Atlantic Gold

# Appendix F.9

Response to Information Request Nos. CEAA 2-36, CEAA 2-37, and NSE 2-130 Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road
Beaver Dam Mine Project Marinette, Nova Scotia - April 14, 2021
Completed for the Updated 2021 Beaver Dam Mine EIS

# Memorandum

April 14, 2021

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|---|---|---|---|
| To: | James Millard and Veronica Chisholm, Atlantic Mining NS Inc. | Ref. No.: | 088664 |
| From: | Steve Harris/Philip Sheffield/lj/3/Rev.1 | Tel: | (519) 340-3932 |
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**Subject:** **Response to Information Request Nos. CEAA 2-36, CEAA 2-37, and NSE 2-130**
**Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition at Along the Haul Road**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

## 1. Introduction

On behalf of Atlantic Mining Nova Scotia Inc. (AMNS), GHD Limited (GHD) prepared this Memorandum to evaluate the potential impacts to groundwater and surface water from metals Constituents of Concern (COCs) originating from dust ($PM_{10}$, $PM_{2.5}$ and total suspended particulate) that may be deposited on surficial soil and surface water along the Haul Road for the Beaver Dam Mine Project (Project). The Project, along with AMNS's proposed Fifteen Mile Stream Gold and Cochrane Hill Gold Projects, plan to use the Haul Road to transport ore to the existing Touquoy Mine Site and Facility for final processing. The Haul Road will be constructed using aggregate material derived from quarries and/or non-acid generating waste rock (NAG). A dust management plan (minimum 80 percent dust mitigation[1]) will be applied to reduce the amount of dust generated by traffic using the Haul Road. However, the Updated 2021 Environmental Impact Statement (AMNS 2021[2]) predicts that some dust will still be deposited along, and in the vicinity of the Haul Road (AMNS 2021, Section 6.2.6.3). There is potential for metals COCs in dust to impact receptors through transport mechanisms including:

- The potential leaching of metals COCs from the dust deposited on surficial soil at sensitive receptor locations to precipitation infiltrating through surficial soil and ultimately reaching groundwater.
- The transport of dissolved metals COCs leaching from surficial soil to surface water runoff ultimately reaching downstream surface waterbodies.
- The transport of metals COCs through surficial soil erosion ultimately reaching downstream surface water bodies.
- The direct deposition of dust containing metals COCs on surface waterbodies.

1 A Provincially approved dust suppressant will be applied. Therefore, there are no adverse environmental impacts anticipated from dust suppressant application.

2 AMNS (Atlantic Mining NS Inc.). Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. March 2021. Middle Musquodoboit, NS.

This Memorandum evaluates the potential impacts of metals COCs in dust emitted from the Haul Road and deposited throughout the receiving environment through transport mechanisms listed above. The sensitive receptors and surface waterbodies considered in this evaluation are those that represent the potential worst case in terms of dust deposition given their proximity to the Haul Road.

GHD conducted air dispersion modelling to predict dust deposition rates in the immediate vicinity of the Haul Road and at each sensitive receptor location where there is a domestic water source (groundwater or surface water) or where it was identified there could be a potential future domestic water source (AMNS 2021, Section 6.2 and Appendices = C.1 [GHD 2021[3]] and C.2 [Intrinsik 2021[4]]). Dust deposition was predicted based on emissions from the Haul Road while being used for the Project only, and then for cumulative emissions from the Haul Road while being used for the Project combined with the nearby projects. GHD (2021) presents the documentation of the air dispersion modelling methodology and results. The location of sensitive receptors and Haul Road sections assessed through air dispersion modelling are presented on Figure 1. Table 1 shows the results of the air dispersion modelling relative to maximum annual dust deposition rates, in terms of total particulate, at the sensitive receptor locations and Haul Road sections where maximum dust deposition occurs.

**Table 1 Maximum Predicted Annual Deposition Rates for Total Particulate**

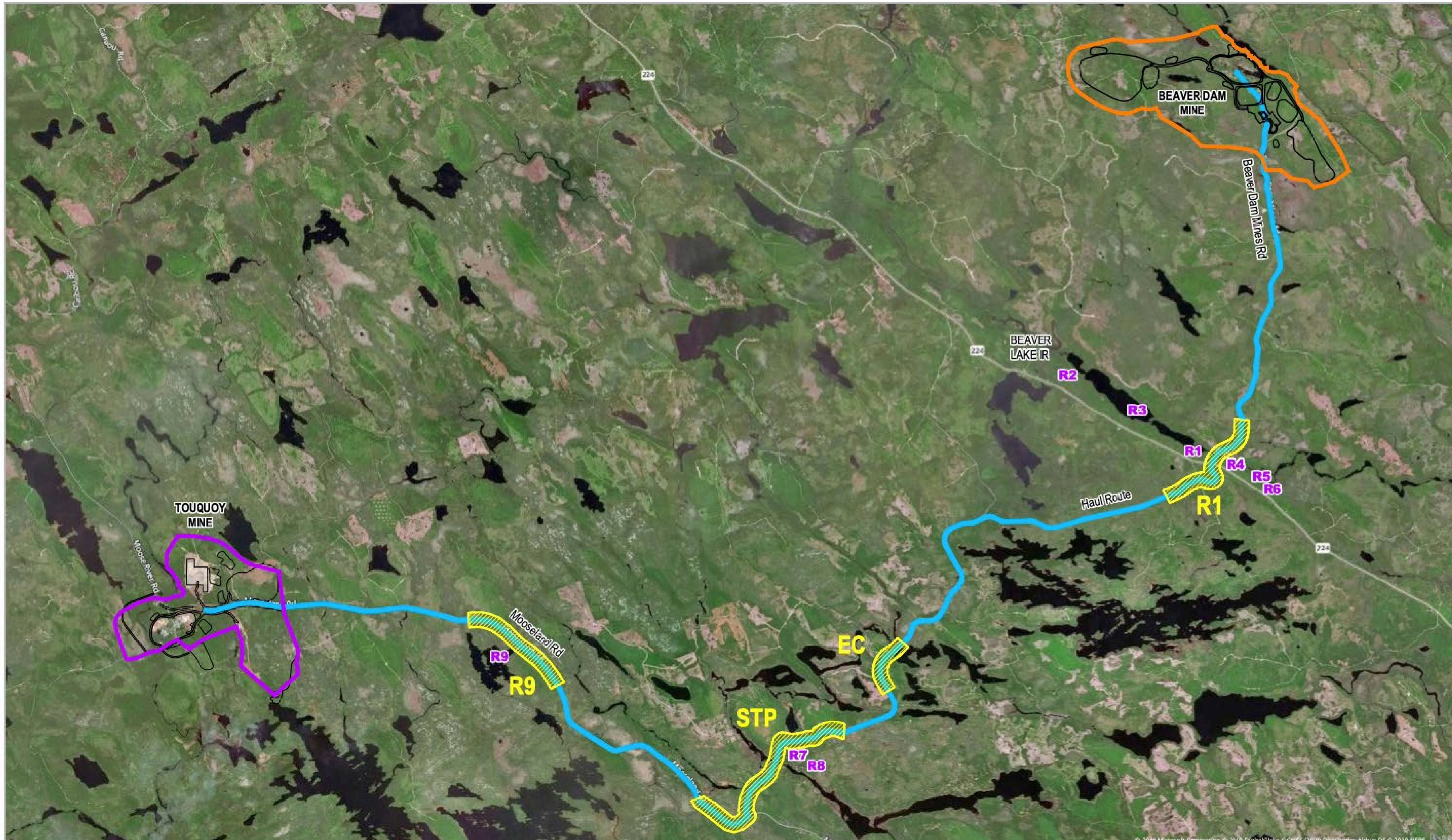
| Sensitive Receptor | Project Alone(1) ($g/m^2$-yr) | Cumulative Project and (Nearby Projects(1) ($g/m^2$-yr) |
|---|---|---|
| R1: 9 Beaver Dam Mines Road (Marlborough/Goodland Property) | 16.9 | 25.5 |
| R2: Highway 224 (Beaver Lake IR) | 0.1 | 0.2 |
| R3: R3 – 4115 Highway 224 (Cottage on Crown land) | 0.5 | 0.7 |
| R4: 3492 Highway 224 (Hobbs Property) | 27.0 | 40.9 |
| R5: 3379 Highway 224 (McLeod Property) | 3.5 | 5.3 |
| R6: 3373 Highway 224 (Smith Property) | 3.0 | 4.5 |
| R7: Tangier River (Deepwood Estates Property) | 49.4 | 74.8 |
| R8: Tangier River (Musquodoboit Lumber Co Ltd. Property) | 7.0 | 10.5 |
| R9: 5579 Mooseland Road (Lloy Property) | 21.9 | 33.1 |
| Road Section R1 | 136.3 | 206.1 |
| Road Section R9 | 116.4 | 176.1 |
| Road Section STP | 133.8 | 202.4 |
| Road Section East Corner | 121.9 | 184.4 |
| Note:<br>(1) Annual dust deposition rates correspond to 80% dust suppression. | | |

Source: AMNS 2021, Appendix C.1 (GHD 2021).

3 GHD. 2021. Air Emissions Assessment Technical Report. Beaver Dam Mine Project, Marinette, Nova Scotia, February 16, 2021. Prepared for Atlantic Mining NS Inc. 088664. Waterloo, ON.

4 Intrinsik (Intrinsik Corp.). 2021. Evaluation of Potential Human Exposures and Risks Related to Emissions from the Beaver Dam Mine Project (Dust Deposition; Recreational Water Usage; Country Foods). Atlantic Mining NS Inc. Beaver Dam Mine Project. Information Request Response: CEAA 2-38. March 2021. Prepared for Atlantic Mining NS Inc. Halifax, NS.

GHD




LEGEND

- HAUL ROUTE
- BEAVER DAM MINE PROPERTY BOUNDARY
- TOUQUOY MINE PROPERTY BOUNDARY
- R1 POINT-OF-RECEPTION LOCATION

0 600 1200 1800m

N

GHD

Atlantic Mining NS Inc.
Beaver Dam Mine Project
AMNS 2021, Appendix C.1 Air Emissions Assessment (GHD 2021)

**Sensitive Receptors and Haul Road Sections Assessed in the Air Dispersion Modelling**

Project No. 88664
Date January 2021

**FIGURE 1**

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Source: Microsoft Product Screen Shot(s) Reprinted with permission from Microsoft Corporation, Accessed: 2019

As shown in Table 1, the highest maximum annual deposition rate along the Haul Road occurs at Road Section R1, and the maximum annual deposition rate for a sensitive receptor occurs at Sensitive Receptor R7, both of which correspond to the cumulative condition where the Haul Road is utilized for the Project as well as the nearby projects.

The duration of the Beaver Dam Mine Project is estimated as 5 years, and thus the highest maximum annual deposition rate would only occur during this time. However, use of the Haul Road by the nearby projects could continue for up to 9 years. As a conservative approach, to assess the impact to groundwater at sensitive receptor locations, the highest maximum annual deposition rate at Sensitive Receptor R7, the closest receptor to the haul road, for the cumulative condition is assumed to occur over all 9 years of Haul Road use and is applied to estimate potential metals COCs leaching to groundwater from dust deposition.

To assess the impact of dust deposition on downstream surface water bodies through surface water runoff, the maximum dust deposition rate at Road Section R1 for the cumulative condition (i.e., the Project as well as the nearby projects) also is assumed to occur over all 9 years of Haul Road use and is applied to estimate metals COCs concentrations in surface water runoff.

Ferry Lake (located approximately 1.5 kilometres [km] southeast of the Haul Road between Road Sections STP and East Corner, as shown on Figure 1) is the only surface water body that was identified as a potable water supply along the Haul Road. To assess the impact of dust deposition on surface water bodies used for potable water supply, the maximum dust deposition rate at Sensitive Receptor R8 for the cumulative condition is used, since Sensitive Receptor R8 is located closest to Ferry Lake and its watershed. The maximum deposition rate at Sensitive Receptor R8 is assumed to occur over all 9 years of Haul Road use and is applied to estimate metals COCs in surface water within Ferry Lake. To estimate the metals COCs concentrations in Ferry Lake, it is assumed that the dust deposition rate at Sensitive Receptor R8 occurs over the entire Ferry Lake watershed. This is conservative since the dust deposition rate within the Ferry Lake watershed would decrease moving away from the Haul Road, resulting in an average deposition rate less than that predicted at Sensitive Receptor R8.

To estimate the metals COCs concentrations that potentially could result from dust deposition, the composition of the dust is examined and the fraction of each metal COC within the dust is determined. To determine the leachable metals composition in dust emitted from the Haul Road, GHD applied the results of both de-ionized water extraction (Shake Flask Extraction) tests and acid extraction (Aqua Regia Extraction) tests conducted on Touquoy Mine Site waste rock samples, in combination with acid extraction tests conducted on waste rock samples from the Project.

GHD used the leachable metals composition in dust emitted from the Haul Road to estimate maximum metals COCs concentrations in groundwater at Sensitive Receptor R7, in surface water runoff from the Haul Road, and in surface water within Ferry Lake. The estimated metals COCs concentrations at each receptor are compared to applicable groundwater and surface water criteria to determine whether potential metals COCs transport from dust deposition may pose a concern for potential groundwater or surface water quality impacts at any of the receptor locations.

The approaches taken to estimate metals COCs concentrations in surficial soil due to dust deposition, and metals COCs loading to surface water bodies are consistent with the methodologies outlined in the United

States Environmental Protection Agency's (USEPA's) guidance, "*Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*" (USEPA, 2005[5]). The approach taken to estimate potential leaching from soil to groundwater is consistent with the methodology outlined in UESPA's guidance, "*Soil Screening Guidance: Technical Background Document*" (USEPA, 1996[6]). The estimated metals COCs concentrations in soil leachate, surface water runoff and Ferry Lake then are compared to applicable groundwater and surface water criteria.

## 2. Leachable Metals Composition in Dust

GHD used the results of extraction tests (de-ionized water and acid extraction tests) conducted on waste rock samples to estimate the leachable metals composition in dust deposited at the sensitive receptors. De-ionized water extraction test results best represent the metals COCs concentrations that potentially could leach to precipitation infiltrating through the deposited dust. The acid extraction test results represent aggressive leaching conditions that would over-estimate metals COCs concentrations potentially leaching to precipitation or partitioning to surface water. Only acid extraction tests were conducted on waste rock samples from the Beaver Dam Mine Site (the source for aggregate material that will be used to construct the Haul Road), while both de-ionized water and acid extraction tests were conducted on waste rock samples from the Touquoy Mine Site. The bedrock formations at the Touquoy and Beaver Dam Mine Sites are similar (both are comprised of greywacke and argillite of the Goldenville and Halifax Formation, respectively, of the Meguma Group). As a result, GHD used the ratio of de-ionized water to acid extraction test results for the Touquoy Mine Site to estimate expected de-ionized water extraction results from the findings of the acid extraction tests conducted on waste rock samples from the Beaver Dam Mine Site.

Table A.1 of Attachment A shows the results of the de-ionized water and acid extraction tests conducted on the Touquoy Mine Site waste rock samples. As a conservative approach, where a metal was not detected in the extraction test results for a particular sample, the metal was assumed present at the laboratory detection limit. GHD determined the ratio of the de-ionized water to acid extraction test results for each sample per metals COC, and the geometric mean of these ratios was then determined for each metals COC. Table A.2 of Attachment A shows the results of the acid extraction tests conducted on the Beaver Dam Mine Site waste rock samples. GHD determined the geometric mean of the acid extraction test results for each metals COC across the samples, which then was multiplied by the corresponding metals COC geometric mean ratio of de-ionized water to acid extraction test result from the Touquoy Mine Site. The outcome of this procedure, as shown in Table A.2, provides the estimated leachable metals COC composition in dust emitted from the Haul Road.

The maximum annual dust deposition rate at Sensitive Receptor R7, Road Section R1, and at Sensitive Receptor R8 (representing the Ferry Lake watershed) are multiplied by the estimated metals COCs composition in the dust to determine an annual deposition rate for each metals COCs at each location. The annual deposition rate for each metals COC then is used to estimate metals COCs concentrations in surficial

[5] USEPA, 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Chapter 5, Estimating Media Concentrations, Office of Solid Waste and Emergency Response, EPA530-R-05-006, September.

[6] USEPA, 1996. Soil Screening Guidance: Technical Background Document, Office of Solid Waste and Emergency Response, EPA/530/R95/128, May.

soil, as presented in Section 3. The soil concentrations then are applied to calculate metals COCs concentrations in groundwater and surface water runoff presented in Section 4, and to calculate metals COCs concentrations in surface water runoff and soil erosion into Ferry Lake presented in Section 5.

# 3. Estimation of Metals COCs Concentrations in Surficial Soil Due to Dust Deposition

The concentration of metals COCs in surficial soil (untilled) due to dust deposition were estimated using the recommended equations presented in USEPA (2005) and reproduced below. Untilled soil was characterized with a soil mixing zone depth of 2 cm after USEPA (2005). USEPA (2005) presents an approach to estimate soil concentrations in tilled soil as well, but the approach assumes soil mixing over a greater depth (e.g., 20 cm), and thus, results in lower soil concentrations. The higher untilled soil concentrations were used to estimate surficial soil concentrations due to dust deposition. GHD then used the resulting soil concentrations to evaluate potential metals COCs concentrations that could result from dust deposition at sensitive receptor locations, and in surface water runoff and soil erosion into Ferry Lake.

The estimated surficial soil concentrations are a result of dust deposition from the atmosphere, minus the loss of metals COCs by several mechanisms including leaching, erosion, runoff, degradation (biotic and abiotic), and volatilization. Losses due to degradation and volatilization would not occur, or would be negligible, for metals, and losses due to soil leaching are neglected since the intent here is to estimate maximum surface soil concentrations that could result in leaching to groundwater or partitioning to surface water runoff. Losses due to erosion also are set to zero as recommended by USEPA (2005) since erosion occurs both onto, and off of, a site. Only loses due to surface water runoff were considered in estimating surficial soil concentrations due to dust deposition, which is conservative with respect to estimating maximum surficial soil concentrations.

Soil concentrations could require many years to reach a steady-state condition. As a result, the equations used to calculate the average soil concentrations over the period of deposition were derived by integrating the instantaneous soil concentration equation over the period of deposition. The period of deposition is set to 9 years, corresponding to 9 years of the Haul Road use by the Beaver Dam Mine Project and nearby projects, as described in Section 1.

Equations 1 and 2 (USEPA, 2005; Equations 5-1C and 5-1E) below represent the calculation of the average soil concentration over the exposure duration for carcinogens and non-carcinogens, respectively, due to deposition.

$$Cs = \frac{Ds}{ks \times (tD - T_1)} \times \left( \left[ tD + \left( \frac{\exp(-ks \times tD)}{ks} \right) \right] - \left[ T1 + \left( \frac{\exp(-ks \times T1)}{ks} \right) \right] \right) \quad \text{Eq. 1}$$

$$Cs_{tD} = \frac{Ds \times [1 - \exp(-ks \times tD)]}{ks} \quad \text{Eq. 2}$$

Where:

$Cs$ = Average soil concentration (carcinogens) over exposure duration (mg/kg)

$Cs_{tD}$ = Average soil concentration at time tD (non-carcinogens) (mg/kg)

$tD$ = Deposition time period (yr) (corresponding to 9 years of the Haul Road use by the Beaver Dam Mine Project and nearby projects)

$Ds$ = Deposition term for untilled soil (mg/kg-yr) (see Equation 3)

$ks$ = COC soil loss constant due to all potential loss processes ($yr^{-1}$) (see Equation 4)

$T_1$ = Time at start of Project (yr) (typically zero)

Equation 1 (for Cs) represents a soil concentration averaged over the exposure duration, while Equation 2 (for $Cs_{tD}$) represents the highest average annual soil concentration typically occurring at the end of the deposition source (USEPA, 2005). Since the intent here is to estimate maximum surficial soil concentrations that could result in soil leaching, $Cs_{tD}$ (Equation 2) is applied to determine the concentration of metals COCs in soil.

