitless	$6.11x10^{-6}$	US EPA 2005
Soil Water Partition Coefficient	K_{ds}	cm^3/g	7000	US EPA 2005
Relative Absorption Factor - Ingestion	RAF_{ing}	unitless	1	HC 2024
Relative Absorption Factor - Dermal	RAF_{derm}	unitless	0.06	HC 2021
Relative Absorption Factor - Inhalation	RAF_{inh}	unitless	1	HC 2024

Source

Mercury is a naturally occurring metal found throughout the environment. Mercury releases from natural sources have remained relatively constant in recent history, resulting in a steady rise in environmental mercury. Human activities since the start of the industrial age (e.g., burning of fossil fuels) have resulted in additional release of mercury to the environment. Inorganic mercury may enter water or soil from the weathering of rocks that contain mercury or from industrial releases. Microorganisms (bacteria, phytoplankton in the ocean, and fungi) convert inorganic mercury to methylmercury. Methylmercury released from microorganisms can enter the water or soil and has a strong affinity for sorption to organic matter. Given the strong affinity to partition to organic matter, methylmercury accumulates within the fatty tissues of organisms and thereby also the food chain. Ingestion of fish therefore represents a dominant pathway of exposure for mercury in the form of methylmercury.

Exposure

Acute

There is very little information on acute exposure to methylmercury, but it is assumed that any exposure will contribute to overall body burden and accumulate over time (RAIS 1992).

Chronic Exposure

Methylmercury is highly poisonous and the toxicity varies according to its form, inflow path, exposure amount, and individual susceptibility. The neurotoxicity of methylmercury is well known through worldwide intoxication incidents (i.e., Minamata) and studies regarding low concentration exposure. Exposure to methylmercury during pregnancy may increase the risk of stillbirth and birth defects or severe nervous system diseases, even when the mother does not show any symptoms of poisoning.

Carcinogenicity

The International Agency for Research on Cancer (IARC 1993) have not classified methylmercury as to its human carcinogenicity.

Toxicological Reference Values

Health Canada (2021) provides two TRVs for methylmercury; one for the general population and one for women of child-bearing age / children less than 12 years old. The more conservative TRV of 2×10^{-4} mg/kg/day for women of child-bearing age and children less than 12 years old, was selected for all receptors in the HHRA. The Health Canada TRV was derived from an epidemiological perspective of neurodevelopmental effects where a threshold of 10 ppm in maternal hair (equivalent to 0.001 mg/kg/day) was derived and an uncertainty factor of 5 applied.

References

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Attachment D-1B
Human Health Toxicological Profiles – Criteria Air Parameters

HUMAN HEALTH TOXICOLOGICAL PROFILES – Criteria Air Parameters

Carbon Monoxide (CO)

Carbon monoxide (CO) is a colorless, odorless and toxic gas commonly found and responsible for numerous fatalities annually.

Source

Carbon monoxide may be produced from incomplete combustion of liquid, solid and gaseous fuels. It can also be produced from furnaces, wood stoves, heaters, gas stoves and fireplaces. Motor vehicle emission is one of the largest emitters of CO (NH DES 2007).

Exposure

Acute

Exposure to CO impedes the ability for blood to carry oxygen to the body organs and tissue. Hemoglobin binds to CO when inhaled to produce carboxylhemoglobin which decreases hemoglobin's oxygen carrying capacity. These effects manifest as headaches, nausea, rapid breathing, weakness, exhaustion and dizziness. Acute exposure to high concentrations of CO causes carbon monoxide poisoning, which can result in irreversible brain and heart damage from cellular hypoxia (CDC 2013).

Chronic Exposure

A study performed on rats exposed chronically to 200 ppm CO for 20 hours per day for 72 weeks did not demonstrate histopathological changes in the lung tissue. The weight of the left and right heart ventricles increased by 20% and 14%, respectively (ATSDR 2012).

Effects during chronic CO exposure can be exasperated when the individual has a preexisting lung or pulmonary condition. Studies have also been done to show the correlation between long-term CO exposure and increased susceptibility to those with previous conditions (ATSDR 2012).

Carcinogenicity

CO has not been assessed for carcinogenicity (ATSDR 2012).

Toxicological Reference Values

The Ontario Ministry of the Environment, Conservation and Parks (MECP 2020) established a 1 hour and 8 hour acute inhalation exposure of 36.2 mg/m^3 and 15.7 mg/m^3 respectively, based on the oxygen carrying capacity of blood.

References

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NH DES 2007. Carbon Monoxide: Health Information Summary. New Hampshire Department of Environmental Services (NH DES). Concord, NH, 2007. Available at http://des.nh.gov/organization/commissioner/pip/factsheets/ard/documents/ard-ehp-20.pdf.