The deposition term (Ds) is calculated using Equation 3 (USEPA, 2005; Equation 5-11) below:

$$Ds = \frac{CF \times Dr}{Zs \times BD} \qquad \text{Eq. 3}$$

Where:

$CF$ = Units conversion factor (100 mg-$m^2$/kg-$cm^2$)

$Dr$ = Annual deposition rate (g/$m^2$-yr) (specific to each metals COC based on atmospheric deposition modelling, as presented in Section 2)

$BD$ = Soil bulk density (g/$cm^3$) (set to 1.4 g/$cm^3$ corresponding to the Atlantic RBCA[7] default value for fine-grained soils, where overburden soils are typically fine-grained in the vicinity of the Project)

$Zs$ = Soil mixing zone depth (cm) (set to 2 cm for untilled soil)

The rate at which a COC is lost from soil is known as the soil loss constant (ks). Physical, chemical, and biological properties of the COCs are used to estimate the COC-specific loss resulting from leaching, runoff, erosion, degradation, and volatilization. As described above, only loses due to surface water runoff were considered in estimating soil concentrations due to dust deposition. The COC loss constant is calculated using Equation 4 (USEPA, 2005; Equation 5-2A) as presented below:

$$ks = ksg + kse + ksr + ksl + ksv \qquad \text{Eq. 4}$$

7 Atlantic RBCA (Risk-Based Corrective Action) for Petroleum Impacted Sites in Atlantic Canada, Version 3, User Guidance, July 2012 (Revised January 2015).

Where:

ksg = COC soil loss – biotic and abiotic degradation ($yr^{-1}$) (set to zero for metals COCs)

kse = COC soil loss – soil erosion ($yr^{-1}$) (set to zero as recommended by USEPA (2005) since erosion occurs both onto, and off of, a site)

ksr = COC soil loss – surface runoff ($yr^{-1}$) (see Equation 5)

ksl = COC soil loss – leaching ($yr^{-1}$) (set to zero since the intent here is to estimate maximum surface soil concentrations that could result in soil leaching to groundwater)

ksv = COC soil loss – volatilization ($yr^{-1}$) (set to zero for metals COCs)

The equation used to calculate COC loss due to surface runoff, ksr, is presented in Equation 5 (USEPA, 2005; Equation 5-4) below:

$$ksr = \left[\frac{RO}{\theta sw \times Zs}\right] \times \left[\frac{1}{1.0 + (Kd_s \times BD/\theta_{sw})}\right] \quad \text{Eq. 5}$$

Where:

RO = Average annual surface runoff (cm/yr) (set to 20 percent of the average annual precipitation value of 1,357.7 mm/yr, corresponding to rolling topography, open sandy load soils, and woodland cover, after Ontario Ministry of the Environment [2003][8])

$\theta_{sw}$ = Soil volume water content ($mL/cm^3$) (set to 0.2 $mL/cm^3$ after USEPA [2005])

$Kd_s$ = Soil-water partition coefficient (mL/g) (specific to each metals COC, as presented in Table 2, attached)

Table 2 (attached) presents the calculation of COC soil loss due to surface runoff using Equation 5.

Table 3 (attached) presents the deposition term for untilled soil calculated using Equation 3. The deposition term is calculated using average annual deposition rates of (for the cumulative condition of the Project and nearby projects):

- 74.8 $g/m^2$-yr corresponding to the deposition rate at Sensitive Receptor R7 (the maximum across all sensitive receptors)
- 206.1 $g/m^2$-yr corresponding to the deposition rate at Road Section R1 (the maximum along the Haul Road)
- 10.5 $g/m^2$-yr corresponding to the deposition rate at Sensitive Receptor R8 (located closest to Ferry Lake and its watershed (Figure 1)

8 Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual, March.

Table 4 (attached) presents the calculation of the maximum leachable soil concentration calculated using Equation 2 at Sensitive Receptor R7, Road Section R1, and the Ferry Lake watershed (represented by Sensitive Receptor R8) due to dust deposition from the Haul Road (Figure 1).

The maximum leachable soil concentration is used to estimate the maximum soil leachate concentration at Sensitive Receptor R7, and the maximum surface water runoff concentration as described in Section 4, and the maximum concentration in Ferry Lake due to metals COCs concentrations in surface water runoff and soil erosion into Ferry Lake as described in Section 5.

## 4. Estimation of Metals COCs Concentrations in Soil Leachate and Surface Water Runoff

GHD applied equilibrium partitioning to estimate soil leachate concentrations from the metals COCs concentrations estimated in soil due to dust deposition at Sensitive Receptor R7 and in surface water runoff from Road Section R1. The soil leachate and surface water runoff concentrations were determined using Equation 6 (USEPA, 1996; Equation 2) below:

$$Cw = \frac{CstD}{\left(Kd_s + \frac{\theta_{sw} + \theta_a \times H}{BD}\right)} \qquad \text{Eq. 6}$$

Where:

| | | |
|---|---|---|
| Cw | = | Soil leachate or surface water runoff concentration (µg/L) |
| $\theta_a$ | = | Soil air water content (mL/cm$^3$) (set to 0.17 mL/cm$^3$ after USEPA [2005]) |
| H | = | Henry's law constant (set to zero for metals) |

Table 5 (attached) presents the soil leachate and surface water runoff concentrations estimated using Equation 6 and compares the estimated concentrations to applicable potable groundwater and surface water criteria. There are no exceedances of the applicable potable groundwater or surface water criteria.

The applicable potable groundwater criteria are taken as the lower of the Nova Scotia Environment (NSE) guidance, "*Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document*" (NSE, 2014[9]) Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater and the Health Canada guidance, "*Guidelines for Canadian Drinking Water Quality, Summary Table*" (Health Canada, 2019[10]) Maximum Acceptable Concentration (MAC). A tapwater Regional Screening Level from USEPA (2019[11]) is used where no applicable standard is available from either NSE (2014) or Health Canada (2019). The applicable potable surface water criteria are taken as the lower of CCME "*Water Quality Guidelines for*

9 NSE, 2014. Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, June.
10 Health Canada, 2019. Guidelines for Canadian Drinking Water Quality, Summary Table, June.
11 USEPA, 2019. Regional Screening Levels, April (https://semspub.epa.gov/work/HQ/199432.pdf).

*the Protection of Aquatic Life"* (CCME, 2020[12]) and Tier 1 Environmental Quality Standards for Surface Water (NSE, 2013[13]).

# 5. Estimation of Metals COCs Concentrations in Ferry Lake

GHD estimated potential metals COCs concentrations in surface water within Ferry Lake due to metals COCs concentrations in surface water runoff and soil erosion into Ferry Lake, and due to direct dust deposition onto Ferry Lake, using the recommended equations presented in USEPA (2005) and reproduced below. Section 5.1 presents the approach used to calculate the total metals COCs load to a surface water body, and Section 5.2 presents the approach used to convert the total metals COCs load to a surface water concentration.

## 5.1 Estimation of Total Metals COCs Load to Surface Water

The total metals COCs load to a surface water body is calculated using Equation 7 (USEPA, 2005; Equation 5-28) below:

$$L_T = L_{DEP} + L_{dif} + L_{RI} + L_R + L_E + L_I \qquad \text{Eq. 7}$$

Where:

| | | |
|---|---|---|
| $L_T$ | = | Total load to a water body (including deposition, runoff, and erosion) (g/yr) |
| $L_{DEP}$ | = | Total (wet and dry) particle phase and vapour phase direct deposition load to a water body (g/yr) |
| $L_{dif}$ | = | Vapour phase diffusion load to a water body (g/yr) |
| $L_{RI}$ | = | Runoff load to a water body from impervious surfaces (g/yr) |
| $L_R$ | = | Runoff load to a water body from pervious surfaces (g/yr) |
| $L_E$ | = | Soil erosion load to a water body (g/yr) |
| $L_I$ | = | Internal transfer due to chemical or biological degradation (g/yr) |

The vapour phase direct deposition component of $L_{DEP}$ and the vapour phase diffusion load, $L_{dif}$, are set to zero as it is assumed that the metals COCs are present predominately in the particulate phase and not in the vapour phase, consistent with USEPA (2005) recommendations.

The Ferry Lake watershed consists predominately of pervious surfaces (i.e., rural and naturally vegetated ground cover). As a result, it is assumed that all surfaces within the watershed are pervious and that the runoff load from impervious surfaces, $L_{RI}$, is zero.

The metals COCs are not subject to any significant chemical or biological degradation, and thus, the internal transfer, $L_I$, of compounds into degradation products is set to zero, as recommended by (USEPA, 2005).

12 CCME, 2020. Water Quality Guidelines for the Protection of Aquatic Life.

13 NSE, 2013. Environmental Quality Standards for Surface Water, July.

The calculation of metals COCs load to Ferry Lake due to particle direct deposition ($L_{DEP}$), runoff from pervious surfaces ($L_R$), and erosion ($L_E$) are presented in Sections 5.1.1, 5.1.2, and 5.1.3, respectively.

### 5.1.1 Estimation of Metals COCs Load from Direct Deposition onto Ferry Lake

GHD applied Equation 8 (USEPA, 2005; Equation 5-29), below, to calculate the estimated metals COCs load to Ferry Lake from direct deposition onto Ferry Lake.

$$L_{DEP} = Q \times [F_v \times Dytwv + (1 - F_v) \times Dytwp] \times A_W \qquad \text{Eq. 8}$$

Where:

| | | |
|---|---|---|
| Q | = | Metals COCs emission rate (g/s) |
| $F_v$ | = | Fraction of air concentration in vapor phase (unitless) (set to zero for metals COCs after USEPA [2005]) |
| Dytwv | = | Unitized yearly (water body or watershed) average total (wet and dry) deposition from vapor phase (s/$m^2$-yr) (set to zero for metals COCs after USEPA [2005]) |
| Dytwp | = | Unitized yearly (water body or watershed) average total (wet and dry) deposition from particle phase (s/$m^2$-yr) |
| $A_W$ | = | Water body surface area ($m^2$)[14] |

The metals COCs emission rate, Q, multiplied by the unitized yearly average total (wet and dry) deposition from the particle phase, Dytwp, is equal to the annual deposition rate of leachable metals, Dr, for the Ferry Lake watershed presented in Table 3 (attached). Therefore, Equation 8 can be simplified to the annual deposition rate of leachable metals, Dr, multiplied by the surface area of major water bodies within the Ferry Lake watershed, $A_W$. Table 6 (attached) presents the calculated metals COCs load from direct dust deposition onto Ferry Lake, $L_{DEP}$.

### 5.1.2 Estimation of Metals COCs Surface Water Runoff Load to Ferry Lake from Pervious Surfaces

GHD applied Equation 9 (USEPA, 2005; Equation 5-32), below, to calculate the estimated metals COCs load to Ferry Lake due to metals COCs dissolved in surface water runoff from pervious surfaces in the Ferry Lake watershed.

$$L_R = RO \times (A_L + A_I) \times \frac{Cs \times BD}{\theta_{sw} + Kd_s \times BD} \times 0.01 \qquad \text{Eq. 9}$$

14 Ferry Lake has a surface area of approximately 670,000 $m^2$, and the total surface area of major water bodies within the Ferry Lake watershed is approximately 818,000 $m^2$.

Where:

| | | |
|---|---|---|
| $A_L$ | = | Total watershed area receiving metals COCs deposition ($m^2$)[15] |
| $A_I$ | = | Impervious watershed area receiving metals COCs deposition ($m^2$) (set to zero as the watershed predominately consists of pervious surfaces) |
| 0.01 | = | Units conversion factor (kg-$cm^2$/mg-$m^2$) |

Table 7 (attached) presents the calculation of the metals COCs load to Ferry Lake due to metals COCs dissolved in surface water runoff from pervious surfaces, $L_R$, using Equation 9.

### 5.1.3 Estimation of Metals COCs Soil Erosion Load to Ferry Lake

GHD applied Equation 10 (USEPA, 2005; Equation 5-33), below, to calculate the estimated metals COCs load to Ferry Lake due to soil erosion (i.e., metals COCs in eroded surficial soil).

$$L_E = X_e \times (A_L - A_I) \times SD \times ER \times \frac{Cs \times Kd_s \times BD}{\theta_{sw} + Kd_s \times BD} \times 0.001 \qquad \text{Eq. 10}$$

Where:

| | | |
|---|---|---|
| $X_e$ | = | Unit soil loss (kg/$m^2$-yr) (see Equation 11) |
| SD | = | Sediment delivery ratio for the watershed (unitless) (see Equation 12) |
| ER | = | Soil enrichment ratio (unitless) (set to 1 after USEPA [2005]) |
| 0.001 | = | Units conversion factor (g/mg) |

The equation used to calculate unit soil loss, $X_e$, is presented in Equation 11 (USEPA, 2005, Equation 5-33A), below:

$$X_e = RF \times K \times LS \times C \times PF \times \frac{907.18}{4047} \qquad \text{Eq. 11}$$

Where:

| | | |
|---|---|---|
| RF | = | Universal Soil Loss Equation (USLE) rainfall (or erosivity) factor ($yr^{-1}$) (set to 300 $yr^{-1}$ after USEPA [2005]) |
| K | = | USLE erodibility factor (ton/acre) (set to 0.39 ton/acre after USEPA [2005]) |
| LS | = | USLE length-slope factor (unitless) (set to 1.5 after USEPA [2005]) |
| C | = | USLE cover management factor (unitless) (set to 0.1 after USEPA [2005]) |

15 The area of the Ferry Lake watershed was defined by identifying topographic highs that result in downslope drainage into the water body, as recommended in USEPA (2005). The total watershed area receiving metals COCs deposition that contributes to surface water runoff load is defined as the total area of the watershed minus the area of major surface water bodies that receive direct dust deposition.

PF = USLE supporting practice factor (unitless) (set to 1 after USEPA [2005])

907.18 = Units conversion factor (kg/ton)

4,047 = Units conversion factor ($m^2$/acre)

The equation used to calculate the sediment delivery ratio, SD, is presented in Equation 12 (USEPA, 2005, Equation 5-34), below:

$$SD = a \times (A_L)^{-b} \qquad \text{Eq. 12}$$

Where:

a = Empirical intercept coefficient (unitless) (set to 1.4 based on a watershed size greater than 1 square mile, but less than 10 square miles after USEPA [2005])

b = Empirical slope coefficient (unitless) (set to 0.125 after USEPA [2005])

Table 8 (attached) presents the presents the calculated unit soil loss (using Equation 11), sediment delivery ratio (using Equation 12), and average annual metals COCs soil erosion load to Ferry Lake, $L_E$ (using Equation 10).

### 5.2 Estimation of Metals COCs Concentrations in Ferry Lake Surface Water

GHD applied Equation 13 (USEPA, 2005; Equation 5-35), below, to estimate the metals COCs concentrations in surface water within Ferry Lake that potentially could result from dust deposition within the Ferry Lake watershed.

$$C_{wtot} = \frac{L_T}{Vf_x \times f_{wc} + k_{wt} \times A_W \times (d_{wc} + d_{bs})} \qquad \text{Eq. 13}$$

Where:

$C_{wtot}$ = Total water body metals COCs concentration (including water column and bed sediment) ($g/m^3$ water body)

$Vf_x$ = Average volumetric flow rate through water body ($m^3$/yr)[16]

$f_{wc}$ = Fraction of total water body metals COCs concentrations in the water column (unitless) (see Equation 14)

$k_{wt}$ = Overall total water body COPC dissipation rate constant ($yr^{-1}$) (conservatively set to 0 $yr^{-1}$)

$d_{wc}$ = Depth of water column (m) (set to 1.7 m, the mean depth of Ferry Lake)

$d_{bs}$ = Depth of upper benthic sediment layer (m) (set to 0.03 m after USEPA [2005])

[16] The total volumetric flow through Ferry Lake is approximated as total surface water runoff to Ferry Lake plus direct precipitation on Ferry Lake minus evapotranspiration.

The equation used to calculate the fraction of total water body metals COCs concentrations in the water column, $f_{wc}$ , is presented in Equation 14 (USEPA, 2005, Equation 5-36a), below:

$$f_{wc} = \frac{\left(1 + Kd_{sw} \times TSS \times 1 \times 10^{-6}\right) \times (d_{wc}/d_z)}{\left(1 + Kd_{sw} \times TSS \times 1 \times 10^{-6}\right) \times (d_{wc}/d_z) + (\theta_{bs} + Kd_{bs} \times C_{BS}) \times (d_{bs}/d_z)} \qquad \text{Eq. 14}$$

Where:

| | | |
|---|---|---|
| $Kd_{sw}$ | = | Suspended sediments/surface water partition coefficient (L water/kg suspended sediment) (set equal to $Kd_s$ for metals after USEPA [2005]) |
| TSS | = | Total suspended solids concentration (mg/L) (set to 10 mg/L after USEPA [1993][17]) |
| $1 \times 10^{-6}$ | = | Units conversion factor (kg/mg) |
| $d_z$ | = | Total water body depth (m) (equal to the sum of $d_{wc}$ and $d_{bs}$) |
| $\theta_{bs}$ | = | Bed sediment porosity ($L_{water}/L_{sediment}$) (set to 0.6 $L_{water}/L_{sediment}$ after USEPA [2005]) |
| $Kd_{bs}$ | = | Bed sediment/sediment pore water partition coefficient (L water/kg bottom sediment) (set equal to $Kd_s$ for metals after USEPA [2005]) |
| $C_{BS}$ | = | Bed sediment concentration ($g/cm^3$ [equivalent to kg/L]) (set to 1 $g/cm^3$ after USEPA [2005]) |

Table 9 (attached) presents the fraction of total water body metals COCs concentrations in the water column and the estimated average annual maximum metals COCs concentrations in Ferry Lake, calculated using Equations 12 and 13, respectively. Table 9 (attached) compares the estimated average annual maximum metals COCs concentrations in Ferry Lake surface water to the applicable potable groundwater and surface water criteria described in Section 4. There are no exceedances of the applicable potable groundwater or surface water criteria.

## 6. Conclusions

As presented in Tables 5 and 9 (attached), the estimated metals COCs concentrations in groundwater leachate at Sensitive Receptor R7, in surface water runoff from Road Section R1, and in Ferry Lake surface water are below the respective potable groundwater and surface water criteria.

With respect to groundwater, the estimated leachate concentrations would be reduced further by dilution as the infiltrating precipitation reaches groundwater where mixing with groundwater flow would occur. With respect to surface water runoff, the estimated metals COCs concentrations would be reduced by dilution as the runoff reaches the surface water receptor and mixes with surface water flow.

17 USEPA, 1993. Addendum: Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions. Working Groundwater Recommendations. Office of Solid Waste and Office of Research and Development. Washington, D.C. September.

These findings indicate that potential leaching of metals COCs from dust deposition at Sensitive Receptor R7 would not pose a concern to groundwater quality at this location. Since the highest maximum annual deposition rate occurs at Sensitive Receptor R7, closest to the Haul Road, dust deposition at the other sensitive receptor locations likewise would not pose a concern to groundwater or surface water quality. Likewise, metals COCs concentrations in surface water runoff from Haul Road Section R1 would not pose a concern to surface water quality at that location. Since the highest annual deposition rate along the Haul Road occurs at Road Section R1, dust deposition at other locations along the Haul Road would not pose a concern to surface water quality.

At Ferry Lake, it was assumed that the deposition rate at Sensitive Receptor R8 (located between the Ferry Lake watershed and the Haul Road) was representative of deposition over the entire Ferry Lake watershed. The deposition rate would decrease across the Ferry Lake watershed with increasing distance from the Haul Road, resulting in an average deposition rate across the watershed that would be less than that at Sensitive Receptor R8. Therefore, the estimated metals COCs concentrations in Ferry Lake surface water are conservative and are well below the applicable potable groundwater and surface water criteria.

# Tables

**Table 2**

**Calculation of Soil Loss Due to Surface Runoff**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Ave. Annual Surface Runoff RO (cm/yr) | Soil Vol. Water Content Θsw (mL/cm³) | Soil Mixing Zone Depth Untilled Zs (cm) | Soil-Water Partitioning Coefficient Kds (mL/g) | Source | Soil Bulk Density BD (g/cm³) | COC Loss Surface Runoff Untilled ksr (3) (yr⁻¹) |
|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | |
| Aluminum | 2.72E+01 | 2.00E-01 | 2.00E+00 | 1.50E+03 | (1) | 1.40E+00 | 6.46E-03 |
| Antimony | 2.72E+01 | 2.00E-01 | 2.00E+00 | 4.50E+01 | (2) | 1.40E+00 | 2.15E-01 |
| Arsenic | 2.72E+01 | 2.00E-01 | 2.00E+00 | 2.90E+01 | (2) | 1.40E+00 | 3.33E-01 |
| Barium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 4.10E+01 | (2) | 1.40E+00 | 2.36E-01 |
| Beryllium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 7.90E+02 | (2) | 1.40E+00 | 1.23E-02 |
| Boron | 2.72E+01 | 2.00E-01 | 2.00E+00 | 3.00E+00 | (1) | 1.40E+00 | 3.09E+00 |
| Cadmium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 7.50E+01 | (2) | 1.40E+00 | 1.29E-01 |
| Chromium Total | 2.72E+01 | 2.00E-01 | 2.00E+00 | 1.90E+01 | (2) | 1.40E+00 | 5.07E-01 |
| Cobalt | 2.72E+01 | 2.00E-01 | 2.00E+00 | 4.50E+01 | (1) | 1.40E+00 | 2.15E-01 |
| Copper | 2.72E+01 | 2.00E-01 | 2.00E+00 | 3.50E+01 | (1) | 1.40E+00 | 2.76E-01 |
| Iron | 2.72E+01 | 2.00E-01 | 2.00E+00 | 2.50E+01 | (1) | 1.40E+00 | 3.86E-01 |
| Lead | 2.72E+01 | 2.00E-01 | 2.00E+00 | 9.00E+02 | (2) | 1.40E+00 | 1.08E-02 |
| Magnesium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 4.50E+00 | (2) | 1.40E+00 | 2.09E+00 |
| Manganese | 2.72E+01 | 2.00E-01 | 2.00E+00 | 6.50E+01 | (1) | 1.40E+00 | 1.49E-01 |
| Mercury, element | 2.72E+01 | 2.00E-01 | 2.00E+00 | 3.30E+03 | (2) | 1.40E+00 | 2.94E-03 |
| Molybdenum | 2.72E+01 | 2.00E-01 | 2.00E+00 | 2.00E+01 | (1) | 1.40E+00 | 4.81E-01 |
| Nickel | 2.72E+01 | 2.00E-01 | 2.00E+00 | 6.50E+01 | (2) | 1.40E+00 | 1.49E-01 |
| Selenium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 5.00E+00 | (2) | 1.40E+00 | 1.89E+00 |
| Silver | 2.72E+01 | 2.00E-01 | 2.00E+00 | 8.30E+00 | (2) | 1.40E+00 | 1.15E+00 |
| Strontium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 3.50E+01 | (1) | 1.40E+00 | 2.76E-01 |
| Thallium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 7.10E+01 | (2) | 1.40E+00 | 1.36E-01 |
| Vanadium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 1.00E+03 | (1) | 1.40E+00 | 9.70E-03 |
| Zinc | 2.72E+01 | 2.00E-01 | 2.00E+00 | 6.20E+01 | (2) | 1.40E+00 | 1.56E-01 |
| Uranium | 2.72E+01 | 2.00E-01 | 2.00E+00 | 4.50E+02 | (1) | 1.40E+00 | 2.15E-02 |

Notes:

(1) RAIS, 2014: Risk Assessment Information System database, October 2019 (http://rais.ornl.gov/).
(2) USEPA, 2005: Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA), Appendix A-2: Human Health Risk Assessment Protocol, EPA520-R-05-006, September 2005.
(3) Calculated using Equation 5.

**Table 3**

**Calculation of Deposition Term in Untilled Soil at Receptor Locations**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Estimated Leachable Metals Composition in Dust (1) (%) | Units Conversion Factor CF ($mg\text{-}m^2/kg\text{-}cm^2$) | Annual Deposition Rate of Leachable Metals Sensitive Receptor R7 Dr (2) ($g/m^2$-yr) | Annual Deposition Rate of Leachable Metals Road Section R1 Dr (3) ($g/m^2$-yr) | Annual Deposition Rate of Leachable Metals Ferry Lake Watershed Dr (4) ($g/m^2$-yr) | Deposition Term for Leachable Metals Untilled Sensitive Receptor R7 Ds (5) (mg/kg-yr) | Deposition Term for Leachable Metals Untilled Road Section R1 Ds (5) (mg/kg-yr) | Deposition Term for Leachable Metals Untilled Ferry Lake Watershed Ds (5) (mg/kg-yr) |
|---|---|---|---|---|---|---|---|---|
| **Dust Annual Deposition Rate (as total particulate) ($g/m^2$-yr) =** | | | **74.8** | **206.1** | **10.5** | **74.8** | **206.1** | **10.5** |
| **Metals** | | | | | | | | |
| Aluminum | 1.01E-04 | 1.00E+02 | 7.58E-05 | 2.09E-04 | 1.06E-05 | 2.71E-03 | 7.46E-03 | 3.80E-04 |
| Antimony | 1.33E-07 | 1.00E+02 | 9.97E-08 | 2.75E-07 | 1.40E-08 | 3.56E-06 | 9.81E-06 | 5.00E-07 |
| Arsenic | 2.73E-07 | 1.00E+02 | 2.04E-07 | 5.62E-07 | 2.86E-08 | 7.29E-06 | 2.01E-05 | 1.02E-06 |
| Barium | 1.17E-06 | 1.00E+02 | 8.78E-07 | 2.42E-06 | 1.23E-07 | 3.13E-05 | 8.64E-05 | 4.40E-06 |
| Beryllium | 1.64E-07 | 1.00E+02 | 1.23E-07 | 3.38E-07 | 1.72E-08 | 4.38E-06 | 1.21E-05 | 6.14E-07 |
| Boron | 3.00E-06 | 1.00E+02 | 2.24E-06 | 6.18E-06 | 3.15E-07 | 8.01E-05 | 2.21E-04 | 1.13E-05 |
| Cadmium | 1.50E-08 | 1.00E+02 | 1.12E-08 | 3.09E-08 | 1.58E-09 | 4.01E-07 | 1.10E-06 | 5.63E-08 |
| Chromium Total | 2.82E-07 | 1.00E+02 | 2.11E-07 | 5.80E-07 | 2.96E-08 | 7.52E-06 | 2.07E-05 | 1.06E-06 |
| Cobalt | 1.91E-08 | 1.00E+02 | 1.43E-08 | 3.94E-08 | 2.01E-09 | 5.11E-07 | 1.41E-06 | 7.17E-08 |
| Copper | 1.49E-07 | 1.00E+02 | 1.12E-07 | 3.08E-07 | 1.57E-08 | 3.99E-06 | 1.10E-05 | 5.60E-07 |
| Iron | 6.77E-06 | 1.00E+02 | 5.07E-06 | 1.40E-05 | 7.11E-07 | 1.81E-04 | 4.99E-04 | 2.54E-05 |
| Lead | 9.04E-09 | 1.00E+02 | 6.77E-09 | 1.86E-08 | 9.50E-10 | 2.42E-07 | 6.66E-07 | 3.39E-08 |
| Magnesium | 5.90E-04 | 1.00E+02 | 4.42E-04 | 1.22E-03 | 6.20E-05 | 1.58E-02 | 4.35E-02 | 2.21E-03 |
| Manganese | 2.15E-06 | 1.00E+02 | 1.61E-06 | 4.44E-06 | 2.26E-07 | 5.75E-05 | 1.59E-04 | 8.08E-06 |
| Mercury | 1.50E-08 | 1.00E+02 | 1.12E-08 | 3.09E-08 | 1.58E-09 | 4.01E-07 | 1.10E-06 | 5.63E-08 |
| Molybdenum | 6.59E-07 | 1.00E+02 | 4.93E-07 | 1.36E-06 | 6.92E-08 | 1.76E-05 | 4.85E-05 | 2.47E-06 |
| Nickel | 1.08E-07 | 1.00E+02 | 8.11E-08 | 2.24E-07 | 1.14E-08 | 2.90E-06 | 7.98E-06 | 4.07E-07 |
| Selenium | 4.51E-07 | 1.00E+02 | 3.37E-07 | 9.30E-07 | 4.74E-08 | 1.20E-05 | 3.32E-05 | 1.69E-06 |
| Silver | 1.43E-08 | 1.00E+02 | 1.07E-08 | 2.95E-08 | 1.50E-09 | 3.82E-07 | 1.05E-06 | 5.37E-08 |
| Strontium | 4.87E-06 | 1.00E+02 | 3.64E-06 | 1.00E-05 | 5.12E-07 | 1.30E-04 | 3.59E-04 | 1.83E-05 |
| Thallium | 3.00E-08 | 1.00E+02 | 2.24E-08 | 6.18E-08 | 3.15E-09 | 8.01E-07 | 2.21E-06 | 1.13E-07 |
| Vanadium | 9.91E-07 | 1.00E+02 | 7.41E-07 | 2.04E-06 | 1.04E-07 | 2.65E-05 | 7.29E-05 | 3.71E-06 |
| Zinc | 2.34E-06 | 1.00E+02 | 1.75E-06 | 4.82E-06 | 2.45E-07 | 6.25E-05 | 1.72E-04 | 8.77E-06 |
| Uranium | 4.65E-08 | 1.00E+02 | 3.48E-08 | 9.58E-08 | 4.88E-09 | 1.24E-06 | 3.42E-06 | 1.74E-07 |

Notes:

(1) Estimated metals COC composition in dust emitted from the Haul Road based on de-ionized water extraction test results, as described in Section 2 and presented in Table A.2.
(2) Annual deposition rate of leachable metals determined as the annual dust deposition rate (as total particulate) at Sensitive Receptor R7 multiplied by the estimated leachable metals COC composition in dust.
(3) Annual deposition rate of leachable metals determined as the annual dust deposition rate (as total particulate) at Road Section R1 multiplied by the estimated leachable metals COC composition in dust.
(4) Annual deposition rate of leachable metals determined as the annual dust deposition rate (as total particulate) at Sensitive Receptor R8 (representative of Ferry Lake Watershed) multiplied by the estimated leachable metals COC composition in dust.
(5) Calculated using Equation 3.

**Table 4**

**Estimated Maximum Leachable Soil Metals COCs Concentrations Due To Haul Road Dust Deposition at Receptor Locations**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Deposition Time Period tD (yr) | COC Soil Loss Constant All Processes Untilled ks (1) ($yr^{-1}$) | Maximum Leachable Soil Concentration at Time tD Sensitive Receptor R7 Cs (2) (mg/kg) | Maximum Leachable Soil Concentration at Time tD Road Section R1 Cs (2) (mg/kg) | Maximum Leachable Soil Concentration at Time tD Ferry Lake Watershed Cs (2) (mg/kg) |
|---|---|---|---|---|---|
| **Metals** | | | | | |
| Aluminum | 9.00E+00 | 6.46E-03 | 2.37E-02 | 6.52E-02 | 3.32E-03 |
| Antimony | 9.00E+00 | 2.15E-01 | 1.42E-05 | 3.91E-05 | 1.99E-06 |
| Arsenic | 9.00E+00 | 3.33E-01 | 2.08E-05 | 5.73E-05 | 2.92E-06 |
| Barium | 9.00E+00 | 2.36E-01 | 1.17E-04 | 3.23E-04 | 1.64E-05 |
| Beryllium | 9.00E+00 | 1.23E-02 | 3.73E-05 | 1.03E-04 | 5.23E-06 |
| Boron | 9.00E+00 | 3.09E+00 | 2.60E-05 | 7.16E-05 | 3.65E-06 |
| Cadmium | 9.00E+00 | 1.29E-01 | 2.13E-06 | 5.88E-06 | 2.99E-07 |
| Chromium Total | 9.00E+00 | 5.07E-01 | 1.47E-05 | 4.05E-05 | 2.06E-06 |
| Cobalt | 9.00E+00 | 2.15E-01 | 2.03E-06 | 5.61E-06 | 2.86E-07 |
| Copper | 9.00E+00 | 2.76E-01 | 1.32E-05 | 3.65E-05 | 1.86E-06 |
| Iron | 9.00E+00 | 3.86E-01 | 4.55E-04 | 1.25E-03 | 6.38E-05 |
| Lead | 9.00E+00 | 1.08E-02 | 2.07E-06 | 5.71E-06 | 2.91E-07 |
| Magnesium | 9.00E+00 | 2.09E+00 | 7.55E-03 | 2.08E-02 | 1.06E-03 |
| Manganese | 9.00E+00 | 1.49E-01 | 2.85E-04 | 7.86E-04 | 4.00E-05 |
| Mercury | 9.00E+00 | 3.68E+00 | 1.09E-07 | 3.00E-07 | 1.53E-08 |
| Molybdenum | 9.00E+00 | 4.81E-01 | 3.61E-05 | 9.94E-05 | 5.06E-06 |
| Nickel | 9.00E+00 | 1.49E-01 | 1.44E-05 | 3.96E-05 | 2.02E-06 |
| Selenium | 9.00E+00 | 1.89E+00 | 6.39E-06 | 1.76E-05 | 8.97E-07 |
| Silver | 9.00E+00 | 1.15E+00 | 3.33E-07 | 9.17E-07 | 4.67E-08 |
| Strontium | 9.00E+00 | 2.76E-01 | 4.32E-04 | 1.19E-03 | 6.07E-05 |
| Thallium | 9.00E+00 | 1.36E-01 | 4.16E-06 | 1.14E-05 | 5.83E-07 |
| Vanadium | 9.00E+00 | 9.70E-03 | 2.28E-04 | 6.28E-04 | 3.20E-05 |
| Zinc | 9.00E+00 | 1.56E-01 | 3.02E-04 | 8.32E-04 | 4.24E-05 |
| Uranium | 9.00E+00 | 2.15E-02 | 1.02E-05 | 2.80E-05 | 1.43E-06 |

Notes:

(1) Set equal to the soil loss term due to surface runoff in Table 2, as described in Section 3.
(2) Calculated using Equation 2.

**Table 5**

**Estimated Maximum Soil Leachate and Surface Water Runoff Metals COCs Concentrations Due To Haul Road Dust Deposition at Sensitive Receptor R7 and Road Section R1**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Maximum Leachable Soil Concentration at Time tD Sensitive Receptor R7 Cs (1) (mg/kg) | Maximum Leachable Soil Concentration at Time tD Road Section R1 Cs (1) (mg/kg) | Soil-water Partitioning Coefficient $Kd_s$(2) (mL/g) | Maximum Soil Leachate Concentration $C_w$ (3) (µg/L) | Maximum Soil Surface Water Runoff Concentration $C_w$ (3) (µg/L) | Applicable Potable Groundwater Criteria (µg/L) | Source (4) | Applicable Potable Surface Water Criteria (µg/L) | Source (5) |
|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | |
| Aluminum | 2.37E-02 | 6.52E-02 | 1.50E+03 | 1.58E-02 | 4.35E-02 | 20,000 | c) | 5 | b) |
| Antimony | 1.42E-05 | 3.91E-05 | 4.50E+01 | 3.14E-04 | 8.66E-04 | 6 | a) | 6 | a) |
| Arsenic | 2.08E-05 | 5.73E-05 | 2.90E+01 | 7.14E-04 | 1.97E-03 | 10 | a) | 5 | b) |
| Barium | 1.17E-04 | 3.23E-04 | 4.10E+01 | 2.85E-03 | 7.84E-03 | 1000 | a) | 1000 | a) |
| Beryllium | 3.73E-05 | 1.03E-04 | 7.90E+02 | 4.72E-05 | 1.30E-04 | 4 | a) | 4 | a) |
| Boron | 2.60E-05 | 7.16E-05 | 3.00E+00 | 8.26E-03 | 2.28E-02 | 5000 | a) | 1500 | b) |
| Cadmium | 2.13E-06 | 5.88E-06 | 7.50E+01 | 2.84E-05 | 7.82E-05 | 5 | a) | 0.09 | b) |
| Chromium Total | 1.47E-05 | 4.05E-05 | 1.90E+01 | 7.68E-04 | 2.11E-03 | 50 | a) | 50 | a) |
| Cobalt | 2.03E-06 | 5.61E-06 | 4.50E+01 | 4.51E-05 | 1.24E-04 | 10 | a) | 10 | a) |
| Copper | 1.32E-05 | 3.65E-05 | 3.50E+01 | 3.77E-04 | 1.04E-03 | 1000 | a) | 2 | b) |
| Iron | 4.55E-04 | 1.25E-03 | 2.50E+01 | 1.81E-02 | 4.98E-02 | 300 | a) | 300 | b) |
| Lead | 2.07E-06 | 5.71E-06 | 9.00E+02 | 2.30E-06 | 6.34E-06 | 5 | b) | 1 | b) |
| Magnesium | 7.55E-03 | 2.08E-02 | 4.50E+00 | 1.63E+00 | 4.48E+00 | None Required | b) | None Required | b) |
| Manganese | 2.85E-04 | 7.86E-04 | 6.50E+01 | 4.38E-03 | 1.21E-02 | 50 | a) | 50 | a) |
| Mercury | 1.09E-07 | 3.00E-07 | 3.30E+03 | 3.30E-08 | 9.10E-08 | 1 | a) | 0.026 | b) |
| Molybdenum | 3.61E-05 | 9.94E-05 | 2.00E+01 | 1.79E-03 | 4.94E-03 | 70 | a) | 70 | a) |
| Nickel | 1.44E-05 | 3.96E-05 | 6.50E+01 | 2.21E-04 | 6.08E-04 | 100 | a) | 25 | b) |
| Selenium | 6.39E-06 | 1.76E-05 | 5.00E+00 | 1.24E-03 | 3.42E-03 | 10 | a) | 1 | b) |
| Silver | 3.33E-07 | 9.17E-07 | 8.30E+00 | 3.94E-05 | 1.09E-04 | 100 | a) | 0.25 | b) |
| Strontium | 4.32E-04 | 1.19E-03 | 3.50E+01 | 1.23E-02 | 3.39E-02 | 4400 | a) | 4400 | a) |
| Thallium | 4.16E-06 | 1.14E-05 | 7.10E+01 | 5.84E-05 | 1.61E-04 | 2 | a) | 0.8 | b) |
| Vanadium | 2.28E-04 | 6.28E-04 | 1.00E+03 | 2.28E-04 | 6.28E-04 | 6.2 | a) | 6.2 | a) |
| Zinc | 3.02E-04 | 8.32E-04 | 6.20E+01 | 4.86E-03 | 1.34E-02 | 5000 | a) | 7 | b) |
| Uranium | 1.02E-05 | 2.80E-05 | 4.50E+02 | 2.26E-05 | 6.22E-05 | 20 | b) | 15 | b) |

Notes:

(1) From Table 4.
(2) From Table 2.
(3) Calculated using Equation 6.
(4) Potable groundwater criteria obtained from:
a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.
b) Health Canada, 2019: Guidelines for Canadian Drinking Water Quality, Summary Table, Maximum Acceptable Concentration (MAC), June.
c) USEPA, 2019: Tapwater Regional Screening Level, April (https://semspub.epa.gov/work/HQ/199432.pdf).
None Required - Magnesium is an essential nutrient.
(5) Potable surface water criteria obtained from:
a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.
b) CCME, 2020: Water Quality Guidelines for the Protection of Aquatic Life

**Table 6**

**Estimated Average Metals COCs Load from Direct Deposition onto Ferry Lake**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Annual Deposition Rate of Leachable Metals Ferry Lake Watershed Dr (1) ($g/m^2$-yr) | Water Body Surface Area $A_w$ (2) ($m^2$) | Total Direct Depostion of Metals COCs Load onto Ferry Lake $L_{DEP}$ (3) (g/yr) |
|---|---|---|---|
| **Metals** | | | |
| Aluminum | 1.06E-05 | 8.18E+05 | 8.70E+00 |
| Antimony | 1.40E-08 | 8.18E+05 | 1.15E-02 |
| Arsenic | 2.86E-08 | 8.18E+05 | 2.34E-02 |
| Barium | 1.23E-07 | 8.18E+05 | 1.01E-01 |
| Beryllium | 1.72E-08 | 8.18E+05 | 1.41E-02 |
| Boron | 3.15E-07 | 8.18E+05 | 2.58E-01 |
| Cadmium | 1.58E-09 | 8.18E+05 | 1.29E-03 |
| Chromium Total | 2.96E-08 | 8.18E+05 | 2.42E-02 |
| Cobalt | 2.01E-09 | 8.18E+05 | 1.64E-03 |
| Copper | 1.57E-08 | 8.18E+05 | 1.28E-02 |
| Iron | 7.11E-07 | 8.18E+05 | 5.82E-01 |
| Lead | 9.50E-10 | 8.18E+05 | 7.77E-04 |
| Magnesium | 6.20E-05 | 8.18E+05 | 5.07E+01 |
| Manganese | 2.26E-07 | 8.18E+05 | 1.85E-01 |
| Mercury | 1.58E-09 | 8.18E+05 | 1.29E-03 |
| Molybdenum | 6.92E-08 | 8.18E+05 | 5.66E-02 |
| Nickel | 1.14E-08 | 8.18E+05 | 9.32E-03 |
| Selenium | 4.74E-08 | 8.18E+05 | 3.87E-02 |
| Silver | 1.50E-09 | 8.18E+05 | 1.23E-03 |
| Strontium | 5.12E-07 | 8.18E+05 | 4.19E-01 |
| Thallium | 3.15E-09 | 8.18E+05 | 2.58E-03 |
| Vanadium | 1.04E-07 | 8.18E+05 | 8.51E-02 |
| Zinc | 2.45E-07 | 8.18E+05 | 2.01E-01 |
| Uranium | 4.88E-09 | 8.18E+05 | 3.99E-03 |

Notes:

(1) From Table 3.
(2) Ferry Lake surface area.
(3) Calculated using Equation 8.