Nitrogen Dioxide (NO_2)

Source

Nitrogen dioxide (NO_2) is a group of gasses known as nitrogen oxides (NO_x). Other nitrogen oxides include nitrous acid and nitric acid. Typically, NO_2 is used as the indicator for the larger group of nitrogen oxides. Sources of NO_2 include emissions from cars, trucks and buses, power plants, and off-road equipment.

Exposure

Acute

Multiple short-term experimental human studies have reported acute health effects following 1-hour exposure to NO_2 concentrations in excess of 0.5 mg/m^3. However, the lowest level of NO_2 exposure indicating direct effects on pulmonary functions in asthmatic human receptors is reported as 0.56 mg/m^3. Studies of bronchial responsiveness on asthmatic subjects have suggested that an increase in responsiveness appears at levels starting from 0.2 mg/m^3 (WHO 2005).

Chronic Exposure

NO_2 is associated with a number of adverse effects on the respiratory system (US EPA 1990). NO_2 exposures may result in adverse respiratory effects including airway inflammation and increased respiratory symptoms in people with asthma.

Toxicological Reference Values

The MECP (2020) derived an acute exposure value of 0.4 mg/m^3 from a study on the respiratory effects of acute nitrogen dioxide exposure (1-hour) and 0.2 mg/m^3 for 24-hour exposure.

The World Health Organization (WHO 2021) has derived a chronic inhalation value of 0.01 mg/m^3 based on non-accidental mortality and cause-specific, respiratory mortality. The Canadian Council of Ministers of the Environment (CCME) developed a 2025 Canadian Ambient Air Quality Standard (CAAQS) of 12 ppb or 23 µg/m^3. This 2025 CAAQS developed by CCME was used in the human health risk assessment.

References

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United States Environmental Protection Agency (US EPA). 1990. National Ambient Air Quality Standards (NAAQS). Available at http://www.epa.gov/air/criteria.html.

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Total Suspended Particulates and Particulate Matter

Source

Total suspended particulates are atmospheric particulate matter that represents a complex mixture of organic and inorganic substances with a range of diameter from <0.1 micrometers (µm) to 100 µm (EEA, 1993).

PM_{10} and $PM_{2.5}$ are atmospheric particulate matter that is 10 µm and 2.5 µm or less, respectively, in diameter. It can consist of a variety of things consisting of extremely small particles and liquid droplets (US EPA 2024); dust and smoke.

The US EPA defined fine particles as those found in smoke and haze that are 2.5 µm in diameter and smaller. The particulates can be emitted from the source directly or from interactions between emissions and air.

Exposure

Acute

The smaller particulates can travel deep into the lungs, whereas the larger particulate is generally trapped within the nose, ears and throat.

Chronic Exposure

Outdoor particulate matter has been shown in numerous studies to have an effect on cardiovascular and respiratory mortality and morbidity endpoints.

Exposure to particulate matter is linked to numerous health impacts including airway inflammation, increased emergency room visits, hospitalization and death. A threshold is difficult to determine due to the range and mixture of particulates that make up $PM_{2.5}$.

Toxicological Reference Values

Total Suspended Particulates

MECP (2020) derived an acute (24-hour) exposure value of 0.12 mg/m^3. This acute exposure value has been used in the assessment. The chronic (annual) value of 0.06 mg/m^3 has been used in the assessment.

PM_{10}

MECP (2020) derived an acute (24-hour) exposure value of 0.05 mg/m^3. This acute exposure value has been used in the assessment.

$PM_{2.5}$

MECP (2020) derived an acute (24-hour) exposure value of 0.027 mg/m^3 adopted from the Canada Wide Standard. The chronic (annual) value of 0.0088 mg/m^3 has been used in the assessment.

WHO (2021) has derived a chronic inhalation value of 0.005 mg/m^3 based on cause-specific mortality, cardiovascular disease, respiratory disease and lung cancer (WHO, 2021).

References

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US EPA. 2024. Particulate Matter (PM) Available online: https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM

MECP 2020. Ministry of the Environment, Conservation and Parks. Ambient Air Quality Criteria. Human Toxicology and Air Standards Section Technical Assessment and Standards Development Branch. May 2020.

WHO 2021. World Health Organization (WHO) Global Air Quality Guidelines. Particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.

Sulphur Dioxide (SO_2)

Source

Sulphur dioxide (SO_2) is a colorless gas with a distinct pungent odor. SO_2 will become liquid at high pressure and dissolves very easily in water (ATSDR 1998). Sulphur compounds enter the atmosphere mainly through anthropogenic activities. Approximately 100 million metric tons of sulphur enter the atmosphere each year, most of it from human activity from combustion of coal and residual fuel oil (Manahan 2005). SO_2 is emitted from burning fossil fuels or from copper mining. SO_2 is produced for elemental sulphur, pyrites, sulphide ore, waste sulphuric acid and sulphates. SO_2 is also emitted from volcanic eruptions, although it is associated with human activity (ATSDR 1998).