**Table 7**

**Estimated Average Annual Metals COCs Surface Water Runoff Load to Ferry Lake**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Maximum Leachable Soil Concentration at Time tD Ferry Lake Watershed $C_s$ (1) (mg/kg) | Soil-water Partitioning Coefficient $Kd_s$(2) (mL/g) | Watershed Area Receiving Metals COCs Deposition $A_L$ (3) ($m^2$) | Average Annual Surface Water Runoff Metals COCs Load $L_R$ (4) (g/yr) |
|---|---|---|---|---|
| **Metals** | | | | |
| Aluminum | 3.32E-03 | 1.50E+03 | 6.11E+06 | 3.67E+00 |
| Antimony | 1.99E-06 | 4.50E+01 | 6.11E+06 | 7.32E-02 |
| Arsenic | 2.92E-06 | 2.90E+01 | 6.11E+06 | 1.66E-01 |
| Barium | 1.64E-05 | 4.10E+01 | 6.11E+06 | 6.63E-01 |
| Beryllium | 5.23E-06 | 7.90E+02 | 6.11E+06 | 1.10E-02 |
| Boron | 3.65E-06 | 3.00E+00 | 6.11E+06 | 1.93E+00 |
| Cadmium | 2.99E-07 | 7.50E+01 | 6.11E+06 | 6.61E-03 |
| Chromium Total | 2.06E-06 | 1.90E+01 | 6.11E+06 | 1.79E-01 |
| Cobalt | 2.86E-07 | 4.50E+01 | 6.11E+06 | 1.05E-02 |
| Copper | 1.86E-06 | 3.50E+01 | 6.11E+06 | 8.78E-02 |
| Iron | 6.38E-05 | 2.50E+01 | 6.11E+06 | 4.21E+00 |
| Lead | 2.91E-07 | 9.00E+02 | 6.11E+06 | 5.36E-04 |
| Magnesium | 1.06E-03 | 4.50E+00 | 6.11E+06 | 3.79E+02 |
| Manganese | 4.00E-05 | 6.50E+01 | 6.11E+06 | 1.02E+00 |
| Mercury | 1.53E-08 | 3.30E+03 | 6.11E+06 | 7.70E-06 |
| Molybdenum | 5.06E-06 | 2.00E+01 | 6.11E+06 | 4.17E-01 |
| Nickel | 2.02E-06 | 6.50E+01 | 6.11E+06 | 5.14E-02 |
| Selenium | 8.97E-07 | 5.00E+00 | 6.11E+06 | 2.89E-01 |
| Silver | 4.67E-08 | 8.30E+00 | 6.11E+06 | 9.19E-03 |
| Strontium | 6.07E-05 | 3.50E+01 | 6.11E+06 | 2.87E+00 |
| Thallium | 5.83E-07 | 7.10E+01 | 6.11E+06 | 1.36E-02 |
| Vanadium | 3.20E-05 | 1.00E+03 | 6.11E+06 | 5.31E-02 |
| Zinc | 4.24E-05 | 6.20E+01 | 6.11E+06 | 1.13E+00 |
| Uranium | 1.43E-06 | 4.50E+02 | 6.11E+06 | 5.26E-03 |

Notes:

(1) From Table 4.
(2) From Table 2.
(3) Ferry Lake watershed area receiving metals COCs deposition contributing to surface water runoff load, equal to the total area of the watershed minus the area of major surface water bodies that receive direct dust deposition.
(4) Calculated using Equation 9.

**Table 8**

**Estimated Average Annual Metals COCs Soil Erosion Load to Ferry Lake**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Maximum Leachable Soil Concentration at Time tD Ferry Lake Watershed $C_s$ (1) (mg/kg) | Soil-water Partitioning Coefficient $Kd_s$ (2) (mL/g) | Unit Soil Loss $X_E$ (3) (kg/m$^2$-yr) | Sediment Delivery Ratio SD (4) (unitless) | Average Annual Soil Erosion COC Load $L_E$ (5) (g/yr) |
|---|---|---|---|---|---|
| **Metals** | | | | | |
| Aluminum | 3.32E-03 | 1.50E+03 | 3.93E+00 | 1.99E-01 | 1.59E+01 |
| Antimony | 1.99E-06 | 4.50E+01 | 3.93E+00 | 1.99E-01 | 9.47E-03 |
| Arsenic | 2.92E-06 | 2.90E+01 | 3.93E+00 | 1.99E-01 | 1.39E-02 |
| Barium | 1.64E-05 | 4.10E+01 | 3.93E+00 | 1.99E-01 | 7.82E-02 |
| Beryllium | 5.23E-06 | 7.90E+02 | 3.93E+00 | 1.99E-01 | 2.50E-02 |
| Boron | 3.65E-06 | 3.00E+00 | 3.93E+00 | 1.99E-01 | 1.66E-02 |
| Cadmium | 2.99E-07 | 7.50E+01 | 3.93E+00 | 1.99E-01 | 1.43E-03 |
| Chromium Total | 2.06E-06 | 1.90E+01 | 3.93E+00 | 1.99E-01 | 9.77E-03 |
| Cobalt | 2.86E-07 | 4.50E+01 | 3.93E+00 | 1.99E-01 | 1.36E-03 |
| Copper | 1.86E-06 | 3.50E+01 | 3.93E+00 | 1.99E-01 | 8.84E-03 |
| Iron | 6.38E-05 | 2.50E+01 | 3.93E+00 | 1.99E-01 | 3.03E-01 |
| Lead | 2.91E-07 | 9.00E+02 | 3.93E+00 | 1.99E-01 | 1.39E-03 |
| Magnesium | 1.06E-03 | 4.50E+00 | 3.93E+00 | 1.99E-01 | 4.90E+00 |
| Manganese | 4.00E-05 | 6.50E+01 | 3.93E+00 | 1.99E-01 | 1.91E-01 |
| Mercury | 1.53E-08 | 3.30E+03 | 3.93E+00 | 1.99E-01 | 7.31E-05 |
| Molybdenum | 5.06E-06 | 2.00E+01 | 3.93E+00 | 1.99E-01 | 2.40E-02 |
| Nickel | 2.02E-06 | 6.50E+01 | 3.93E+00 | 1.99E-01 | 9.61E-03 |
| Selenium | 8.97E-07 | 5.00E+00 | 3.93E+00 | 1.99E-01 | 4.16E-03 |
| Silver | 4.67E-08 | 8.30E+00 | 3.93E+00 | 1.99E-01 | 2.19E-04 |
| Strontium | 6.07E-05 | 3.50E+01 | 3.93E+00 | 1.99E-01 | 2.89E-01 |
| Thallium | 5.83E-07 | 7.10E+01 | 3.93E+00 | 1.99E-01 | 2.78E-03 |
| Vanadium | 3.20E-05 | 1.00E+03 | 3.93E+00 | 1.99E-01 | 1.53E-01 |
| Zinc | 4.24E-05 | 6.20E+01 | 3.93E+00 | 1.99E-01 | 2.02E-01 |
| Uranium | 1.43E-06 | 4.50E+02 | 3.93E+00 | 1.99E-01 | 6.81E-03 |

Notes:

(1) From Table 4.
(2) From Table 2.
(3) Calculated using Equation 11.
(4) Calculated using Equation 12.
(5) Calculated using Equation 10.

**Table 9**

**Estimated Average Annual Maximum Metals COCs Concentrations in Ferry Lake Surface Water**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

| Contaminant of Concern (COC) | Total Direct Deposition COC Load to Ferry Lake $L_{DEP}$ (1) (g/yr) | Average Annual Surface Water Runoff COC Load $L_R$ (2) (g/yr) | Average Annual Soil Erosion COC Load $L_E$ (3) (g/yr) | Total Average Annual COC Load to Ferry Lake $L_T$ (4) (g/yr) | Fraction of Total COC Concentration in Water Column $f_{wc}$ (5) (unitless) | Average Annual COC Concentration in Ferry Lake Surface Water $C_{wtot}$ (6) (µg/L) | Applicable Potable Groundwater Criteria (µg/L) | Source (7) | Applicable Potable Surface Water Criteria (µg/L) | Source (8) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | |
| Aluminum | 8.70E+00 | 3.67E+00 | 1.59E+01 | 2.82E+01 | 3.69E-02 | 3.26E-01 | 20,000 | c) | 5 | b) |
| Antimony | 1.15E-02 | 7.32E-02 | 9.47E-03 | 9.41E-02 | 5.54E-01 | 7.23E-05 | 6 | a) | 6 | a) |
| Arsenic | 2.34E-02 | 1.66E-01 | 1.39E-02 | 2.04E-01 | 6.57E-01 | 1.32E-04 | 10 | a) | 5 | b) |
| Barium | 1.01E-01 | 6.63E-01 | 7.82E-02 | 8.42E-01 | 5.77E-01 | 6.21E-04 | 1000 | a) | 1000 | a) |
| Beryllium | 1.41E-02 | 1.10E-02 | 2.50E-02 | 5.00E-02 | 6.74E-02 | 3.16E-04 | 4 | a) | 4 | a) |
| Boron | 2.58E-01 | 1.93E+00 | 1.66E-02 | 2.20E+00 | 9.40E-01 | 9.96E-04 | 5000 | a) | 1500 | b) |
| Cadmium | 1.29E-03 | 6.61E-03 | 1.43E-03 | 9.33E-03 | 4.29E-01 | 9.27E-06 | 5 | a) | 0.09 | b) |
| Chromium Total | 2.42E-02 | 1.79E-01 | 9.77E-03 | 2.13E-01 | 7.43E-01 | 1.22E-04 | 50 | a) | 50 | a) |
| Cobalt | 1.64E-03 | 1.05E-02 | 1.36E-03 | 1.35E-02 | 5.54E-01 | 1.04E-05 | 10 | a) | 10 | a) |
| Copper | 1.28E-02 | 8.78E-02 | 8.84E-03 | 1.09E-01 | 6.14E-01 | 7.59E-05 | 1000 | a) | 2 | b) |
| Iron | 5.82E-01 | 4.21E+00 | 3.03E-01 | 5.10E+00 | 6.89E-01 | 3.15E-03 | 300 | a) | 300 | b) |
| Lead | 7.77E-04 | 5.36E-04 | 1.39E-03 | 2.70E-03 | 5.97E-02 | 1.93E-05 | 5 | b) | 1 | b) |
| Magnesium | 5.07E+01 | 3.79E+02 | 4.90E+00 | 4.35E+02 | 9.17E-01 | 2.02E-01 | None Required | b) | None Required | b) |
| Manganese | 1.85E-01 | 1.02E+00 | 1.91E-01 | 1.40E+00 | 4.64E-01 | 1.28E-03 | 50 | a) | 50 | a) |
| Mercury | 1.29E-03 | 7.70E-06 | 7.31E-05 | 1.37E-03 | 1.74E-02 | 3.34E-05 | 1 | a) | 0.026 | b) |
| Molybdenum | 5.66E-02 | 4.17E-01 | 2.40E-02 | 4.98E-01 | 7.33E-01 | 2.89E-04 | 70 | a) | 70 | a) |
| Nickel | 9.32E-03 | 5.14E-02 | 9.61E-03 | 7.03E-02 | 4.64E-01 | 6.45E-05 | 100 | a) | 25 | b) |
| Selenium | 3.87E-02 | 2.89E-01 | 4.16E-03 | 3.32E-01 | 9.10E-01 | 1.55E-04 | 10 | a) | 1 | b) |
| Silver | 1.23E-03 | 9.19E-03 | 2.19E-04 | 1.06E-02 | 8.64E-01 | 5.24E-06 | 100 | a) | 0.25 | b) |
| Strontium | 4.19E-01 | 2.87E+00 | 2.89E-01 | 3.57E+00 | 6.14E-01 | 2.48E-03 | 4400 | a) | 4400 | a) |
| Thallium | 2.58E-03 | 1.36E-02 | 2.78E-03 | 1.90E-02 | 4.42E-01 | 1.83E-05 | 2 | a) | 0.8 | b) |
| Vanadium | 8.51E-02 | 5.31E-02 | 1.53E-01 | 2.91E-01 | 5.41E-02 | 2.29E-03 | 6.2 | a) | 6.2 | a) |
| Zinc | 2.01E-01 | 1.13E+00 | 2.02E-01 | 1.53E+00 | 4.75E-01 | 1.37E-03 | 5000 | a) | 7 | b) |
| Uranium | 3.99E-03 | 5.26E-03 | 6.81E-03 | 1.61E-02 | 1.12E-01 | 6.10E-05 | 20 | b) | 15 | b) |

Notes:

(1) From Table 6.
(2) From Table 7.
(3) From Table 8.
(4) Calculated using Equation 7.
(5) Calculated using Equation 14.
(6) Calculated using Equation 13.
(7) Potable groundwater criteria obtained from:
a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.
b) Health Canada, 2019: Guidelines for Canadian Drinking Water Quality, Summary Table, Maximum Acceptable Concentration (MAC), June.
c) USEPA, 2019: Tapwater Regional Screening Level, April (https://semspub.epa.gov/work/HQ/199432.pdf).
None Required - Magnesium is an essential nutrient.
(8) Potable surface water criteria obtained from:
a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.
b) CCME, 2020: Water Quality Guidelines for the Protection of Aquatic Life

# Attachment A

**Table A.1**

**De-Ionized Water and Acid Extraction Test Results - Touquoy Mine Site Waste Rock Samples**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

**DE-IONIZED WATER EXTRACTION (SHAKE FLASK EXTRACTION) TEST RESULTS - DETECTED LEACHATE CONCENTRATION**

| Sample Label | Sulfate (SO4) | Ag | Al | As | B | Ba | Be | Bi | Ca | Cd | Co | Cr | Cu | Fe | Hg | K | Mg | Mn | Mo | Na | Ni | P | Pb | Sb | Se | Sr | Ti | Tl | U | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| 090-18-17-02 | 36 | <0.00005 | 0.49 | 0.087 | <0.01 | 0.0015 | <0.0005 | <0.0005 | 14 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 11 | 0.98 | 0.0029 | 0.0011 | 1.4 | <0.0005 | <0.3 | <0.0001 | 0.00093 | 0.00056 | 0.031 | <0.01 | <0.0001 | 0.00011 | 0.0012 | <0.01 |
| 090-18-17-03 | 52 | <0.00005 | 0.42 | 0.040 | <0.01 | 0.0019 | <0.0005 | <0.0005 | 19 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 13 | 1.4 | 0.0066 | 0.0012 | 2.0 | <0.0005 | <0.3 | <0.0001 | 0.00053 | <0.0005 | 0.037 | <0.01 | <0.0001 | 0.00015 | <0.001 | <0.01 |
| 090-2018-08LG-01 | 37 | <0.00005 | 0.38 | 0.019 | <0.01 | 0.0013 | <0.0005 | <0.0005 | 13 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 11 | 1.5 | 0.010 | 0.0011 | 2.4 | <0.0005 | <0.3 | <0.0001 | 0.00011 | <0.0005 | 0.026 | <0.01 | <0.0001 | 0.000072 | <0.001 | <0.01 |
| 090-2018-08LG-02 | 32 | <0.00005 | 0.41 | 0.027 | <0.01 | 0.0011 | <0.0005 | <0.0005 | 13 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 6.1 | 0.90 | 0.0089 | 0.0012 | 2.4 | <0.0005 | <0.3 | <0.0001 | 0.00015 | <0.0005 | 0.026 | <0.01 | <0.0001 | 0.000073 | <0.001 | <0.01 |
| 090-2018-08LG-03 | 44 | <0.00005 | 0.43 | 0.047 | <0.01 | 0.0015 | <0.0005 | <0.0005 | 15 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 15 | 1.8 | 0.0067 | 0.0018 | 2.9 | <0.0005 | <0.3 | <0.0001 | 0.00027 | <0.0005 | 0.029 | <0.01 | <0.0001 | 0.00015 | <0.001 | <0.01 |
| 090-MW07-01 | 23 | <0.00005 | 0.50 | 0.030 | <0.01 | 0.0011 | <0.0005 | <0.0005 | 8.7 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 13 | 1.4 | 0.0085 | 0.00070 | 1.5 | <0.0005 | <0.3 | <0.0001 | 0.00024 | <0.0005 | 0.015 | <0.01 | <0.0001 | 0.000045 | <0.001 | <0.01 |
| 090MW07-02 | 33 | <0.00005 | 0.42 | 0.028 | <0.01 | 0.0012 | <0.0005 | <0.0005 | 12 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 13 | 1.7 | 0.0095 | 0.00081 | 1.7 | <0.0005 | <0.3 | <0.0001 | 0.00028 | <0.0005 | 0.019 | <0.01 | <0.0001 | 0.000065 | <0.001 | <0.01 |
| 090NW09-02 | 53 | <0.00005 | 0.34 | 0.055 | <0.01 | 0.0023 | <0.0005 | <0.0005 | 15 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 26 | 2.2 | 0.0086 | 0.0034 | 3.1 | <0.0005 | <0.3 | <0.0001 | 0.00049 | <0.0005 | 0.030 | <0.01 | <0.0001 | 0.00015 | 0.0011 | <0.01 |
| 09MW09-01 | 25 | <0.00005 | 0.43 | 0.028 | <0.01 | 0.0014 | <0.0005 | <0.0005 | 10 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 11 | 1.5 | 0.0087 | 0.00053 | 1.5 | <0.0005 | <0.3 | <0.0001 | 0.00021 | <0.0005 | 0.019 | <0.01 | <0.0001 | 0.000069 | <0.001 | <0.01 |
| 100-2018-26-01 | 23 | <0.00005 | 0.60 | 0.14 | <0.01 | <0.001 | <0.0005 | <0.0005 | 8.9 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 20 | 1.4 | 0.0042 | 0.0032 | 3.4 | <0.0005 | <0.3 | <0.0001 | 0.00038 | <0.0005 | 0.018 | <0.01 | <0.0001 | 0.00012 | 0.0021 | <0.01 |
| 100-2018-26-02 | 39 | <0.00005 | 0.52 | 0.044 | <0.01 | 0.0012 | <0.0005 | <0.0005 | 13 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 19 | 1.7 | 0.0062 | 0.0018 | 2.7 | <0.0005 | <0.3 | <0.0001 | 0.00040 | <0.0005 | 0.026 | <0.01 | <0.0001 | 0.000087 | 0.0014 | <0.01 |
| 105-48-MW-01 | 77.9 | <0.00005 | 0.268 | 0.111 | <0.01 | 0.0024 | <0.0005 | <0.0005 | 23.9 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 19.6 | 3.22 | 0.0272 | 0.00667 | 3.85 | <0.0005 | <0.3 | <0.0001 | 0.00134 | <0.0005 | 0.0396 | <0.01 | <0.0001 | 0.000246 | <0.001 | <0.01 |
| 105-48MW-02 | 106 | <0.00005 | 0.191 | 0.151 | <0.01 | 0.0034 | <0.0005 | <0.0005 | 39.1 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 15.4 | 3.92 | 0.0335 | 0.00162 | 3.42 | <0.0005 | <0.3 | <0.0001 | 0.00107 | <0.0005 | 0.0597 | <0.01 | <0.0001 | 0.000277 | <0.001 | <0.01 |
| 105-48MW-03 | 83.4 | <0.00005 | 0.251 | 0.215 | <0.01 | 0.0013 | <0.0005 | <0.0005 | 25.9 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 12.5 | 4.21 | 0.0188 | 0.00150 | 3.38 | <0.0005 | <0.3 | <0.0001 | 0.00053 | <0.0005 | 0.0462 | <0.01 | <0.0001 | 0.000172 | <0.001 | <0.01 |
| 105-49MG-01 | 87 | <0.00005 | 0.23 | 0.112 | <0.01 | 0.0023 | <0.0005 | <0.0005 | 30.6 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 17.4 | 2.21 | 0.0194 | 0.00158 | 3.07 | <0.0005 | <0.3 | <0.0001 | 0.00045 | <0.0005 | 0.0444 | <0.01 | <0.0001 | 0.000184 | <0.001 | <0.01 |
| 105-49MG-03 | 49.5 | <0.00005 | 0.298 | 0.0791 | <0.01 | 0.0018 | <0.0005 | <0.0005 | 19.1 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 15.5 | 1.65 | 0.0110 | 0.00166 | 2.29 | <0.0005 | <0.3 | <0.0001 | 0.00089 | <0.0005 | 0.0344 | <0.01 | <0.0001 | 0.000134 | <0.001 | <0.01 |
| 108-18-19-04 | 28 | <0.00005 | 0.60 | 0.026 | <0.01 | 0.0011 | <0.0005 | <0.0005 | 10.0 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 14 | 1.5 | 0.0048 | 0.00086 | 2.9 | <0.0005 | <0.3 | <0.0001 | 0.00030 | <0.0005 | 0.025 | <0.01 | <0.0001 | 0.00011 | 0.0010 | <0.01 |
| 110-2018-08MW-02 | 117 | <0.00005 | 0.14 | 0.019 | <0.01 | 0.0049 | <0.0005 | <0.0005 | 40 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 10.0 | 2.7 | 0.024 | 0.0026 | 2.8 | <0.0005 | <0.3 | <0.0001 | 0.00037 | 0.00058 | 0.14 | <0.01 | <0.0001 | 0.00029 | <0.001 | <0.01 |
| 110-2018-08MW-03 | 78 | <0.00005 | 0.28 | 0.025 | <0.01 | 0.0024 | <0.0005 | <0.0005 | 25 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 13 | 1.5 | 0.0072 | 0.0033 | 4.0 | <0.0005 | <0.3 | <0.0001 | 0.00023 | <0.0005 | 0.066 | <0.01 | <0.0001 | 0.00014 | 0.0010 | <0.01 |
| 110-2018-T02-01 | 60 | <0.00005 | 0.34 | 0.062 | <0.01 | 0.0020 | <0.0005 | <0.0005 | 22 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 9.8 | 1.7 | 0.018 | 0.00088 | 1.5 | <0.0005 | <0.3 | <0.0001 | 0.00028 | 0.0013 | 0.035 | <0.01 | <0.0001 | 0.00020 | <0.001 | <0.01 |
| 110-2018-T02-02 | 49 | <0.00005 | 0.34 | 0.085 | <0.01 | 0.0019 | <0.0005 | <0.0005 | 17 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 17 | 1.8 | 0.011 | 0.0017 | 2.4 | <0.0005 | <0.3 | <0.0001 | 0.0011 | 0.00092 | 0.034 | <0.01 | <0.0001 | 0.00030 | <0.001 | <0.01 |
| 17-153-100-35MW-03 | 40.7 | <0.00005 | 0.434 | 0.0592 | <0.01 | 0.0014 | <0.0005 | <0.0005 | 14.9 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 8.63 | 1.28 | 0.0046 | 0.00242 | 2.94 | <0.0005 | <0.3 | <0.0001 | 0.00056 | <0.0005 | 0.0291 | <0.01 | <0.0001 | 0.0002 | 0.001 | <0.01 |
| 17-153-105-32-02 | 63 | <0.00005 | 0.33 | 0.033 | <0.01 | 0.0023 | <0.0005 | <0.0005 | 21 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 18 | 3.4 | 0.018 | 0.0024 | 3.3 | <0.0005 | <0.3 | <0.0001 | 0.00024 | <0.0005 | 0.038 | <0.01 | <0.0001 | 0.00025 | <0.001 | <0.01 |
| 17-153-105-TO6 | 42 | <0.00005 | 0.39 | 0.13 | <0.01 | 0.0018 | <0.0005 | <0.0005 | 15 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 7.4 | 2.1 | 0.0071 | 0.0037 | 5.8 | <0.0005 | <0.3 | <0.0001 | 0.00087 | <0.0005 | 0.039 | <0.01 | <0.0001 | 0.00037 | 0.0016 | <0.01 |
| 18-100-14-MW01 | 78 | <0.00005 | 0.33 | 0.034 | <0.01 | 0.0029 | <0.0005 | <0.0005 | 19 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 32 | 3.1 | 0.011 | 0.0028 | 4.8 | <0.0005 | <0.3 | <0.0001 | 0.00045 | 0.00050 | 0.041 | <0.01 | <0.0001 | 0.00027 | 0.0010 | <0.01 |
| 18-100-14-MW-02 | 53 | <0.00005 | 0.38 | 0.053 | <0.01 | 0.0021 | <0.0005 | <0.0005 | 16 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 19 | 2.5 | 0.011 | 0.0036 | 2.6 | <0.0005 | <0.3 | <0.0001 | 0.00041 | <0.0005 | 0.029 | <0.01 | <0.0001 | 0.00017 | 0.0010 | <0.01 |
| 18-153-095-09LG-01 | 70 | <0.00005 | 0.28 | 0.010 | <0.01 | 0.0026 | <0.0005 | <0.0005 | 22 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 11 | 3.1 | 0.021 | 0.00035 | 1.9 | <0.0005 | <0.3 | <0.0001 | 0.00015 | <0.0005 | 0.039 | <0.01 | <0.0001 | 0.00011 | <0.001 | <0.01 |
| 18-153-095-09LG-02 | 43 | <0.00005 | 0.33 | 0.029 | <0.01 | 0.0017 | <0.0005 | <0.0005 | 15 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 14 | 2.0 | 0.0073 | 0.0011 | 2.2 | <0.0005 | <0.3 | <0.0001 | 0.00029 | <0.0005 | 0.032 | <0.01 | <0.0001 | 0.00012 | <0.001 | <0.01 |
| 18-153-095-09LG-03 | 22 | <0.00005 | 0.48 | 0.051 | <0.01 | 0.0010 | <0.0005 | <0.0005 | 8.8 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 13 | 1.2 | 0.0037 | 0.0012 | 2.4 | <0.0005 | <0.3 | <0.0001 | 0.00038 | <0.0005 | 0.018 | <0.01 | <0.0001 | 0.000086 | 0.0011 | <0.01 |
| 18-153-105-27-01 | 39.7 | <0.00005 | 0.248 | 0.256 | <0.01 | <0.001 | <0.0005 | <0.0005 | 16.6 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 8.37 | 2.29 | 0.00953 | 0.0043 | 3.43 | <0.0005 | <0.3 | <0.0001 | 0.00081 | <0.0005 | 0.068 | <0.01 | <0.0001 | 0.000299 | <0.001 | <0.01 |
| 18-153-105-27-02 | 28.1 | <0.00005 | 0.278 | 0.904 | <0.01 | <0.001 | <0.0005 | <0.0005 | 13.8 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 11 | 1.94 | 0.0117 | 0.0106 | 4.66 | <0.0005 | <0.3 | <0.0001 | 0.00113 | <0.0005 | 0.0276 | <0.01 | <0.0001 | 0.000251 | <0.001 | <0.01 |
| 18-153-105-27-03 | 30.9 | <0.00005 | 0.279 | 0.429 | <0.01 | <0.001 | <0.0005 | <0.0005 | 14.4 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 13.1 | 1.95 | 0.00829 | 0.00848 | 4.79 | <0.0005 | <0.3 | <0.0001 | 0.00097 | <0.0005 | 0.0304 | <0.01 | <0.0001 | 0.000267 | <0.001 | <0.01 |
| 18-153-105-27-04 | 55.1 | <0.00005 | 0.291 | 0.18 | <0.01 | 0.0016 | <0.0005 | <0.0005 | 18.1 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 16.4 | 3.35 | 0.0169 | 0.00244 | 2.67 | <0.0005 | <0.3 | <0.0001 | 0.00062 | <0.0005 | 0.0311 | <0.01 | <0.0001 | 0.000291 | <0.001 | <0.01 |
| 18-153-105-27-05 | 104 | <0.00005 | 0.122 | 0.0542 | <0.01 | 0.0027 | <0.0005 | <0.0005 | 33 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 17.7 | 7.45 | 0.128 | 0.00194 | 2.18 | <0.0005 | <0.3 | <0.0001 | 0.00041 | <0.0005 | 0.0577 | <0.01 | <0.0001 | 0.000164 | <0.001 | <0.01 |
| 18-153-90-31HG-02 | 31.5 | <0.00005 | 0.329 | 0.0881 | 0.01 | 0.0016 | <0.0005 | <0.0005 | 12.3 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 17.2 | 1.8 | 0.00229 | 0.00897 | 3 | <0.0005 | <0.3 | <0.0001 | 0.0007 | <0.0005 | 0.0223 | <0.01 | <0.0001 | 0.000163 | 0.0015 | <0.01 |
| 18-153-90-31HG-03 | 25.1 | <0.00005 | 0.328 | 0.0891 | <0.01 | 0.0014 | <0.0005 | <0.0005 | 11.7 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 18.3 | 1.31 | 0.00227 | 0.0339 | 3.44 | <0.0005 | <0.3 | <0.0001 | 0.00086 | <0.0005 | 0.0265 | <0.01 | <0.0001 | 0.000132 | 0.0019 | <0.01 |
| 18-153-90-31HG-05 | 23.2 | <0.00005 | 0.394 | 0.122 | <0.01 | 0.0014 | <0.0005 | <0.0005 | 10.2 | <0.00005 | <0.0001 | <0.0005 | <0.001 | <0.03 | <0.00005 | 16.4 | 1.41 | 0.00186 | 0.0178 | 2.73 | <0.0005 | <0.3 | <0.0001 | 0.00122 | <0.0005 | 0.023 | <0.01 | <0.0001 | 0.000177 | 0.0021 | <0.01 |

**CONVERSION OF DETECTED LEACHATE CONCENTRATION TO DE-IONIZED WATER LEACHABLE SOLID PHASE CONCENTRATION[(1)]**

| Sample Label | S | Ag | Al | As | B | Ba | Be | Bi | Ca | Cd | Co | Cr | Cu | Fe | Hg | K | Mg | Mn | Mo | Na | Ni | P | Pb | Sb | Se | Sr | Ti | Tl | U | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| 090-18-17-02 | 36 | 0.00015 | 1.482 | 0.2604 | 0.03 | 0.0045 | 0.0015 | 0.0015 | 41.1 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 31.5 | 2.931 | 0.00873 | 0.0033 | 4.26 | 0.0015 | 0.9 | 0.0003 | 0.00279 | 0.00168 | 0.0921 | 0.03 | 0.0003 | 0.000333 | 0.0036 | 0.03 |
| 090-18-17-03 | 52 | 0.00015 | 1.251 | 0.1194 | 0.03 | 0.0057 | 0.0015 | 0.0015 | 56.4 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 39.3 | 4.08 | 0.01971 | 0.00372 | 6.12 | 0.0015 | 0.9 | 0.0003 | 0.00159 | 0.0015 | 0.1101 | 0.03 | 0.0003 | 0.000447 | 0.003 | 0.03 |
| 090-2018-08LG-01 | 37 | 0.00015 | 1.131 | 0.057 | 0.03 | 0.0039 | 0.0015 | 0.0015 | 40.2 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 31.5 | 4.56 | 0.0303 | 0.00327 | 7.14 | 0.0015 | 0.9 | 0.0003 | 0.00033 | 0.0015 | 0.0771 | 0.03 | 0.0003 | 0.000216 | 0.003 | 0.03 |
| 090-2018-08LG-02 | 32 | 0.00015 | 1.242 | 0.0798 | 0.03 | 0.0033 | 0.0015 | 0.0015 | 38.4 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 18.24 | 2.712 | 0.02667 | 0.00372 | 7.23 | 0.0015 | 0.9 | 0.0003 | 0.00045 | 0.0015 | 0.0789 | 0.03 | 0.0003 | 0.000219 | 0.003 | 0.03 |
| 090-2018-08LG-03 | 44 | 0.00015 | 1.299 | 0.1401 | 0.03 | 0.0045 | 0.0015 | 0.0015 | 44.4 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 45.9 | 5.46 | 0.02022 | 0.00537 | 8.82 | 0.0015 | 0.9 | 0.0003 | 0.00081 | 0.0015 | 0.0879 | 0.03 | 0.0003 | 0.000438 | 0.003 | 0.03 |
| 090-MW07-01 | 23 | 0.00015 | 1.509 | 0.0888 | 0.03 | 0.0033 | 0.0015 | 0.0015 | 26.01 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 37.8 | 4.17 | 0.02559 | 0.0021 | 4.53 | 0.0015 | 0.9 | 0.0003 | 0.00072 | 0.0015 | 0.0447 | 0.03 | 0.0003 | 0.000135 | 0.003 | 0.03 |
| 090MW07-02 | 33 | 0.00015 | 1.245 | 0.084 | 0.03 | 0.0036 | 0.0015 | 0.0015 | 34.5 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 38.7 | 5.04 | 0.02847 | 0.00243 | 4.98 | 0.0015 | 0.9 | 0.0003 | 0.00084 | 0.0015 | 0.0558 | 0.03 | 0.0003 | 0.000195 | 0.003 | 0.03 |
| 090NW09-02 | 53 | 0.00015 | 1.014 | 0.1638 | 0.03 | 0.0069 | 0.0015 | 0.0015 | 44.7 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 78.6 | 6.72 | 0.02589 | 0.01023 | 9.15 | 0.0015 | 0.9 | 0.0003 | 0.00147 | 0.0015 | 0.0903 | 0.03 | 0.0003 | 0.000462 | 0.0033 | 0.03 |
| 09MW09-01 | 25 | 0.00015 | 1.29 | 0.0834 | 0.03 | 0.0042 | 0.0015 | 0.0015 | 30.3 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 33.3 | 4.62 | 0.0261 | 0.00159 | 4.5 | 0.0015 | 0.9 | 0.0003 | 0.00063 | 0.0015 | 0.0567 | 0.03 | 0.0003 | 0.000207 | 0.003 | 0.03 |
| 100-2018-26-01 | 23 | 0.00015 | 1.806 | 0.429 | 0.03 | 0.003 | 0.0015 | 0.0015 | 26.58 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 59.4 | 4.26 | 0.0126 | 0.00951 | 10.29 | 0.0015 | 0.9 | 0.0003 | 0.00114 | 0.0015 | 0.0537 | 0.03 | 0.0003 | 0.000357 | 0.0063 | 0.03 |
| 100-2018-26-02 | 39 | 0.00015 | 1.554 | 0.1323 | 0.03 | 0.0036 | 0.0015 | 0.0015 | 38.1 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 57 | 5.07 | 0.01848 | 0.00549 | 7.95 | 0.0015 | 0.9 | 0.0003 | 0.0012 | 0.0015 | 0.0765 | 0.03 | 0.0003 | 0.000261 | 0.0042 | 0.03 |
| 105-48-MW-01 | 78 | 0.00015 | 0.804 | 0.333 | 0.03 | 0.0072 | 0.0015 | 0.0015 | 71.7 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 58.8 | 9.66 | 0.0816 | 0.02001 | 11.55 | 0.0015 | 0.9 | 0.0003 | 0.00402 | 0.0015 | 0.1188 | 0.03 | 0.0003 | 0.000738 | 0.003 | 0.03 |
| 105-48MW-02 | 106 | 0.00015 | 0.573 | 0.453 | 0.03 | 0.0102 | 0.0015 | 0.0015 | 117.3 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 46.2 | 11.76 | 0.1005 | 0.00486 | 10.26 | 0.0015 | 0.9 | 0.0003 | 0.00321 | 0.0015 | 0.1791 | 0.03 | 0.0003 | 0.000831 | 0.003 | 0.03 |
| 105-48MW-03 | 84 | 0.00015 | 0.753 | 0.645 | 0.03 | 0.0039 | 0.0015 | 0.0015 | 77.7 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 37.5 | 12.63 | 0.0564 | 0.0045 | 10.14 | 0.0015 | 0.9 | 0.0003 | 0.00159 | 0.0015 | 0.1386 | 0.03 | 0.0003 | 0.000516 | 0.003 | 0.03 |
| 105-49MG-01 | 87 | 0.00015 | 0.69 | 0.336 | 0.03 | 0.0069 | 0.0015 | 0.0015 | 91.8 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 52.2 | 6.63 | 0.0582 | 0.00474 | 9.21 | 0.0015 | 0.9 | 0.0003 | 0.00135 | 0.0015 | 0.1332 | 0.03 | 0.0003 | 0.000552 | 0.003 | 0.03 |
| 105-49MG-03 | 50 | 0.00015 | 0.894 | 0.2373 | 0.03 | 0.0054 | 0.0015 | 0.0015 | 57.3 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 46.5 | 4.95 | 0.033 | 0.00498 | 6.87 | 0.0015 | 0.9 | 0.0003 | 0.00267 | 0.0015 | 0.1032 | 0.03 | 0.0003 | 0.000402 | 0.003 | 0.03 |
| 108-18-19-04 | 28 | 0.00015 | 1.806 | 0.0786 | 0.03 | 0.0033 | 0.0015 | 0.0015 | 29.94 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 41.4 | 4.35 | 0.01446 | 0.00258 | 8.7 | 0.0015 | 0.9 | 0.0003 | 0.0009 | 0.0015 | 0.0744 | 0.03 | 0.0003 | 0.000339 | 0.003 | 0.03 |
| 110-2018-08MW-02 | 117 | 0.00015 | 0.411 | 0.0582 | 0.03 | 0.0147 | 0.0015 | 0.0015 | 120 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 29.85 | 8.01 | 0.0711 | 0.00786 | 8.25 | 0.0015 | 0.9 | 0.0003 | 0.00111 | 0.00174 | 0.417 | 0.03 | 0.0003 | 0.000876 | 0.003 | 0.03 |
| 110-2018-08MW-03 | 78 | 0.00015 | 0.846 | 0.0747 | 0.03 | 0.0072 | 0.0015 | 0.0015 | 75 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 38.7 | 4.35 | 0.02145 | 0.00987 | 12.06 | 0.0015 | 0.9 | 0.0003 | 0.00069 | 0.0015 | 0.1977 | 0.03 | 0.0003 | 0.00042 | 0.003 | 0.03 |
| 110-2018-T02-01 | 60 | 0.00015 | 1.005 | 0.1851 | 0.03 | 0.006 | 0.0015 | 0.0015 | 66.3 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 29.43 | 5.04 | 0.0534 | 0.00264 | 4.62 | 0.0015 | 0.9 | 0.0003 | 0.00084 | 0.00387 | 0.1035 | 0.03 | 0.0003 | 0.000591 | 0.003 | 0.03 |
| 110-2018-T02-02 | 49 | 0.00015 | 1.026 | 0.2562 | 0.03 | 0.0057 | 0.0015 | 0.0015 | 51 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 51.6 | 5.49 | 0.033 | 0.00516 | 7.08 | 0.0015 | 0.9 | 0.0003 | 0.00318 | 0.00276 | 0.1029 | 0.03 | 0.0003 | 0.000912 | 0.003 | 0.03 |
| 17-153-100-35MW-03 | 41 | 0.00015 | 1.302 | 0.1776 | 0.03 | 0.0042 | 0.0015 | 0.0015 | 44.7 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 25.89 | 3.84 | 0.0138 | 0.00726 | 8.82 | 0.0015 | 0.9 | 0.0003 | 0.00168 | 0.0015 | 0.0873 | 0.03 | 0.0003 | 0.0006 | 0.003 | 0.03 |
| 17-153-105-32-02 | 63 | 0.00015 | 0.999 | 0.099 | 0.03 | 0.0069 | 0.0015 | 0.0015 | 62.7 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 52.5 | 10.29 | 0.054 | 0.00723 | 10.02 | 0.0015 | 0.9 | 0.0003 | 0.00072 | 0.0015 | 0.1146 | 0.03 | 0.0003 | 0.00075 | 0.003 | 0.03 |
| 17-153-105-TO6 | 42 | 0.00015 | 1.182 | 0.384 | 0.03 | 0.0054 | 0.0015 | 0.0015 | 43.5 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 22.05 | 6.18 | 0.02139 | 0.01119 | 17.25 | 0.0015 | 0.9 | 0.0003 | 0.00261 | 0.0015 | 0.1161 | 0.03 | 0.0003 | 0.001107 | 0.0048 | 0.03 |
| 18-100-14-MW01 | 78 | 0.00015 | 0.987 | 0.1029 | 0.03 | 0.0087 | 0.0015 | 0.0015 | 57.6 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 94.8 | 9.42 | 0.0315 | 0.00828 | 14.37 | 0.0015 | 0.9 | 0.0003 | 0.00135 | 0.0015 | 0.1218 | 0.03 | 0.0003 | 0.000822 | 0.003 | 0.03 |
| 18-100-14-MW-02 | 53 | 0.00015 | 1.125 | 0.1602 | 0.03 | 0.0063 | 0.0015 | 0.0015 | 48 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 57.3 | 7.38 | 0.0315 | 0.01074 | 7.71 | 0.0015 | 0.9 | 0.0003 | 0.00123 | 0.0015 | 0.0873 | 0.03 | 0.0003 | 0.000498 | 0.003 | 0.03 |
| 18-153-095-09LG-01 | 70 | 0.00015 | 0.84 | 0.0303 | 0.03 | 0.0078 | 0.0015 | 0.0015 | 65.4 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 33 | 9.15 | 0.0618 | 0.00105 | 5.7 | 0.0015 | 0.9 | 0.0003 | 0.00045 | 0.0015 | 0.1155 | 0.03 | 0.0003 | 0.000333 | 0.003 | 0.03 |
| 18-153-095-09LG-02 | 43 | 0.00015 | 0.987 | 0.0858 | 0.03 | 0.0051 | 0.0015 | 0.0015 | 45.9 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 40.5 | 5.97 | 0.02178 | 0.00315 | 6.57 | 0.0015 | 0.9 | 0.0003 | 0.00087 | 0.0015 | 0.0945 | 0.03 | 0.0003 | 0.000345 | 0.003 | 0.03 |
| 18-153-095-09LG-03 | 22 | 0.00015 | 1.443 | 0.1521 | 0.03 | 0.003 | 0.0015 | 0.0015 | 26.49 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 40.2 | 3.51 | 0.01122 | 0.0036 | 7.11 | 0.0015 | 0.9 | 0.0003 | 0.00114 | 0.0015 | 0.0528 | 0.03 | 0.0003 | 0.000258 | 0.0033 | 0.03 |
| 18-153-105-27-01 | 40 | 0.00015 | 0.744 | 0.768 | 0.03 | 0.003 | 0.0015 | 0.0015 | 49.8 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 25.11 | 6.87 | 0.02859 | 0.0129 | 10.29 | 0.0015 | 0.9 | 0.0003 | 0.00243 | 0.0015 | 0.204 | 0.03 | 0.0003 | 0.000897 | 0.003 | 0.03 |
| 18-153-105-27-02 | 28 | 0.00015 | 0.834 | 2.712 | 0.03 | 0.003 | 0.0015 | 0.0015 | 41.4 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 33 | 5.82 | 0.0351 | 0.0318 | 13.98 | 0.0015 | 0.9 | 0.0003 | 0.00339 | 0.0015 | 0.0828 | 0.03 | 0.0003 | 0.000753 | 0.003 | 0.03 |
| 18-153-105-27-03 | 31 | 0.00015 | 0.837 | 1.287 | 0.03 | 0.003 | 0.0015 | 0.0015 | 43.2 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 39.3 | 5.85 | 0.02487 | 0.02544 | 14.37 | 0.0015 | 0.9 | 0.0003 | 0.00291 | 0.0015 | 0.0912 | 0.03 | 0.0003 | 0.000801 | 0.003 | 0.03 |
| 18-153-105-27-04 | 55 | 0.00015 | 0.873 | 0.54 | 0.03 | 0.0048 | 0.0015 | 0.0015 | 54.3 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 49.2 | 10.05 | 0.0507 | 0.00732 | 8.01 | 0.0015 | 0.9 | 0.0003 | 0.00186 | 0.0015 | 0.0933 | 0.03 | 0.0003 | 0.000873 | 0.003 | 0.03 |
| 18-153-105-27-05 | 104 | 0.00015 | 0.366 | 0.1626 | 0.03 | 0.0081 | 0.0015 | 0.0015 | 99 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 53.1 | 22.35 | 0.384 | 0.00582 | 6.54 | 0.0015 | 0.9 | 0.0003 | 0.00123 | 0.0015 | 0.1731 | 0.03 | 0.0003 | 0.000492 | 0.003 | 0.03 |
| 18-153-90-31HG-02 | 32 | 0.00015 | 0.987 | 0.2643 | 0.03 | 0.0048 | 0.0015 | 0.0015 | 36.9 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 51.6 | 5.4 | 0.00687 | 0.02691 | 9 | 0.0015 | 0.9 | 0.0003 | 0.0021 | 0.0015 | 0.0669 | 0.03 | 0.0003 | 0.000489 | 0.0045 | 0.03 |
| 18-153-90-31HG-03 | 25 | 0.00015 | 0.984 | 0.2673 | 0.03 | 0.0042 | 0.0015 | 0.0015 | 35.1 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 54.9 | 3.93 | 0.00681 | 0.1017 | 10.32 | 0.0015 | 0.9 | 0.0003 | 0.00258 | 0.0015 | 0.0795 | 0.03 | 0.0003 | 0.000396 | 0.0057 | 0.03 |
| 18-153-90-31HG-05 | 23 | 0.00015 | 1.182 | 0.366 | 0.03 | 0.0042 | 0.0015 | 0.0015 | 30.6 | 0.00015 | 0.0003 | 0.0015 | 0.003 | 0.09 | 0.00015 | 49.2 | 4.23 | 0.00558 | 0.0534 | 8.19 | 0.0015 | 0.9 | 0.0003 | 0.00366 | 0.0015 | 0.069 | 0.03 | 0.0003 | 0.000531 | 0.0063 | 0.03 |