Exposure

Acute

Acute duration exposures to high concentrations of SO_2can result in biochemical, clinical, and histological changes in the respiratory system. Respiratory changes occur when an individual is exposed to acute levels of SO_2. Studies completed measuring pulmonary lung function and airway resistance determined that anything from a cough, lung irritation, increased fluid in the lungs to death were linked to high levels of SO_2. Asthmatics are particularly susceptible to SO_2 in the air (ATSDR 1998)

Mortality in humans due to high pollution and acute smog in large cities has been documented. There have been many cases of human death from acute exposures to high concentrations of SO_2 (ATSDR 1998).

Chronic Exposure

Animal studies concluded that chronic exposure to SO_2 can result in exasperated respiratory effects. Asthmatics experience increased effects when exposed to SO_2 in the air (ATSDR 1998). Hepatic effects of chronic exposure are limited and therefore additional studies are required. Occupational studies find that SO_2induces oxidative stress in erythrocytes.

Carcinogenicity

ATSDR (1998) reports that no evidence for carcinogenicity has been established for SO_2. Epidemiological studies have been completed on copper smelter workers and pulp and paper mill workers exposed to SO_2. No correlation has been made between prolonged exposure to SO_2 and cancer (ATSDR 1998).

Toxicological Reference Values

MECP (2020) has developed a short exposure time (i.e., 10 minutes) inhalation value of 0.1782 mg/m^3, based on studies involving exercising asthmatics indicating changes in pulmonary function and respiratory symptoms after short periods of exposure to SO_2.

MECP (2020) derived an acute (1-hour) exposure value of 0.1064 mg/m^3 from a study in 1975 on the effects of pulmonary function in acute SO_2 exposure.

MECP (2020) has derived a chronic inhalation value of 0.0106 mg/m^3 which was adopted from the Canadian Air Quality Criteria value for an annual average.

References

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Attachment D-2
Ecological Health Toxicological Profiles

ECOLOGICAL HEALTH TOXICOLOGICAL PROFILES

Arsenic

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2005a) Ecological Soil Screening Level (Eco-SSL). This was based on a comparison of the geometric mean of the NOAEL values for growth and reproduction from a number of studies with the LOAEL for reproduction, growth, or survival. The geometric mean of NOAEL values was 2.47 mg arsenic/kg-d. However, this value is higher than the lowest bounded LOAEL (lowest observable adverse effect level). Therefore, the TRV was established at 1.04 mg/kg-d, representing the highest NOAEL that was still lower than the lowest LOAEL for reproduction, growth, or survival.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from CEAEQ (2012), which represents an EC_{20} based on reduced growth in chickens. The dataset also considered growth, mortality and reproduction endpoints.

Cadmium

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2005b). This was based on a comparison of the geometric mean of the NOAEL values for growth and reproduction from a number of studies with the LOAEL for reproduction, growth or mortality. The geometric mean of NOAEL values was 1.86 mg cadmium/kg-d. However, this value is higher than the lowest bounded LOAEL. Therefore, the TRV was established at 0.77 mg/kg-day, representing the highest NOAEL, which was still lower than the lowest LOAEL for reproduction, growth and mortality.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the CEAEQ (2012), which represents an EC_{20} based on six studies that included data for four species (quails, chickens, pheasants, and Mallard Ducks) and three endpoints (juvenile growth, reproduction, and survival).

Chromium

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2008). The TRV for chromium (total) was established at 2.4 mg/kg-day, which was based on the geometric mean of the NOAEL values for growth endpoints from eight unique studies.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2008). The TRV for chromium (total) was established at 2.66 mg/kg-day, which was based on the geometric mean of the NOAELs for growth and reproduction endpoints from ten toxicological studies on three test species (mostly chicken, but also turkey and black duck).

Cobalt

Mammals

Ecological Soil Screening Level (Eco-SSL) for mammals has been calculated by the US EPA (2005c). A geometric mean of the NOAEL values for growth was calculated at 7.33 mg/kg-day. This value is lower than the lowest bounded LOAEL for either growth or reproduction results. Therefore, the TRV is equal to the geometric mean NOAEL at 7.33 mg/kg-day.

Birds

Ecological Soil Screening Level (Eco-SSL) for avian species has been calculated by the US EPA (2005c). A geometric mean of the NOAEL values for growth was calculated at 7.61 mg/kg-day. This value is lower than the lowest bounded LOAEL for growth. Therefore, the TRV is equal to the geometric mean NOAEL at 7.61 mg/kg-day.

Copper

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2007a). The selected TRV of 5.6 mg/kg-day is the highest bound NOAEL below the lowest bound LOAEL for reproduction, growth, and survival endpoints.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from CEAEQ (2012), which represents an EC_{20} based on five studies that considered reproductive endpoints in chickens.