**Table A.1**

**De-Ionized Water and Acid Extraction Test Results - Touquoy Mine Site Waste Rock Samples**
**Beaver Dam Mine Project**
**Marinette, Nova Scotia**

**ACID EXTRACTION (AQUA REGIA EXTRACTION) TEST RESULTS - ACID LEACHABLE SOLID PHASE**

| Sample Label | S | Ag | Al | As | B | Ba | Be | Bi | Ca | Cd | Co | Cr | Cu | Fe | Hg | K | Mg | Mn | Mo | Na | Ni | P | Pb | Sb | Se | Sr | Ti | Tl | U | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *%* | *ppm* | *%* | *ppm* | *ppm* | *ppm* | *ppm* | *ppm* | *%* | *ppm* | *ppm* | *ppm* | *ppm* | *%* | *ppm* | *%* | *%* | *ppm* | *ppm* | *%* | *ppm* | *ppm* | *ppm* | *ppm* | *ppm* | *ppm* | *%* | *ppm* | *ppm* | *ppm* | *ppm* |
| 090-18-17-02 | 0.26 | <0.2 | 2.7 | 99 | 10 | 40 | <0.5 | <2 | 0.87 | <0.5 | 22 | 29 | 48 | 5.3 | <0.005 | 0.25 | 1.3 | 687 | <1 | 0.010 | 46 | 450 | 42 | 3.0 | 2.0 | 18 | 0.010 | <10 | <10 | 20 | 100 |
| 090-18-17-03 | 0.60 | <0.2 | 2.2 | 228 | <10 | 40 | <0.5 | 2.0 | 1.9 | <0.5 | 21 | 23 | 82 | 4.7 | <0.005 | 0.21 | 1.1 | 867 | <1 | 0.010 | 45 | 450 | 105 | <2 | 2.0 | 38 | 0.010 | <10 | <10 | 14 | 106 |
| 090-2018-08LG-01 | 0.50 | <0.2 | 1.9 | 2150 | <10 | 30 | <0.5 | <2 | 1.3 | <0.5 | 22 | 20 | 46 | 4.7 | <0.005 | 0.16 | 1.1 | 880 | 1.0 | 0.010 | 39 | 450 | 13 | <2 | 2.0 | 42 | 0.010 | <10 | <10 | 14 | 82 |
| 090-2018-08LG-02 | 0.43 | <0.2 | 1.7 | 1070 | <10 | 20 | <0.5 | <2 | 1.1 | <0.5 | 18 | 19 | 29 | 4.0 | <0.005 | 0.13 | 0.90 | 732 | <1 | 0.010 | 32 | 420 | 11 | <2 | 2.0 | 32 | 0.010 | <10 | <10 | 13 | 72 |
| 090-2018-08LG-03 | 0.48 | <0.2 | 1.9 | 1665 | <10 | 30 | <0.5 | <2 | 1.2 | <0.5 | 25 | 20 | 49 | 4.8 | <0.005 | 0.18 | 1.2 | 773 | <1 | 0.010 | 43 | 440 | 19 | 3.0 | 2.0 | 42 | 0.010 | <10 | <10 | 13 | 86 |
| 090-MW07-01 | 0.52 | <0.2 | 2.5 | 1985 | <10 | 30 | <0.5 | 2.0 | 0.82 | <0.5 | 27 | 25 | 43 | 5.7 | <0.005 | 0.19 | 1.3 | 823 | 1.0 | 0.010 | 50 | 490 | 12 | <2 | 2.0 | 31 | 0.010 | <10 | <10 | 18 | 105 |
| 090MW07-02 | 0.66 | <0.2 | 2.3 | 1405 | <10 | 30 | <0.5 | <2 | 0.83 | <0.5 | 25 | 23 | 41 | 5.4 | <0.005 | 0.18 | 1.3 | 768 | 1.0 | 0.010 | 45 | 480 | 24 | <2 | 2.0 | 28 | 0.010 | <10 | <10 | 17 | 101 |
| 090NW09-02 | 0.66 | 0.30 | 2.3 | 1745 | <10 | 30 | <0.5 | <2 | 0.70 | <0.5 | 21 | 23 | 42 | 5.4 | <0.005 | 0.21 | 1.2 | 724 | 2.0 | 0.020 | 45 | 460 | 14 | <2 | 2.0 | 27 | 0.010 | <10 | <10 | 16 | 108 |
| 09MW09-01 | 0.69 | <0.2 | 2.1 | 682 | <10 | 30 | <0.5 | <2 | 1.2 | <0.5 | 25 | 21 | 47 | 5.3 | <0.005 | 0.18 | 1.2 | 863 | 1.0 | 0.010 | 47 | 480 | 10 | <2 | 2.0 | 40 | 0.010 | <10 | <10 | 15 | 92 |
| 100-2018-26-01 | 0.61 | 0.30 | 2.0 | 4170 | <10 | 30 | <0.5 | <2 | 0.97 | <0.5 | 22 | 22 | 39 | 4.7 | <0.005 | 0.21 | 1.2 | 691 | 1.0 | 0.010 | 40 | 410 | 25 | <2 | 2.0 | 23 | 0.010 | <10 | <10 | 15 | 87 |
| 100-2018-26-02 | 0.75 | <0.2 | 2.3 | 1480 | <10 | 40 | <0.5 | <2 | 0.94 | <0.5 | 23 | 24 | 61 | 5.4 | <0.005 | 0.24 | 1.2 | 737 | <1 | 0.010 | 43 | 470 | 19 | <2 | 2.0 | 24 | 0.010 | <10 | <10 | 17 | 99 |
| 105-48-MW-01 | 0.49 | <0.2 | 2.3 | 1025 | <10 | 40 | <0.5 | <2 | 0.86 | <0.5 | 28 | 25 | 46 | 5.2 | <0.005 | 0.20 | 1.2 | 735 | 1.0 | 0.010 | 48 | 490 | 14 | <2 | 2.0 | 29 | 0.010 | <10 | <10 | 18 | 96 |
| 105-48MW-02 | 0.72 | <0.2 | 2.0 | 3930 | <10 | 30 | <0.5 | <2 | 0.91 | <0.5 | 26 | 22 | 50 | 5.1 | <0.005 | 0.16 | 1.1 | 710 | <1 | 0.010 | 45 | 460 | 15 | <2 | 2.0 | 27 | <0.01 | <10 | <10 | 14 | 90 |
| 105-48MW-03 | 0.55 | <0.2 | 1.9 | 2700 | <10 | 30 | <0.5 | <2 | 1.1 | <0.5 | 23 | 20 | 38 | 4.8 | <0.005 | 0.19 | 1.2 | 796 | <1 | 0.010 | 43 | 460 | 13 | <2 | 2.0 | 41 | 0.010 | <10 | <10 | 13 | 86 |
| 105-49MG-01 | 0.33 | <0.2 | 2.5 | 561 | <10 | 30 | <0.5 | <2 | 0.74 | <0.5 | 26 | 28 | 41 | 5.3 | <0.005 | 0.19 | 1.3 | 698 | 1.0 | 0.010 | 48 | 470 | 8.0 | <2 | 2.0 | 23 | 0.010 | <10 | <10 | 18 | 101 |
| 105-49MG-03 | 0.56 | 0.20 | 2.3 | 1315 | <10 | 30 | <0.5 | <2 | 0.85 | <0.5 | 26 | 25 | 48 | 5.1 | <0.005 | 0.17 | 1.2 | 644 | <1 | 0.010 | 47 | 450 | 24 | <2 | 2.0 | 26 | 0.010 | <10 | <10 | 16 | 96 |
| 108-18-19-04 | 0.36 | <0.2 | 2.3 | 1260 | <10 | 40 | <0.5 | <2 | 1.2 | <0.5 | 21 | 25 | 38 | 4.8 | <0.005 | 0.21 | 1.2 | 687 | <1 | 0.010 | 42 | 470 | 8.0 | <2 | 2.0 | 33 | 0.010 | <10 | <10 | 17 | 96 |
| 110-2018-08MW-02 | 0.53 | 0.50 | 2.3 | 928 | <10 | 30 | <0.5 | <2 | 0.65 | <0.5 | 20 | 24 | 45 | 5.1 | <0.005 | 0.13 | 1.1 | 618 | 1.0 | 0.010 | 37 | 450 | 21 | <2 | 2.0 | 22 | 0.010 | <10 | <10 | 18 | 99 |
| 110-2018-08MW-03 | 0.33 | <0.2 | 2.3 | 143 | <10 | 20 | <0.5 | <2 | 0.84 | <0.5 | 19 | 25 | 35 | 4.7 | <0.005 | 0.11 | 1.1 | 666 | 1.0 | 0.010 | 37 | 450 | 10 | <2 | 2.0 | 26 | 0.010 | <10 | <10 | 18 | 90 |
| 110-2018-T02-01 | 0.55 | <0.2 | 2.2 | 1860 | <10 | 30 | <0.5 | 2.0 | 0.96 | <0.5 | 22 | 23 | 47 | 5.0 | <0.005 | 0.16 | 1.1 | 667 | 1.0 | 0.010 | 39 | 450 | 24 | 2.0 | 2.0 | 22 | <0.01 | <10 | <10 | 16 | 91 |
| 110-2018-T02-02 | 0.54 | <0.2 | 2.3 | 1600 | <10 | 30 | <0.5 | <2 | 0.97 | <0.5 | 25 | 24 | 43 | 5.1 | <0.005 | 0.19 | 1.2 | 683 | <1 | 0.010 | 45 | 470 | 12 | <2 | 2.0 | 29 | 0.010 | <10 | <10 | 17 | 95 |
| 17-153-100-35MW-03 | 0.33 | <0.2 | 2.1 | 221 | 10 | 30 | <0.5 | 2.0 | 1.1 | <0.5 | 18 | 24 | 34 | 4.3 | <0.005 | 0.18 | 1.0 | 643 | <1 | 0.020 | 35 | 460 | 16 | <2 | 2.0 | 33 | 0.010 | <10 | <10 | 18 | 86 |
| 17-153-105-32-02 | 0.43 | <0.2 | 2.0 | 972 | <10 | 30 | <0.5 | <2 | 1.1 | <0.5 | 21 | 21 | 51 | 4.9 | <0.005 | 0.14 | 1.1 | 810 | 1.0 | 0.010 | 39 | 470 | 8.0 | <2 | 2.0 | 35 | 0.010 | <10 | <10 | 15 | 93 |
| 17-153-105-TO6 | 0.65 | <0.2 | 1.5 | 9420 | <10 | 20 | <0.5 | <2 | 2.0 | <0.5 | 18 | 17 | 21 | 3.7 | <0.005 | 0.090 | 0.85 | 872 | 1.0 | 0.010 | 33 | 620 | 8.0 | 3.0 | 2.0 | 33 | <0.01 | <10 | <10 | 13 | 51 |
| 18-100-14-MW01 | 0.27 | <0.2 | 2.5 | 299 | <10 | 40 | <0.5 | <2 | 0.66 | <0.5 | 18 | 26 | 44 | 5.3 | <0.005 | 0.22 | 1.3 | 661 | <1 | 0.020 | 42 | 470 | 14 | <2 | 2.0 | 24 | 0.010 | <10 | <10 | 19 | 109 |
| 18-100-14-MW-02 | 0.35 | <0.2 | 2.4 | 509 | <10 | 30 | <0.5 | <2 | 0.82 | <0.5 | 24 | 26 | 43 | 5.2 | <0.005 | 0.20 | 1.3 | 803 | 1.0 | 0.010 | 44 | 500 | 13 | <2 | 2.0 | 29 | 0.020 | <10 | <10 | 18 | 104 |
| 18-153-095-09LG-01 | 0.32 | <0.2 | 2.3 | 528 | <10 | 30 | <0.5 | <2 | 0.87 | <0.5 | 21 | 24 | 40 | 5.1 | <0.005 | 0.14 | 1.2 | 747 | <1 | 0.010 | 41 | 460 | 10 | <2 | 2.0 | 29 | 0.010 | <10 | <10 | 17 | 99 |
| 18-153-095-09LG-02 | 0.43 | <0.2 | 2.0 | 1100 | <10 | 30 | <0.5 | <2 | 1.2 | <0.5 | 22 | 20 | 54 | 4.9 | <0.005 | 0.15 | 1.1 | 786 | 1.0 | 0.010 | 42 | 420 | 13 | <2 | 2.0 | 41 | 0.010 | <10 | <10 | 13 | 83 |
| 18-153-095-09LG-03 | 0.38 | <0.2 | 1.9 | 2680 | <10 | 30 | <0.5 | 2.0 | 1.1 | <0.5 | 21 | 20 | 42 | 4.7 | <0.005 | 0.15 | 1.1 | 752 | <1 | 0.010 | 41 | 430 | 17 | <2 | 2.0 | 40 | 0.010 | <10 | <10 | 13 | 84 |
| 18-153-105-27-01 | 0.78 | 0.20 | 1.4 | 8390 | <10 | 20 | <0.5 | <2 | 1.4 | <0.5 | 17 | 17 | 35 | 3.9 | <0.005 | 0.14 | 0.80 | 619 | 1.0 | 0.010 | 35 | 390 | 18 | <2 | 1.0 | 28 | <0.01 | <10 | <10 | 12 | 49 |
| 18-153-105-27-02 | 0.62 | 0.20 | 1.3 | 5360 | <10 | 30 | <0.5 | <2 | 1.3 | <0.5 | 16 | 14 | 24 | 3.5 | <0.005 | 0.14 | 0.84 | 830 | 1.0 | 0.010 | 31 | 500 | 31 | <2 | 1.0 | 30 | <0.01 | <10 | <10 | 8.0 | 52 |
| 18-153-105-27-03 | 0.75 | 0.20 | 1.4 | 6810 | <10 | 30 | <0.5 | <2 | 1.3 | <0.5 | 16 | 15 | 31 | 4.0 | <0.005 | 0.17 | 0.92 | 894 | 1.0 | 0.010 | 35 | 450 | 27 | <2 | 1.0 | 34 | <0.01 | 10 | <10 | 9.0 | 56 |
| 18-153-105-27-04 | 0.78 | 0.20 | 1.8 | 2880 | <10 | 30 | <0.5 | <2 | 0.94 | <0.5 | 24 | 20 | 48 | 4.8 | <0.005 | 0.20 | 1.1 | 793 | <1 | 0.010 | 45 | 470 | 20 | <2 | 2.0 | 38 | 0.010 | <10 | <10 | 13 | 86 |
| 18-153-105-27-05 | 0.88 | 0.20 | 2.0 | 1860 | <10 | 40 | <0.5 | 2.0 | 0.65 | <0.5 | 24 | 21 | 65 | 5.3 | <0.005 | 0.20 | 1.2 | 745 | 1.0 | 0.010 | 46 | 460 | 23 | <2 | 2.0 | 29 | 0.010 | <10 | <10 | 14 | 92 |
| 18-153-90-31HG-02 | 0.42 | <0.2 | 2.5 | 1005 | <10 | 20 | <0.5 | <2 | 0.92 | <0.5 | 23 | 27 | 45 | 5.3 | <0.005 | 0.14 | 1.3 | 629 | <1 | 0.010 | 46 | 490 | 10 | <2 | 2.0 | 22 | 0.010 | <10 | <10 | 19 | 101 |
| 18-153-90-31HG-03 | 0.38 | <0.2 | 2.5 | 924 | <10 | 30 | <0.5 | <2 | 1.2 | <0.5 | 23 | 27 | 46 | 5.1 | <0.005 | 0.20 | 1.3 | 689 | <1 | 0.010 | 44 | 480 | 20 | 2.0 | 2.0 | 30 | 0.010 | <10 | <10 | 19 | 98 |
| 18-153-90-31HG-05 | 0.31 | <0.2 | 2.5 | 604 | <10 | 30 | <0.5 | <2 | 1.1 | <0.5 | 23 | 27 | 36 | 5.0 | <0.005 | 0.20 | 1.2 | 674 | <1 | 0.010 | 44 | 470 | 21 | <2 | 2.0 | 32 | 0.010 | <10 | <10 | 19 | 99 |

**RATIO OF DE-IONIZED WATER LEACHABLE SOLID PHASE CONCENTRATION TO ACID LEACHABLE SOLID PHASE**

| Sample Label | S | Ag | Al | As | B | Ba | Be | Bi | Ca | Cd | Co | Cr | Cu | Fe | Hg | K | Mg | Mn | Mo | Na | Ni | P | Pb | Sb | Se | Sr | Ti | Tl | U | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 090-18-17-02 | 1.394% | 0.075% | 0.006% | 0.263% | 0.300% | 0.011% | 0.300% | 0.075% | 0.472% | 0.030% | 0.001% | 0.005% | 0.006% | 0.000% | 3.000% | 1.260% | 0.023% | 0.001% | 0.330% | 4.260% | 0.003% | 0.200% | 0.001% | 0.093% | 0.084% | 0.512% | 0.030% | 0.003% | 0.003% | 0.018% | 0.030% |
| 090-18-17-03 | 0.861% | 0.075% | 0.006% | 0.052% | 0.300% | 0.014% | 0.300% | 0.075% | 0.297% | 0.030% | 0.001% | 0.007% | 0.004% | 0.000% | 3.000% | 1.871% | 0.036% | 0.002% | 0.372% | 6.120% | 0.003% | 0.200% | 0.000% | 0.080% | 0.075% | 0.290% | 0.030% | 0.003% | 0.004% | 0.021% | 0.028% |
| 090-2018-08LG-01 | 0.749% | 0.075% | 0.006% | 0.003% | 0.300% | 0.013% | 0.300% | 0.075% | 0.309% | 0.030% | 0.001% | 0.008% | 0.007% | 0.000% | 3.000% | 1.969% | 0.041% | 0.003% | 0.327% | 7.140% | 0.004% | 0.200% | 0.002% | 0.017% | 0.075% | 0.184% | 0.030% | 0.003% | 0.002% | 0.021% | 0.037% |
| 090-2018-08LG-02 | 0.748% | 0.075% | 0.007% | 0.007% | 0.300% | 0.017% | 0.300% | 0.075% | 0.337% | 0.030% | 0.002% | 0.008% | 0.010% | 0.000% | 3.000% | 1.403% | 0.030% | 0.004% | 0.372% | 7.230% | 0.005% | 0.214% | 0.003% | 0.023% | 0.075% | 0.247% | 0.030% | 0.003% | 0.002% | 0.023% | 0.042% |
| 090-2018-08LG-03 | 0.924% | 0.075% | 0.007% | 0.008% | 0.300% | 0.015% | 0.300% | 0.075% | 0.367% | 0.030% | 0.001% | 0.008% | 0.006% | 0.000% | 3.000% | 2.550% | 0.047% | 0.003% | 0.537% | 8.820% | 0.003% | 0.205% | 0.002% | 0.027% | 0.075% | 0.209% | 0.030% | 0.003% | 0.004% | 0.023% | 0.035% |
| 090-MW07-01 | 0.451% | 0.075% | 0.006% | 0.004% | 0.300% | 0.011% | 0.300% | 0.075% | 0.317% | 0.030% | 0.001% | 0.006% | 0.007% | 0.000% | 3.000% | 1.989% | 0.031% | 0.003% | 0.210% | 4.530% | 0.003% | 0.184% | 0.003% | 0.036% | 0.075% | 0.144% | 0.030% | 0.003% | 0.001% | 0.017% | 0.029% |
| 090MW07-02 | 0.499% | 0.075% | 0.005% | 0.006% | 0.300% | 0.012% | 0.300% | 0.075% | 0.416% | 0.030% | 0.001% | 0.007% | 0.007% | 0.000% | 3.000% | 2.150% | 0.040% | 0.004% | 0.243% | 4.980% | 0.003% | 0.188% | 0.001% | 0.042% | 0.075% | 0.199% | 0.030% | 0.003% | 0.002% | 0.018% | 0.030% |
| 090NW09-02 | 0.804% | 0.050% | 0.004% | 0.009% | 0.300% | 0.023% | 0.300% | 0.075% | 0.639% | 0.030% | 0.001% | 0.007% | 0.007% | 0.000% | 3.000% | 3.743% | 0.055% | 0.004% | 0.512% | 4.575% | 0.003% | 0.196% | 0.002% | 0.074% | 0.075% | 0.334% | 0.030% | 0.003% | 0.005% | 0.021% | 0.028% |
| 09MW09-01 | 0.358% | 0.075% | 0.006% | 0.012% | 0.300% | 0.014% | 0.300% | 0.075% | 0.261% | 0.030% | 0.001% | 0.007% | 0.006% | 0.000% | 3.000% | 1.850% | 0.039% | 0.003% | 0.159% | 4.500% | 0.003% | 0.188% | 0.003% | 0.032% | 0.075% | 0.142% | 0.030% | 0.003% | 0.002% | 0.020% | 0.033% |
| 100-2018-26-01 | 0.384% | 0.050% | 0.009% | 0.010% | 0.300% | 0.010% | 0.300% | 0.075% | 0.274% | 0.030% | 0.001% | 0.007% | 0.008% | 0.000% | 3.000% | 2.829% | 0.036% | 0.002% | 0.951% | 10.290% | 0.004% | 0.220% | 0.001% | 0.057% | 0.075% | 0.233% | 0.030% | 0.003% | 0.004% | 0.042% | 0.034% |
| 100-2018-26-02 | 0.515% | 0.075% | 0.007% | 0.009% | 0.300% | 0.009% | 0.300% | 0.075% | 0.405% | 0.030% | 0.001% | 0.006% | 0.005% | 0.000% | 3.000% | 2.375% | 0.041% | 0.003% | 0.549% | 7.950% | 0.003% | 0.191% | 0.002% | 0.060% | 0.075% | 0.319% | 0.030% | 0.003% | 0.003% | 0.025% | 0.030% |
| 105-48-MW-01 | 1.592% | 0.075% | 0.003% | 0.032% | 0.300% | 0.018% | 0.300% | 0.075% | 0.834% | 0.030% | 0.001% | 0.006% | 0.007% | 0.000% | 3.000% | 2.940% | 0.080% | 0.011% | 2.001% | 11.550% | 0.003% | 0.184% | 0.002% | 0.201% | 0.075% | 0.410% | 0.030% | 0.003% | 0.007% | 0.017% | 0.031% |
| 105-48MW-02 | 1.474% | 0.075% | 0.003% | 0.012% | 0.300% | 0.034% | 0.300% | 0.075% | 1.289% | 0.030% | 0.001% | 0.007% | 0.006% | 0.000% | 3.000% | 2.888% | 0.104% | 0.014% | 0.486% | 10.260% | 0.003% | 0.196% | 0.002% | 0.161% | 0.075% | 0.663% | 0.030% | 0.003% | 0.008% | 0.021% | 0.033% |
| 105-48MW-03 | 1.518% | 0.075% | 0.004% | 0.024% | 0.300% | 0.013% | 0.300% | 0.075% | 0.713% | 0.030% | 0.001% | 0.008% | 0.008% | 0.000% | 3.000% | 1.974% | 0.109% | 0.007% | 0.450% | 10.140% | 0.003% | 0.196% | 0.002% | 0.080% | 0.075% | 0.338% | 0.030% | 0.003% | 0.005% | 0.023% | 0.035% |
| 105-49MG-01 | 2.640% | 0.075% | 0.003% | 0.060% | 0.300% | 0.023% | 0.300% | 0.075% | 1.241% | 0.030% | 0.001% | 0.005% | 0.007% | 0.000% | 3.000% | 2.747% | 0.053% | 0.008% | 0.474% | 9.210% | 0.003% | 0.191% | 0.004% | 0.068% | 0.075% | 0.579% | 0.030% | 0.003% | 0.006% | 0.017% | 0.030% |
| 105-49MG-03 | 0.885% | 0.075% | 0.004% | 0.018% | 0.300% | 0.018% | 0.300% | 0.075% | 0.674% | 0.030% | 0.001% | 0.006% | 0.006% | 0.000% | 3.000% | 2.735% | 0.042% | 0.005% | 0.498% | 6.870% | 0.003% | 0.200% | 0.001% | 0.134% | 0.075% | 0.397% | 0.030% | 0.003% | 0.004% | 0.019% | 0.031% |
| 108-18-19-04 | 0.773% | 0.075% | 0.008% | 0.006% | 0.300% | 0.008% | 0.300% | 0.075% | 0.258% | 0.030% | 0.001% | 0.006% | 0.008% | 0.000% | 3.000% | 1.971% | 0.036% | 0.002% | 0.258% | 8.700% | 0.004% | 0.191% | 0.004% | 0.045% | 0.075% | 0.225% | 0.030% | 0.003% | 0.003% | 0.018% | 0.031% |
| 110-2018-08MW-02 | 2.211% | 0.030% | 0.002% | 0.006% | 0.300% | 0.049% | 0.300% | 0.075% | 1.846% | 0.030% | 0.002% | 0.006% | 0.007% | 0.000% | 3.000% | 2.296% | 0.072% | 0.012% | 0.786% | 8.250% | 0.004% | 0.200% | 0.001% | 0.056% | 0.087% | 1.895% | 0.030% | 0.003% | 0.009% | 0.017% | 0.030% |
| 110-2018-08MW-03 | 2.373% | 0.075% | 0.004% | 0.052% | 0.300% | 0.036% | 0.300% | 0.075% | 0.893% | 0.030% | 0.002% | 0.006% | 0.009% | 0.000% | 3.000% | 3.518% | 0.039% | 0.003% | 0.987% | 12.060% | 0.004% | 0.200% | 0.003% | 0.035% | 0.075% | 0.760% | 0.030% | 0.003% | 0.004% | 0.017% | 0.033% |
| 110-2018-T02-01 | 1.083% | 0.075% | 0.005% | 0.010% | 0.300% | 0.020% | 0.300% | 0.075% | 0.691% | 0.030% | 0.001% | 0.007% | 0.006% | 0.000% | 3.000% | 1.839% | 0.044% | 0.008% | 0.264% | 4.620% | 0.004% | 0.200% | 0.001% | 0.042% | 0.194% | 0.470% | 0.030% | 0.003% | 0.006% | 0.019% | 0.033% |
| 110-2018-T02-02 | 0.916% | 0.075% | 0.004% | 0.016% | 0.300% | 0.019% | 0.300% | 0.075% | 0.526% | 0.030% | 0.001% | 0.006% | 0.007% | 0.000% | 3.000% | 2.716% | 0.045% | 0.005% | 0.516% | 7.080% | 0.003% | 0.191% | 0.003% | 0.159% | 0.138% | 0.355% | 0.030% | 0.003% | 0.009% | 0.018% | 0.032% |
| 17-153-100-35MW-03 | 1.235% | 0.075% | 0.006% | 0.080% | 0.300% | 0.014% | 0.300% | 0.075% | 0.399% | 0.030% | 0.002% | 0.006% | 0.009% | 0.000% | 3.000% | 1.438% | 0.037% | 0.002% | 0.726% | 4.410% | 0.004% | 0.196% | 0.002% | 0.084% | 0.075% | 0.265% | 0.030% | 0.003% | 0.006% | 0.017% | 0.035% |
| 17-153-105-32-02 | 1.474% | 0.075% | 0.005% | 0.010% | 0.300% | 0.023% | 0.300% | 0.075% | 0.592% | 0.030% | 0.001% | 0.007% | 0.006% | 0.000% | 3.000% | 3.750% | 0.093% | 0.007% | 0.723% | 10.020% | 0.004% | 0.191% | 0.004% | 0.036% | 0.075% | 0.327% | 0.030% | 0.003% | 0.008% | 0.020% | 0.032% |
| 17-153-105-TO6 | 0.639% | 0.075% | 0.008% | 0.004% | 0.300% | 0.027% | 0.300% | 0.075% | 0.223% | 0.030% | 0.002% | 0.009% | 0.014% | 0.000% | 3.000% | 2.450% | 0.073% | 0.002% | 1.119% | 17.250% | 0.005% | 0.145% | 0.004% | 0.087% | 0.075% | 0.352% | 0.030% | 0.003% | 0.011% | 0.037% | 0.059% |
| 18-100-14-MW01 | 2.897% | 0.075% | 0.004% | 0.034% | 0.300% | 0.022% | 0.300% | 0.075% | 0.873% | 0.030% | 0.002% | 0.006% | 0.007% | 0.000% | 3.000% | 4.309% | 0.075% | 0.005% | 0.828% | 7.185% | 0.004% | 0.191% | 0.002% | 0.068% | 0.075% | 0.508% | 0.030% | 0.003% | 0.008% | 0.016% | 0.028% |
| 18-100-14-MW-02 | 1.505% | 0.075% | 0.005% | 0.031% | 0.300% | 0.021% | 0.300% | 0.075% | 0.585% | 0.030% | 0.001% | 0.006% | 0.007% | 0.000% | 3.000% | 2.865% | 0.059% | 0.004% | 1.074% | 7.710% | 0.003% | 0.180% | 0.002% | 0.062% | 0.075% | 0.301% | 0.015% | 0.003% | 0.005% | 0.017% | 0.029% |
| 18-153-095-09LG-01 | 2.203% | 0.075% | 0.004% | 0.006% | 0.300% | 0.026% | 0.300% | 0.075% | 0.752% | 0.030% | 0.001% | 0.006% | 0.008% | 0.000% | 3.000% | 2.357% | 0.077% | 0.008% | 0.105% | 5.700% | 0.004% | 0.196% | 0.003% | 0.023% | 0.075% | 0.398% | 0.030% | 0.003% | 0.003% | 0.018% | 0.030% |
| 18-153-095-09LG-02 | 1.008% | 0.075% | 0.005% | 0.008% | 0.300% | 0.017% | 0.300% | 0.075% | 0.399% | 0.030% | 0.001% | 0.008% | 0.006% | 0.000% | 3.000% | 2.700% | 0.052% | 0.003% | 0.315% | 6.570% | 0.004% | 0.214% | 0.002% | 0.044% | 0.075% | 0.230% | 0.030% | 0.003% | 0.003% | 0.023% | 0.036% |
| 18-153-095-09LG-03 | 0.574% | 0.075% | 0.007% | 0.006% | 0.300% | 0.010% | 0.300% | 0.075% | 0.252% | 0.030% | 0.001% | 0.008% | 0.007% | 0.000% | 3.000% | 2.680% | 0.032% | 0.001% | 0.360% | 7.110% | 0.004% | 0.209% | 0.002% | 0.057% | 0.075% | 0.132% | 0.030% | 0.003% | 0.003% | 0.025% | 0.036% |
| 18-153-105-27-01 | 0.510% | 0.075% | 0.005% | 0.009% | 0.300% | 0.015% | 0.300% | 0.075% | 0.364% | 0.030% | 0.002% | 0.009% | 0.009% | 0.000% | 3.000% | 1.794% | 0.086% | 0.005% | 1.290% | 10.290% | 0.004% | 0.231% | 0.002% | 0.122% | 0.150% | 0.729% | 0.030% | 0.003% | 0.009% | 0.025% | 0.061% |
| 18-153-105-27-02 | 0.454% | 0.075% | 0.007% | 0.051% | 0.300% | 0.010% | 0.300% | 0.075% | 0.331% | 0.030% | 0.002% | 0.011% | 0.013% | 0.000% | 3.000% | 2.357% | 0.069% | 0.004% | 3.180% | 13.980% | 0.005% | 0.180% | 0.001% | 0.170% | 0.150% | 0.276% | 0.030% | 0.003% | 0.008% | 0.038% | 0.058% |
| 18-153-105-27-03 | 0.413% | 0.075% | 0.006% | 0.019% | 0.300% | 0.010% | 0.300% | 0.075% | 0.325% | 0.030% | 0.002% | 0.010% | 0.010% | 0.000% | 3.000% | 2.312% | 0.064% | 0.003% | 2.544% | 14.370% | 0.004% | 0.200% | 0.001% | 0.146% | 0.150% | 0.268% | 0.030% | 0.003% | 0.008% | 0.033% | 0.054% |
| 18-153-105-27-04 | 0.707% | 0.075% | 0.005% | 0.019% | 0.300% | 0.016% | 0.300% | 0.075% | 0.578% | 0.030% | 0.001% | 0.008% | 0.006% | 0.000% | 3.000% | 2.460% | 0.088% | 0.006% | 0.732% | 8.010% | 0.003% | 0.191% | 0.002% | 0.093% | 0.075% | 0.246% | 0.030% | 0.003% | 0.009% | 0.023% | 0.035% |
| 18-153-105-27-05 | 1.183% | 0.075% | 0.002% | 0.009% | 0.300% | 0.020% | 0.300% | 0.075% | 1.523% | 0.030% | 0.001% | 0.007% | 0.005% | 0.000% | 3.000% | 2.655% | 0.189% | 0.052% | 0.582% | 6.540% | 0.003% | 0.196% | 0.001% | 0.062% | 0.075% | 0.597% | 0.030% | 0.003% | 0.005% | 0.021% | 0.033% |
| 18-153-90-31HG-02 | 0.751% | 0.075% | 0.004% | 0.026% | 0.300% | 0.024% | 0.300% | 0.075% | 0.401% | 0.030% | 0.001% | 0.006% | 0.007% | 0.000% | 3.000% | 3.686% | 0.041% | 0.001% | 2.691% | 9.000% | 0.003% | 0.184% | 0.003% | 0.105% | 0.075% | 0.304% | 0.030% | 0.003% | 0.005% | 0.024% | 0.030% |
| 18-153-90-31HG-03 | 0.661% | 0.075% | 0.004% | 0.029% | 0.300% | 0.014% | 0.300% | 0.075% | 0.300% | 0.030% | 0.001% | 0.006% | 0.007% | 0.000% | 3.000% | 2.745% | 0.031% | 0.001% | 10.170% | 10.320% | 0.003% | 0.188% | 0.002% | 0.129% | 0.075% | 0.265% | 0.030% | 0.003% | 0.004% | 0.030% | 0.031% |
| 18-153-90-31HG-05 | 0.749% | 0.075% | 0.005% | 0.061% | 0.300% | 0.014% | 0.300% | 0.075% | 0.283% | 0.030% | 0.001% | 0.006% | 0.008% | 0.000% | 3.000% | 2.460% | 0.034% | 0.001% | 5.340% | 8.190% | 0.003% | 0.191% | 0.001% | 0.183% | 0.075% | 0.216% | 0.030% | 0.003% | 0.005% | 0.033% | 0.030% |
| **Geometric Mean Ratio:** | **0.9229%** | **0.0716%** | **0.0048%** | **0.0155%** | **0.3000%** | **0.0166%** | **0.3000%** | **0.0750%** | **0.4886%** | **0.0300%** | **0.0014%** | **0.0067%** | **0.0071%** | **0.0002%** | **3.0000%** | **2.4146%** | **0.0520%** | **0.0038%** | **0.6589%** | **7.7740%** | **0.0036%** | **0.1946%** | **0.0018%** | **0.0667%** | **0.0833%** | **0.3283%** | **0.0294%** | **0.0030%** | **0.0046%** | **0.0217%** | **0.0341%** |