Iron

There are no established TRV for mammals or avian receptors for Iron.

Lead

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2005d). The selected TRV is from a dataset of 219 studies and is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth and mortality endpoints, which equaled 4.70 mg/kg-d.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2005d). A TRV of 1.63 mg/kg- day was selected by the US EPA dataset of 54 studies and was the highest bounded NOAEL lower than the lowest bounded LOAEL for growth, reproduction and mortality endpoints

Manganese

Mammals

A geometric mean of the NOAEL values for growth and reproduction from 58 studies was calculated at 51.5 mg/kg-d by the US EPA (2007b). This value is lower than the lowest bounded LOAEL for reproduction, growth or mortality results. Therefore, the value of 51.5 mg/kg-d was used in this assessment.

Birds

A geometric mean of the NOAEL values for growth and reproduction from 40 studies was calculated at 179 mg/kg-d by the US EPA (2007b). This value is lower than the lowest bounded LOAEL for reproduction, growth or survival endpoints. Therefore, the value of 179 mg/kg-d was used in this assessment.

Mercury

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the CEAEQ (2012). The value represents an EC_{20} based on a single study (Aulerich et al. 1974) that considered reproductive endpoints in mink.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the CEAEQ (2012). The selected TRV of 0.8 mg/kg-d was derived by CEAEQ (2012) from a dataset of three inorganic mercury toxicity studies. The selected EC20 (Effective Concentration for 20%) was calculated from a toxicity study (Packhurst and Thaxton 1973; as cited in CEAEQ 2012) in roosters exposed to inorganic mercury in drinking water for 112 days, with survival as the endpoint.

Methylmercury

Mammals

The NOAEL was obtained from Sample et al. (1996). Sample et al. (1996) reported a chronic LOAEL of 0.0247 mg/kg-d from toxicity tests with methylmercury chloride on mink, with mortality as the endpoint. The NOAEL for mortality and growth endpoints was calculated at 0.015 mg/kg-day, which was used in this assessment.

Birds

Sample et al. (1996) reported a chronic LOAEL of 0.064 mg/kg/day from toxicity tests with methylmercury dicyandiamide on Mallard Duck in a multi-generational study, with reproduction as the endpoint. A NOAEL of 0.0064 mg/kg-day was estimated using an uncertainty factor of 10. A critical review of toxicity reference values for birds by Fuchsman et al. (2017) identified NOAELs ranging from 0.02 to 0.4 mg/kg/day and threshold/LOAELs/EC20 values ranging from 0.05 to 1.5 mg/kg/day. The highest NOAEL below the lowest LOAEL of 0.03 mg/kg/day was selected as the TRV.

Molybdenum

Mammals

The NOAEL was obtained from Sample et al. (1996). Sample et al. (1996) reported a chronic LOAEL of 2.6 mg/kg-day from toxicity tests with molybdate on mice in a multi-generational study, with reproduction as the endpoint, The NOAEL was estimated by multiplying the chronic LOAEL by an uncertainty factor of 0.1. resulting in a value of 0.26 mg/kg-day, which was adopted as the TRV for molybdenum in mammals for this assessment.

Birds

The NOAEL was obtained from Sample et al. (1996). Sample et al. (1996) reported a chronic LOAEL of 35.3 mg/kg-day from toxicity tests with sodium molybdate on chickens, with reproduction as the endpoint, The NOAEL was estimated by multiplying the chronic LOAEL by an uncertainty factor of 0.1. resulting in a value of 3.5 mg/kg-day, which was adopted as the TRV for molybdenum in mammals for this assessment.

Nickel

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2007c). A geometric mean of the NOAEL values from 119 studies for reproduction and growth was calculated at 7.70 mg/kg-day. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL lower than the lowest bounded LOAEL for reproduction, growth, or survival endpoints, 1.70 mg/kg-day.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2007c). A geometric mean of the NOAEL values from 11 studies for reproduction and growth was calculated at 6.71 mg/kg-day. This value is lower than the lowest bounded LOAEL for reproduction, growth, or survival. Therefore, the TRV is equal to the geometric mean of the NOAEL values for reproduction and growth endpoints, 6.71 mg/kg-day.

Zinc

Mammals

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2007e). The Eco-SSL for mammals was calculated by the US EPA based on a calculation of the geometric mean of 69 NOAEL values for reproduction and growth endpoints. The geometric mean of NOAEL values was 75.4 mg copper/kg-day and was used as the TRV for this assessment.

Birds

The NOAEL was obtained from FCSAP (2021). FCSAP selected the value from the US EPA (2007e). The Eco-SSL for birds was calculated by the US EPA and is the geometric mean of the 43 NOAEL values for growth and reproduction endpoints. The geometric mean of NOAEL values was 66.1 mg copper/kg-day and was used as the TRV for this assessment.

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