Notes:

(1) Determined based on 750 mL (750 mg) of de-ionized water mixed with 250 mg of rock.

**Table A.2**

**Acid Extraction Test Results - Beaver Dam Mine Site Waste Rock Samples Estimated De-Ionized Water Leachable Metals Composition**
**Beaver Dam Mine Site**
**Marinette, Novs Scotia**

| Sample ID | Hole ID | Interval From | Interval To | Lithology | Hg ppm | Ag ppm | Al % % | Al ppm (or mg/kg) | As ppm | B ppm | Ba ppm | Be ppm | Bi ppm | Ca % % | Ca ppm (or mg/kg) | Cd ppm | Co ppm | Cr ppm | Cu ppm | Fe % % | Fe ppm (or mg/kg) | Hg-ICP-AES ppm | K % % | K ppm (or mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LX17-18 | BD14-178 | 147 | 148 | GA | *<0.005* | *<0.2* | 0.69 | 6900 | 2800 | *<10* | 20 | *<0.5* | *<2* | 0.68 | 6800 | *<0.5* | 4 | 21 | 13 | 1.5 | 15000 | *<1* | 0.16 | 1600 |
| LX17-16 | BD14-178 | 49 | 50 | GW | *<0.005* | *<0.2* | 1.13 | 11300 | 10 | *<10* | 40 | 0.7 | *<2* | 0.93 | 9300 | *<0.5* | 7 | 31 | 18 | 2.12 | 21200 | *<1* | 0.21 | 2100 |
| LX17-26 | BD14-188 | 51 | 52 | GWKE | *<0.005* | *<0.2* | 1.24 | 12400 | 7 | *<10* | 30 | *<0.5* | *<2* | 0.34 | 3400 | *<0.5* | 7 | 24 | 9 | 2.37 | 23700 | *<1* | 0.21 | 2100 |
| LX17-27 | BD14-173 | 12 | 13 | GWKE | *<0.005* | *<0.2* | 1.32 | 13200 | 19 | *<10* | 30 | 0.5 | *<2* | 0.51 | 5100 | *<0.5* | 7 | 31 | 24 | 2.53 | 25300 | *<1* | 0.15 | 1500 |
| LX17-25 | BD14-188 | 38 | 39 | GWKE | *<0.005* | *<0.2* | 1.33 | 13300 | 8 | *<10* | 90 | *<0.5* | *<2* | 1.53 | 15300 | *<0.5* | 9 | 31 | 28 | 2.29 | 22900 | *<1* | 0.65 | 6500 |
| LX17-23 | BD14-188 | 10 | 11 | GA | *<0.005* | *<0.2* | 1.99 | 19900 | 25 | *<10* | 130 | 0.6 | *<2* | 1.33 | 13300 | *<0.5* | 13 | 41 | 25 | 3.28 | 32800 | *<1* | 0.98 | 9800 |
| LX17-15 | BD14-178 | 58 | 59 | GA | *<0.005* | *<0.2* | 2.07 | 20700 | 17 | *<10* | 90 | 0.5 | *<2* | 2.3 | 23000 | *<0.5* | 14 | 60 | 6 | 3.85 | 38500 | *<1* | 0.46 | 4600 |
| LX17-29 | BD14-173 | 37 | 38 | GA | *<0.005* | *<0.2* | 2.12 | 21200 | 14 | *<10* | 30 | 0.9 | *<2* | 0.73 | 7300 | *<0.5* | 14 | 40 | 21 | 3.91 | 39100 | *<1* | 0.16 | 1600 |
| LX17-08 | BD15-GT08 | 23 | 24 | GW | *<0.005* | *<0.2* | 2.2 | 22000 | 8 | 10 | 40 | *<0.5* | *<2* | 0.67 | 6700 | *<0.5* | 15 | 48 | 29 | 3.85 | 38500 | *<1* | 0.22 | 2200 |
| LX17-30 | BD14-173 | 53 | 54 | GWKE | *<0.005* | *<0.2* | 2.29 | 22900 | 12 | *<10* | 20 | 0.5 | *<2* | 2.2 | 22000 | *<0.5* | 16 | 41 | 15 | 4.05 | 40500 | *<1* | 0.18 | 1800 |
| LX17-06 | BD15-GT08 | 91 | 10 | GW | *<0.005* | *<0.2* | 2.32 | 23200 | 11 | *<10* | 130 | *<0.5* | *<2* | 0.57 | 5700 | *<0.5* | 18 | 50 | 25 | 4.05 | 40500 | *<1* | 0.74 | 7400 |
| LX17-14 | BD14-178 | 30 | 31 | GA | *<0.005* | *<0.2* | 2.42 | 24200 | 14 | *<10* | 190 | *<0.5* | *<2* | 0.33 | 3300 | *<0.5* | 16 | 54 | 17 | 3.81 | 38100 | *<1* | 1.24 | 12400 |
| LX17-10 | BD14-172 | 140 | 141 | AG | *<0.005* | *<0.2* | 2.64 | 26400 | 15 | *<10* | 120 | *<0.5* | *<2* | 0.85 | 8500 | *<0.5* | 19 | 48 | 4 | 4.45 | 44500 | 1 | 0.85 | 8500 |
| LX17-12 | BD14-178 | 7 | 7.9 | AR | *<0.005* | *<0.2* | 2.74 | 27400 | 17 | *<10* | 90 | 0.5 | *<2* | 0.2 | 2000 | *<0.5* | 20 | 41 | 28 | 4.57 | 45700 | *<1* | 1.08 | 10800 |
| LX17-28 | BD14-173 | 22 | 23 | AG | *<0.005* | *<0.2* | 2.9 | 29000 | 29 | *<10* | 80 | 0.8 | *<2* | 0.34 | 3400 | *<0.5* | 21 | 45 | 39 | 4.85 | 48500 | *<1* | 0.63 | 6300 |
| LX17-13 | BD14-178 | 15 | 16 | AG | *<0.005* | *<0.2* | 2.97 | 29700 | 8 | *<10* | 140 | 0.5 | *<2* | 0.24 | 2400 | *<0.5* | 21 | 51 | 26 | 4.84 | 48400 | *<1* | 1.12 | 11200 |
| LX17-09 | BD15-GT08 | 37 | 38 | AG | *<0.005* | *<0.2* | 3.02 | 30200 | 15 | *<10* | 130 | *<0.5* | *<2* | 0.21 | 2100 | *<0.5* | 21 | 62 | 67 | 5.09 | 50900 | 1 | 0.9 | 9000 |
| LX17-07 | BD15-GT08 | 14 | 15 | GA | *<0.005* | *<0.2* | 3.12 | 31200 | 9 | *<10* | 90 | *<0.5* | *<2* | 0.2 | 2000 | *<0.5* | 23 | 50 | 57 | 5.65 | 56500 | *<1* | 0.76 | 7600 |
| LX17-11 | BD14-172 | 170 | 171 | AG | *<0.005* | *<0.2* | 3.21 | 32100 | 28 | 10 | 100 | *<0.5* | *<2* | 0.24 | 2400 | *<0.5* | 25 | 48 | 13 | 5.4 | 54000 | *<1* | 0.84 | 8400 |
| LX17-05 | BD15-GT02 | 46 | 47 | GA | *<0.005* | *<0.2* | 3.3 | 33000 | 13 | *<10* | 150 | 0.6 | *<2* | 1.54 | 15400 | *<0.5* | 17 | 52 | 67 | 4.54 | 45400 | *<1* | 0.98 | 9800 |
| GeoMean Beaver Dam Aqua Regia Result -> | | | | | 0.005 | 0.200 | | 20931.929 | 17.543 | 10.000 | 70.628 | 0.546 | 2.000 | | 5854.396 | 0.500 | 13.922 | 41.871 | 21.118 | | 36483.869 | 1.000 | | 4907.936 |
| GeoMean Touquoy SFE:Aqua RegiaRatio (%) -> | | | | | 3.000% | 0.072% | | 0.005% | 0.016% | 0.300% | 0.017% | 0.300% | 0.075% | | 0.489% | 0.030% | 0.001% | 0.007% | 0.007% | | 0.000% | 3.000% | | 2.415% |
| Estimated Beaver Dam SPE (ppm or mg/kg) -> | | | | | 0.0002 | 0.0001 | | 1.0130 | 0.0027 | 0.0300 | 0.0117 | 0.0016 | 0.0015 | | 28.6035 | 0.0002 | 0.0002 | 0.0028 | 0.0015 | | 0.0677 | 0.0300 | | 118.5078 |
| Estimated Beaver Dam SPE (%) -> | | | | | 0.0000015% | 0.0000014% | | 0.0101298% | 0.0000273% | 0.0003000% | 0.0001174% | 0.0000164% | 0.0000150% | | 0.2860348% | 0.0000015% | 0.0000019% | 0.0000282% | 0.0000149% | | 0.0006774% | 0.0003000% | | 1.1850776% |

**Table A.2**

**Acid Extraction Test Results - Beaver Dam Mine Site Waste Rock Samples Estimated De-Ionized Water Leachable Metals Composition**
**Beaver Dam Mine Site**
**Marinette, Novs Scotia**

| Sample ID | Hole ID | Interval From | Interval To | Lithology | Mg % % | Mg ppm (or mg/kg) | Mn ppm | Mo ppm | Na % % | Na ppm (or mg/kg) | Ni ppm | P ppm | Pb ppm | S % % | S ppm (or mg/kg) | Sb ppm | Se ppm | Sr ppm | Ti % % | Ti ppm (or mg/kg) | Tl ppm | U ppm | V ppm | Zn ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LX17-18 | BD14-178 | 147 | 148 | GA | 0.4 | 4000 | 274 | 1 | 0.04 | 400 | 6 | 180 | 17 | 0.15 | 1500 | 2 | 2 | 6 | 0.03 | 300 | *<10* | *<10* | 20 | 43 |
| LX17-16 | BD14-178 | 49 | 50 | GW | 0.58 | 5800 | 372 | 1 | 0.04 | 400 | 15 | 520 | 2 | 0.03 | 300 | *<2* | 3 | 15 | 0.09 | 900 | *<10* | *<10* | 29 | 34 |
| LX17-26 | BD14-188 | 51 | 52 | GWKE | 0.7 | 7000 | 310 | 1 | 0.04 | 400 | 15 | 450 | 2 | 0.02 | 200 | *<2* | 3 | 10 | 0.07 | 700 | *<10* | *<10* | 23 | 38 |
| LX17-27 | BD14-173 | 12 | 13 | GWKE | 0.71 | 7100 | 388 | *<1* | 0.04 | 400 | 16 | 530 | 3 | 0.02 | 200 | 2 | 3 | 14 | 0.06 | 600 | *<10* | *<10* | 32 | 25 |
| LX17-25 | BD14-188 | 38 | 39 | GWKE | 0.69 | 6900 | 461 | *<1* | 0.05 | 500 | 18 | 510 | 8 | *<0.01* | 100 | *<2* | 5 | 19 | 0.13 | 1300 | *<10* | *<10* | 35 | 50 |
| LX17-23 | BD14-188 | 10 | 11 | GA | 1.05 | 10500 | 512 | *<1* | 0.05 | 500 | 30 | 650 | 7 | 0.05 | 500 | *<2* | 7 | 20 | 0.17 | 1700 | *<10* | *<10* | 51 | 76 |
| LX17-15 | BD14-178 | 58 | 59 | GA | 1.19 | 11900 | 800 | *<1* | 0.04 | 400 | 30 | 750 | 33 | 0.04 | 400 | *<2* | 8 | 35 | 0.15 | 1500 | *<10* | *<10* | 76 | 65 |
| LX17-29 | BD14-173 | 37 | 38 | GA | 1.24 | 12400 | 594 | *<1* | 0.03 | 300 | 33 | 680 | 2 | 0.03 | 300 | *<2* | 3 | 13 | 0.03 | 300 | *<10* | *<10* | 42 | 64 |
| LX17-08 | BD15-GT08 | 23 | 24 | GW | 1.35 | 13500 | 512 | *<1* | 0.05 | 500 | 36 | 630 | 5 | *<0.01* | 100 | *<2* | 6 | 10 | 0.09 | 900 | *<10* | *<10* | 57 | 78 |
| LX17-30 | BD14-173 | 53 | 54 | GWKE | 1.4 | 14000 | 1045 | *<1* | 0.03 | 300 | 38 | 770 | 4 | *<0.01* | 100 | *<2* | 4 | 22 | 0.02 | 200 | *<10* | *<10* | 42 | 75 |
| LX17-06 | BD15-GT08 | 91 | 10 | GW | 1.18 | 11800 | 624 | *<1* | 0.05 | 500 | 36 | 540 | 5 | *<0.01* | 100 | *<2* | 8 | 13 | 0.16 | 1600 | *<10* | *<10* | 54 | 79 |
| LX17-14 | BD14-178 | 30 | 31 | GA | 1.33 | 13300 | 578 | 1 | 0.06 | 600 | 36 | 710 | 3 | *<0.01* | 100 | *<2* | 9 | 24 | 0.2 | 2000 | *<10* | *<10* | 66 | 69 |
| LX17-10 | BD14-172 | 140 | 141 | AG | 1.52 | 15200 | 774 | *<1* | 0.05 | 500 | 43 | 640 | 7 | 0.06 | 600 | *<2* | 7 | 20 | 0.16 | 1600 | *<10* | *<10* | 54 | 103 |
| LX17-12 | BD14-178 | 7 | 7.9 | AR | 1.43 | 14300 | 534 | *<1* | 0.03 | 300 | 44 | 610 | 11 | 0.02 | 200 | *<2* | 6 | 10 | 0.17 | 1700 | *<10* | *<10* | 44 | 89 |
| LX17-28 | BD14-173 | 22 | 23 | AG | 1.74 | 17400 | 687 | *<1* | 0.03 | 300 | 43 | 690 | 4 | 0.04 | 400 | *<2* | 6 | 24 | 0.09 | 900 | *<10* | *<10* | 49 | 90 |
| LX17-13 | BD14-178 | 15 | 16 | AG | 1.67 | 16700 | 726 | *<1* | 0.04 | 400 | 45 | 710 | 3 | 0.01 | 100 | *<2* | 7 | 12 | 0.18 | 1800 | *<10* | *<10* | 62 | 89 |
| LX17-09 | BD15-GT08 | 37 | 38 | AG | 1.75 | 17500 | 680 | *<1* | 0.04 | 400 | 44 | 660 | *<2* | 0.01 | 100 | *<2* | 10 | 7 | 0.15 | 1500 | *<10* | *<10* | 72 | 102 |
| LX17-07 | BD15-GT08 | 14 | 15 | GA | 1.6 | 16000 | 640 | *<1* | 0.03 | 300 | 48 | 640 | 4 | 0.04 | 400 | *<2* | 7 | 9 | 0.14 | 1400 | *<10* | *<10* | 51 | 111 |
| LX17-11 | BD14-172 | 170 | 171 | AG | 1.85 | 18500 | 677 | *<1* | 0.03 | 300 | 51 | 670 | 5 | 0.03 | 300 | *<2* | 6 | 8 | 0.14 | 1400 | *<10* | *<10* | 50 | 116 |
| LX17-05 | BD15-GT02 | 46 | 47 | GA | 1.06 | 10600 | 732 | *<1* | 0.11 | 1100 | 45 | 500 | 8 | 0.42 | 4200 | *<2* | 8 | 62 | 0.16 | 1600 | *<10* | *<10* | 56 | 80 |
| GeoMean Beaver Dam Aqua Regia Result -> | | | | | | 11354.196 | 567.009 | 1.000 | | 416.464 | 30.062 | 580.677 | 4.912 | | 263.545 | 2.000 | 5.412 | 14.842 | | 1014.985 | 10.000 | 10.000 | 45.643 | 68.648 |
| GeoMean Touquoy SFE:Aqua RegiaRatio (%) -> | | | | | | 0.052% | 0.004% | 0.659% | | 7.774% | 0.004% | 0.195% | 0.002% | | 0.923% | 0.067% | 0.083% | 0.328% | | 0.029% | 0.003% | 0.005% | 0.022% | 0.034% |
| Estimated Beaver Dam SPE (ppm or mg/kg) -> | | | | | | 5.9038 | 0.0215 | 0.0066 | | 32.3759 | 0.0011 | 1.1298 | 0.0001 | | 2.4324 | 0.0013 | 0.0045 | 0.0487 | | 0.2988 | 0.0003 | 0.0005 | 0.0099 | 0.0234 |
| Estimated Beaver Dam SPE (%) -> | | | | | | 0.0590381% | 0.0002154% | 0.0000659% | | 0.3237587% | 0.0000108% | 0.0112984% | 0.0000009% | | 0.0243235% | 0.0000133% | 0.0000451% | 0.0004873% | | 0.0029884% | 0.0000030% | 0.0000046% | 0.0000991% | 0.0002338% |